

What prior knowledge do students starting GCSE need?

If students are to be successful at GCSE, acquiring basic programming and computational thinking skills at Key Stage 3 is vital.

Programming is a common element in all the GCSE specifications. Candidates must be able to analyse, design, code, test and evaluate a program written in a high level programming language, such as Pascal, Python or Small Basic. In the National Curriculum Computing Programme of Study for Key Stage 3 this is:

design, use and evaluate computational abstractions that model the state and behaviour of real-world problems and physical systems*

use two or more programming languages, at least one of which is textual, to solve a variety of computational problems; make appropriate use of data structures (for example, lists tables or arrays); design and develop modular programs that use procedures or functions.

Designing a solution to a programming problem requires an algorithmic approach and an appreciation of key algorithms and computational thinking is therefore essential. Being able to write and follow algorithms is also part of the examined content for all three major specifications at GCSE. In the National Curriculum Computing Programme of Study for Key Stage 3 this is:

understand several key algorithms that reflect computational thinking (for example, one for sorting and searching); to use logical reasoning to compare the utility of alternative algorithms for the same problem.

All three major GCSE specifications require an understanding of the basics of Boolean algebra and the use of AND, OR and NOT in logic circuits and in programming. In the National Curriculum Computing Programme of Study for Key Stage 3 this is:

understand simple Boolean logic (for example, AND, OR and NOT) and some of its uses in circuits and programming.

An understanding of the basic hardware and software that makes up a computer system is

fundamental to all GCSE specifications. In the National Curriculum Computing Programme of Study for Key Stage 3 this is:

understand the hardware and software components that make up computer systems, and how they communicate with one another and with other systems.

An appreciation of the various data types and how computers store and use data in binary is central to all three major specifications at GCSE. They all require the candidate to be able to work with binary to perform simple calculations and conversions. In the National Curriculum Computing Programme of Study for Key Stage 3 this is:

understand how instructions are stored and executed within a computer system; understand how data of various types (including text, sounds and pictures) can be represented and manipulated digitally, in the form of binary digits

understand how numbers can be represented in binary, and be able to carry out simple operations on binary numbers (for example, binary addition, and conversion between binary and decimal).

In order to prepare students for GCSE they need to be introduced to and have grounding in all of these areas but learning to program takes time and should be a key element of any Key Stage 3 course. Remember, though, that computing is more than just programming and that computational thinking skills are at the heart of computing. Learning to program starts with the core computational thinking skills of decomposition, abstraction, algorithm design, generalisation and evaluation. After all, you need to understand the problem and identify a solution before you can begin programming. So, if there are any skills that a student should have at their disposal when starting out on a GCSE course they are these.

* Remember, if you need further guidance on the breadth and depth expected for each of the bullet points in the National Curriculum Programmes of Study, look at *Computing in the National Curriculum: a guide for secondary teachers*. The *Interactive Progression Pathways Tool* will also help you.