for Primary Schools

Y1-Y6

iCompute

Primary Computing

# CS Progression

## Computer Science

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# CS Progression in Primary Computing

This guide is intended to support teachers using iCompute's Primary Computing Scheme of Work for pupil progression in the Computer Science (CS) strand of the National Curriculum for Computing for Key Stage 1 and Key Stage 2.

It forms part of a comprehensive Computing Assessment Toolkit for Primary Computing covering all strands of the National Curriculum:

- Computer Science
- Digital Literacy (incl. eSafety)
- Information Technology

## CS Progression

To demonstrate good practice in developing learning across the curriculum, this guide has been arranged into six sections: Year 1 to Year 6

This guide shows how expectations for children's CS capability can progress throughout Year 1 to Year 6.
It is a guide only and should be adjusted to suit your school setting and the capabilities and competencies of your pupils.
It does not cover progression in Information Technology and Digital Literacy; which are detailed separately in the Assessment Toolkit.

## Declarative and Procedural Knowledge

For progress in computing to take place, pupils need to be taught components of learning and acquire declarative and procedural knowledge.

At iCompute, we think of knowledge components in terms of **know that… understand that… know how…**

Procedural Knowledge refers to the knowledge of "how to" perform a specific skill or task.
Declarative Knowledge involves "knowing that" and "understanding that".



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## Working Towards

| Declarative Knowledge<br>Pupils understand/know that.. | Procedural Knowledge<br>Pupils know how to… |
|---|---|
| instructions are directions or orders that tell you what to do<br>you give instructions and follow them<br>you can use computers to do things<br>patterns are things that repeat<br>charts are a way of showing information | follow and give simple instructions with help (algorithms)<br>make a programmable toy move but not always as planned (programming)<br>use a limited set of software and tools to make something happen on screen but not always according to those planned<br>identify simple repeating patterns<br>sort a small set of objects according to criteria, sometimes with support |

## Meeting

| Declarative Knowledge<br>Pupils understand/know that.. | Procedural Knowledge<br>Pupils know how to… |
|---|---|
| people and computers can follow instructions<br>you can change instructions<br>you can give some toys instructions<br>you can make choices on-screen<br>you can sort things<br>pictures on a pictogram represent numerical values | give and follow simple instructions in order (algorithms)<br>create a short sequence of instructions (algorithms)<br>change instructions to create a different outcome (algorithms)<br>make a programmable toy move (programming)<br>use simple software and tools to make something planned happen<br>make choices on-screen using buttons and pictures |

## Greater Depth

| Declarative Knowledge<br>Pupils understand/know that.. | Procedural Knowledge<br>Pupils know how to… |
|---|---|
| you can predict what might happen by looking at a set of instructions before following them<br>you can change instructions and predict what will make them if you followed them<br>you can fix instructions if you predict or find out that they're wrong<br>you can make instructions better<br>patterns are repeated designs, sequences, or arrangements that can be found in objects, | read a set of instructions and predict the outcome<br>write/draw a set of simple instructions in order<br>make changes to instructions and predict how the outcome will change<br>plan a set of instructions for a programmable toy and make it move<br>correct mistakes if instructions are incorrect<br>talk about how instructions could be improved |

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# Computer Science

## Working Towards

| Declarative Knowledge<br>Pupils understand/know that.. | Procedural Knowledge<br>Pupils know how to… |
|---|---|

## Meeting

| Declarative Knowledge<br>Pupils understand/know that.. | Procedural Knowledge<br>Pupils know how to… |
|---|---|
| | create, recreate and continue patterns<br>sort a set of objects according to criteria<br>construct simple pictograms |

## Greater Depth

| Declarative Knowledge<br>Pupils understand/know that.. | Procedural Knowledge<br>Pupils know how to… |
|---|---|
| numbers, behaviour and sounds<br>graphs and charts can help you answer questions | describe patterns and relationships<br>sort objects into sets according to one or more criteria<br>compare data using simple charts and graphs<br>suggest different ways data could be organised or displayed<br>use graphs to answer a range of questions<br>create own questions that could be answered by interpreting data on a graph<br>make comparisons between data on a graph |

