ICT and 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, mathematical 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 knowledge and understanding, pupils are equipped to apply information technology to critically evaluate and 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.
- Can critically articulate the individual, cultural, and societal impacts of digital technology, and know how to stay safe, exploit opportunities, and manage risks.

Attainment targets

By the end of each key stage, all pupils should be challenged to know, apply, explain, understand, analyse and evaluate the matters skills and processes specified in the relevant programme of study.

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Subject content

Key Stage 1

Pupils should be taught to:

- understand that algorithms are a set of instructions that link an input and an output and that this set of instructions is a program on a digital device
- write and test simple programs; use logical reasoning to predict the behaviour of simple programs
- explore problems playfully, using software on a range of devices; use technologies such as the Web as a tool for learning and research, communication and collaboration.
- organise, store, manipulate, create and retrieve data in a range of digital formats
- communicate safely and respectfully online, keeping personal information private, how to report concerns and recognise common uses of information technology beyond school.

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 information is found and stored; carry out effective searches of information found in a variety of formats including online; be discerning in evaluating digital content; respect individuals and intellectual property; use technology responsibly, securely and safely and know a range of ways to report concerns.
- 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, communicating and collaborating effectively. plan, create, test, and evaluate a range of digital artefacts for a given
Comment [39]: We believe this is important in order to ensure this programme of study has balance, so that it includes ambitious, creative learning opportunities and encourages the development of higher level thinking skills.
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, describe and build searchable indexes of online information, and understand some limitations of this. 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 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, across a range of devices, to achieve challenging goals, including collecting and analysing data, meeting the needs of known users and communicating effectively
- create, reuse, revise and repurpose digital information and content with attention to design, intellectual property and audience.
- Critically evaluate digital artefacts, including their context, provenance and trustworthiness; reflect on the personal, social, economic, and ethical impacts of technology and technological change, and the implications for rights, responsibilities, and freedoms

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

● know how IT has impact on industries, innovation and entrepreneurialism, including business applications of IT systems, online commerce, finance and creative industries; develop an awareness of ICT, IT and computing-based careers.

● Understand and apply international and industry specific standards to plan, create and evaluate digital artefacts in a chosen field of this subject.

  — Manage 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.

Comment [J17]: We have added this as it will enable detailed courses to be developed at GCSE which reflect current industry practice, whilst allowing scope to cover developments in the future.

It allows for further study, whether the chosen field of study is computer science, programming, IT systems, business applications, digital media, design, etc. Artefacts will be appropriate to the chosen field of study.

Comment [J18]: Given our comments in our detailed response about the need to include more specific safe and responsible use at Key Stage 3 and 4, we respectfully request that the attainment targets from the expert advice are re-instated in this programme of study.