

# Computing

## Purpose of study

A high-quality **computing** education equips pupils to understand and change the world through computational thinking. It develops and requires logical thinking and precision. It combines creativity with rigour: pupils apply underlying principles to understand real-world systems, and to create purposeful and usable **artefacts**. More broadly, it provides a lens through which to understand both natural and artificial systems, and **has substantial links with the teaching of mathematics, science, and design and technology**.

At the core of computing is the science and engineering discipline of computer science, in which pupils are taught how digital systems work, how they are designed and programmed, and the fundamental principles of information and computation. **Building on this core**, computing equips pupils to **apply** information technology to create products and solutions. A computing education also ensures that pupils become digitally literate – able to use, and express themselves through, information and communication technology – at a level suitable for the future workplace and as active participants in a digital world.

## Aims

The National Curriculum for computing aims to ensure that all pupils:

- can understand and apply the fundamental principles of computer science, including logic, algorithms, data representation, and **communication**
- can analyse problems in computational terms, and have repeated practical experience of writing computer programs in order to solve such problems
- can **evaluate** and apply information technology, including new or unfamiliar technologies, analytically to solve problems
- are **responsible**, competent, confident and creative users of information and **communication** technology.

## Attainment targets

By the end of each key stage, pupils are expected to know, apply and understand the matters, skills and processes specified in the relevant programme of study.

**Comment [J1]:** Aspects that are new and were not presented in the expert advice are highlighted

**Comment [J2]:** Naace has been arguing for ICT to remain the subject name – a recognized umbrella term that covers the three curriculum areas identified by the Royal Society Report – Information Technology, Digital Literacy and Computer Science. The original brief for the expert panel from the DfE was to retain the name ICT and to include a balanced approach between these three areas in the development of the draft programme of study. This was NOT meant to be an issue up for discussion in the original submission to the DfE

**Comment [J3]:** “Effective use” of digital artefacts has been left out of this section

**Comment [J4]:** To apply assumes that knowledge and understanding are in place – see Bloom’s taxonomy. Also, the aspect of critical evaluation is not included here (which is a higher level thinking skill in Bloom’s taxonomy)

**Comment [J5]:** These aims have been re-ordered from those proposed by the expert panel

**Comment [J6]:** This was originally “networks” in the expert advice

**Comment [J7]:** Has left out aspects of collaborating, responsibly and effectively from the statement

**Comment [J8]:** The term “critically” has been left out here

**Comment [J9]:** There has been significant re-ordering of the aims

**Comment [J10]:** Safe and responsible use is not clearly stated as an aim of the curriculum, as it was in the expert guidance; neither is the historical, individual and societal context/impact of ICT developments

# Subject content

## 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 a sequence of instructions**
- write and test simple programs
- **use logical reasoning to predict the behaviour of simple programs**
- organise, store, manipulate and retrieve data in a range of digital **formats**
- **communicate** safely and respectfully online, keeping personal information private, and recognise common uses of information technology beyond school.

**Comment [J11]:** The only type of creativity mentioned in KS1 is writing and testing simple programs. It fails to recognize the importance of children at this age learning through creating – whether that is taking/making pictures/video/audio recordings, sharing their work with a wider audience using digital tools

**Comment [J12]:** All mention of collaboration, creativity and playful exploration are missing here

**Comment [J13]:** Is this age appropriate? An understanding of child development should be taken into account when developing logical thinking

**Comment [J14]:** The expert guidance also talks about creating, manipulating and evaluating digital CONTENT as well as using digital content from e.g. the internet

**Comment [J15]:** This doesn't include pupils knowing how to interpret and evaluate digital sources of information

## Key Stage 2

Pupils should be taught to:

- **design and write** 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; generate appropriate inputs and predicted outputs to test programs**
- **use logical reasoning to explain how a simple algorithm works** 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
- **describe how internet search engines find and store data;** use search engines effectively; be discerning in evaluating digital content; respect individuals and intellectual property; use technology responsibly, securely and safely
- select, use and combine a variety of software (including internet services) on a range of digital devices to accomplish given goals, including collecting, analysing, evaluating and presenting data and **information**.

**Comment [J16]:** This was originally "develop"

**Comment [J17]:** This is exactly as stated in the expert draft

**Comment [J18]:** The first part of this is entirely as written in the expert draft; the highlighted part is additional

**Comment [J19]:** This goes further than the expert draft, which talks about evaluating alternative algorithms and designs to solve the same problem

**Comment [J20]:** This was original worded "appreciate how results are selected and ranked" which now appears in KS3

**Comment [J21]:** A re-ordering of the content KS2 compared with the original expert draft

## Key Stage 3

Pupils should be taught to:

- design, use and evaluate computational abstractions that model the state and behaviour of real-world problems and physical systems
- understand at least two key algorithms for each of sorting and searching; use logical reasoning to evaluate the performance trade-offs of using alternative algorithms to solve the same problem
- use two or more programming languages, one of which is textual, each used to solve a variety of computational problems; use data structures such as tables or arrays; use procedures to write modular programs; for each procedure, be able to explain how it works and how to test it
- understand simple Boolean logic (such as AND, OR and NOT) and its use in determining which parts of a program are executed; use Boolean logic and wild-cards in search or database queries; appreciate how search engine results are selected and ranked
- understand the hardware and software components that make up networked computer systems, how they interact, and how they affect cost and performance; explain how networks such as the internet work; understand how computers can monitor and control physical systems
- explain how instructions are stored and executed within a computer system
- explain how data of various types can be represented and manipulated in the form of binary digits including numbers, text, sounds and pictures, and be able to carry out some such manipulations by hand
- undertake creative projects that involve selecting, using, and combining multiple applications, preferably across a range of devices, to achieve challenging goals, including collecting and analysing data and meeting the needs of known users
- create, reuse, revise and repurpose digital information and content with attention to design, intellectual property and audience.

**Comment [J22]:** This section has been re-worded

**Comment [J23]:** This section was originally in KS2 programme of study put together by the expert panel

**Comment [J24]:** The addition of “preferably” this section changes the responsibility of the school from providing a range of experiences/opportunities that develop resilience/flexibility/adaptability and problem solving for young people

## Key Stage 4

All pupils must have the opportunity to study aspects of information technology and computer science at sufficient depth to allow them to progress to higher levels of study or to a professional career.

All pupils should be taught to:

- develop their capability, creativity and knowledge in computer science, digital media and information technology
- develop and apply their analytic, problem-solving, design, and computational thinking skills.

**Comment [J25]:** This is a re-worded introduction to KS4 – probably a better way of conveying the same message, although it loses the sentiment that schools ought to offer a range of different qualifications in different aspects of ICT

**Comment [J26]:** The term “exercise and” was included here in the expert draft in order to convey the message that ALL pupils at KS4 should continue to put into practice and develop what they have already learnt, even if they are not taking a formal ICT qualification.

**Comment [J27]:** •There is a key aspect that has been left out from the expert draft:

- Manage their online identity, participate in online communities, develop and critically evaluate digital media, and take account of ethical, legal, social, and environmental consequences of information systems.



Department  
for Education

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