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# Computer Science

| Working Towards | | Meeting | | Greater Depth | |
|---|---|---|---|---|---|
| **Declarative Knowledge** | **Procedural Knowledge** | **Declarative Knowledge** | **Procedural Knowledge** | **Declarative Knowledge** | **Procedural Knowledge** |
| **Pupils understand/know that..** | **Pupils know how to...** | **Pupils understand/know that..** | **Pupils know how to...** | **Pupils understand/know that..** | **Pupils know how to...** |
| humans and computers follow instructions | read a set of instructions and sometimes predict the correct outcome<br>produce instructions but sequence them incorrectly or make assumptions | computers follow instructions given in a precise way | read a set of instructions and usually predict the correct outcome<br>produce a set of instructions that others can usually follow | computers have no intelligence | read a set of instructions and predict the correct outcome<br>produce an accurate set of instructions using agreed language that others can follow |

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Year 1

# Computer Science

## Working Towards

| Declarative Knowledge | Procedural Knowledge |
|---|---|
| Pupils understand/know that.. | Pupils know how to… |
| programming applications (e.g. Scratch) can be given commands to produce specific effects | produce a command that achieves a simple effect (e.g. movement)<br>plan and give direct instructions to make things happen (e.g. playing robots) |

## Meeting

| Declarative Knowledge | Procedural Knowledge |
|---|---|
| Pupils understand/know that.. | Pupils know how to… |
| an algorithm is a set of instructions | produce a sequence of instructions that result in planned outcomes<br>program a short a sequence of commands that results in a planned effect<br>program and test a simple program<br>create algorithms to solve simple problems |

## Greater Depth

| Declarative Knowledge | Procedural Knowledge |
|---|---|
| Pupils understand/know that.. | Pupils know how to… |
| computers follow algorithms and they are implemented as programs | predict the behaviour of simple algorithms and programs<br>program a short sequence of commands, with repetition (loops) that results in a planned effect<br>debug simple programs by correcting mistakes when things do not go as planned |

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Year 2

# Computer Science

## Working Towards

| Declarative Knowledge | Procedural Knowledge |
|---|---|
| Pupils understand/know that.. | Pupils know how to... |
| programming applications (e.g. Scratch) can be given commands to produce specific effects on screen | produce a sequence of blocks that achieves a simple effect (e.g. move a sprite around the screen) |
| a network is two or more devices connected | |
| not all devices need a wire | |
| devices have an address | |

## Meeting

| Declarative Knowledge | Procedural Knowledge |
|---|---|
| Pupils understand/know that.. | Pupils know how to... |
| repetition involves a command or commands being repeated | plan a sequence of instructions |
| selection is making choices in programming (e.g. if..then) | give a sequence of instructions, some of which are repeated and involve choices (selection) |
| programs need to be tested to find errors | program a sequence of commands that results in a planned effect |
| connections can be wired or wireless | program and test a simple program |
| each device on a network has its own address | demonstrate that a network is two or more devices connected |
| | identify different devices within a network |

## Greater Depth

| Declarative Knowledge | Procedural Knowledge |
|---|---|
| Pupils understand/know that.. | Pupils know how to... |
| algorithms and programs need to be designed | design and develop basic computer programs |
| a procedure is a block of code that can be reused | combine sequences of commands into procedures that are repeated |
| each device has a unique address called and IP address | test and correct simple programs |
| information travels through a network in a variety of ways | evaluate their own work and comment on improvements |
| website addresses are nicknames for IP addresses | explain why networks are used and what they're used for |
| | identify a range of wired and wireless devices on a network |
| | explain the role of devices on a network |
| | model how information travels through a network using switches and routers |

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Year 3

# Computer Science

## Working Towards

| Declarative Knowledge | Procedural Knowledge |
| --- | --- |
| Pupils understand/know that.. | Pupils know how to... |
| computers take input and produce output | identify when it is possible to use the repeat command |
| algorithms are a set of instructions | create algorithms with steps, some of which are repeated |
| programs are algorithms written in a language a computer can understand | suggest what I think might happen if an algorithm or program were executed (not always accurately) |
| instructions/commands can be repeated | |

## Meeting

| Declarative Knowledge | Procedural Knowledge |
| --- | --- |
| Pupils understand/know that.. | Pupils know how to... |
| difference between the internet and internet services e.g. the world wide web | use sequence, selection and repetition in computer programs |
| computers store data as numbers | predict the outcome of a given algorithm or program and correctly identify if repetition is involved |
| | identify a number of computing devices inside and outside of the classroom and identify some common forms of input and output |

## Greater Depth

| Declarative Knowledge | Procedural Knowledge |
| --- | --- |
| Pupils understand/know that.. | Pupils know how to... |
| instructions and commands can be repeated | write an algorithm to produce a given effect using repetition |
| different services use the internet (e.g. email) | accurately predict the outcome of a range of algorithms and programs |
| a computer takes input, processes it and produces output | explain how a programmed effect has been achieved |
| computers store and manipulate data as a series of ones and zeros and that this is called **binary** | identify some common internet services that use the internet (e.g. online gaming or voice over internet) |
| | identify a variety of computing devices and a number of inputs and outputs (e.g. touch, sound) |
| | test, debug and refine algorithms and programs |

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Year 4

# Computer Science

## Working Towards

| Declarative Knowledge | Procedural Knowledge |
|---|---|
| Pupils understand/know that.. | Pupils know how to… |
| computer programs contain commands that achieve a specific action | Write or amend computer programs to produce specific actions with assistance |
| internet search engines search for websites | use a search engine |
| keywords should be precise and specific to obtain the most relevant results | use keywords as search terms |
| the world wide web is all of the content online linked | navigate online using links |
| online content is displayed on a website or webpage | |

## Meeting

| Declarative Knowledge | Procedural Knowledge |
|---|---|
| Pupils understand/know that.. | Pupils know how to… |
| a variable is a value that can be changed | write and amend computer programs |
| a conditional statement means something happens 'if' something is true (e.g. if..then..else) | program a number of algorithms that achieve a specific outcome |
| testing systematically makes finding bugs easier | use repetition, variables and conditional statements in computer programs |
| World Wide Web consists of many websites and that web pages can be accessed using the internet | test computer programs and correct any errors |
| web pages are formatted using a type of 'code' | use search technology to find things out |
| | use precise keywords and operands to search online |

## Greater Depth

| Declarative Knowledge | Procedural Knowledge |
|---|---|
| Pupils understand/know that.. | Pupils know how to… |
| programs should be designed | write and amend more complex programs to create a variety of outcomes |
| abstraction means taking the detail out of a problem to find a solution | program algorithms that achieve a range of specified outcomes |
| a procedure is chunks of code that can be reused | create efficient programs by designing solutions using abstraction (e.g. using procedures in the form of broadcasts in Scratch) |
| the World Wide Web is one of a number of services provided on the internet | Test, debug and refine computer programs |
| HTML tells the computer what to put where on a web page | use search technology and clear search terms to find things out |
| Understand that CSS tells the computer how content inside HTML tags should be styled | create basic web content using HTML |
| | style text using CSS |

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Year 5

# Computer Science – Knowledge Components

## Working Towards

| Declarative Knowledge | Procedural Knowledge |
|---|---|
| Pupils understand/know that.. | Pupils know how to... |
| the same 'problem' can be solved in different ways | write or amend computer programs to produce specific actions |
| that commands can be given in shorter form | use iteration (repeats and loops) in algorithms and programs |
| the internet is a network | use a search engine to find information online |
| a computer network is a group of computers that are connected | |
| search engines order the results they return | |

## Meeting

| Declarative Knowledge | Procedural Knowledge |
|---|---|
| Pupils understand/know that.. | Pupils know how to... |
| decomposition means splitting a problem down into smaller parts to make problems easier to solve | write and amend more complex computer programs to create a variety of outcomes |
| iteration means repeats and loops | decompose 'problems' by splitting them into smaller 'problems' and designing solutions for each part |
| a variable is a value that can change | use iteration(repeats and loops), variables and conditional statements (if..then) in computer programs |
| conditional statements mean something will happen 'if' something is true | test computer programs and correct most errors |
| the internet is an example of a computer network | |
| use search technology to find things out and check for reliability | |

## Greater Depth

| Declarative Knowledge | Procedural Knowledge |
|---|---|
| Pupils understand/know that.. | Pupils know how to... |
| Boolean variables can only be true or false | create and use efficient methods of iteration, and nested conditional statements |
| variables can be numbers, text or lists | systematically test computer programs for bugs and make them work as expected |
| conditional statements can be nested (e.g. if..then..if) | critically analyse algorithms and programs and suggest more elegant solutions |
| working systematically makes bugs easier to find and fix | create procedures that call on other procedures (e.g. by using broadcasting blocks) |
| internet search engines list search results in order of popularity | use search technology and clear search terms |
| special devices and services are required to connect to the internet | |

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Year 6