

for Primary Schools

Y1-Y6

iCompute
Primary Computing



CS Progression

Computer Science

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".

Working Towards

Meeting

Greater Depth

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...
<ul style="list-style-type: none">instructions are directions or orders that tell you what to doyou give instructions and follow themyou can use computers to do thingspatterns are things that repeatcharts are a way of showing information	<ul style="list-style-type: none">follow and give simple instructions with help (algorithms)make a programmable toy move but not always as planned (programming)use a limited set of software and tools to make something happen on screen but not always according to those plannedidentify simple repeating patternssort a small set of objects according to criteria, sometimes with support	<ul style="list-style-type: none">people and computers can follow instructionsyou can change instructionsyou can give some toys instructionsyou can make choices on-screenyou can sort thingspictures on a pictogram represent numerical values	<ul style="list-style-type: none">give and follow simple instructions in order (algorithms)create a short sequence of instructions (algorithms)change instructions to create a different outcome (algorithms)make a programmable toy move (programming)use simple software and tools to make something planned happenmake choices on-screen using buttons and pictures	<ul style="list-style-type: none">you can predict what might happen by looking at a set of instructions before following themyou can change instructions and predict what will make them if you followed themyou can fix instructions if you predict or find out that they're wrongyou can make instructions betterpatterns are repeated designs, sequences, or arrangements that can be found in objects,	<ul style="list-style-type: none">read a set of instructions and predict the outcomewrite/draw a set of simple instructions in ordermake changes to instructions and predict how the outcome will changeplan a set of instructions for a programmable toy and make it movecorrect mistakes if instructions are incorrecttalk about how instructions could be improved

Working Towards

Meeting

Greater Depth

Declarative Knowledge

Pupils understand/know that..

Procedural Knowledge

Pupils know how to...

Declarative Knowledge

Pupils understand/know that..

Procedural Knowledge

Pupils know how to...

Declarative Knowledge

Pupils understand/know that..

Procedural Knowledge

Pupils know how to...

- create, recreate and continue patterns
- sort a set of objects according to criteria
- construct simple pictograms

- numbers, behaviour and sounds
- graphs and charts can help you answer questions

- describe patterns and relationships
- sort objects into sets according to one or more criteria
- compare data using simple charts and graphs
- suggest different ways data could be organised or displayed
- use graphs to answer a range of questions
- create own questions that could be answered by interpreting data on a graph
- make comparisons between data on a graph

Working Towards

Meeting

Greater Depth

Declarative Knowledge

Pupils understand/know that..

- humans and computers follow instructions

Procedural Knowledge

Pupils know how to...

- read a set of instructions and sometimes predict the correct outcome
- produce instructions but sequence them incorrectly or make assumptions

Declarative Knowledge

Pupils understand/know that..

- computers follow instructions given in a precise way

Procedural Knowledge

Pupils know how to...

- read a set of instructions and usually predict the correct outcome
- produce a set of instructions that others can usually follow

Declarative Knowledge

Pupils understand/know that..

- computers have no intelligence

Procedural Knowledge

Pupils know how to...

- read a set of instructions and predict the correct outcome
- produce an accurate set of instructions using agreed language that others can follow

Declarative Knowledge Pupils understand/know that..	Procedural Knowledge Pupils know how to...	Declarative Knowledge Pupils understand/know that..	Procedural Knowledge Pupils know how to...	Declarative Knowledge Pupils understand/know that..	Procedural Knowledge Pupils know how to...
<ul style="list-style-type: none">programming applications (e.g. Scratch) can be given commands to produce specific effects	<ul style="list-style-type: none">produce a command that achieves a simple effect (e.g. movement)plan and give direct instructions to make things happen (e.g. playing robots)	<ul style="list-style-type: none">an algorithm is a set of instructions	<ul style="list-style-type: none">produce a sequence of instructions that result in planned outcomesprogram a short a sequence of commands that results in a planned effectprogram and test a simple programcreate algorithms to solve simple problems	<ul style="list-style-type: none">computers follow algorithms and they are implemented as programs	<ul style="list-style-type: none">predict the behaviour of simple algorithms and programsprogram a short sequence of commands, with repetition (loops) that results in a planned effectdebug simple programs by correcting mistakes when things do not go as planned

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...
<ul style="list-style-type: none">programming applications (e.g. Scratch) can be given commands to produce specific effects on screena network is two or more devices connectednot all devices need a wiredevices have an address	<ul style="list-style-type: none">produce a sequence of blocks that achieves a simple effect (e.g. move a sprite around the screen)	<ul style="list-style-type: none">repetition involves a command or commands being repeatedselection is making choices in programming (e.g. if..then)programs need to be tested to find errorsconnections can be wired or wirelesseach device on a network has its own address	<ul style="list-style-type: none">plan a sequence of instructionsgive a sequence of instructions, some of which are repeated and involve choices (selection)program a sequence of commands that results in a planned effectprogram and test a simple programdemonstrate that a network is two or more devices connectedidentify different devices within a network	<ul style="list-style-type: none">algorithms and programs need to be designeda procedure is a block of code that can be reusedeach device has a unique address called and IP addressinformation travels through a network in a variety of wayswebsite addresses are nicknames for IP addresses	<ul style="list-style-type: none">design and develop basic computer programscombine sequences of commands into procedures that are repeatedtest and correct simple programsevaluate their own work and comment on improvementsexplain why networks are used and what they're used foridentify a range of wired and wireless devices on a networkexplain the role of devices on a networkmodel how information travels through a network using switches and routers

Working Towards

Meeting

Greater Depth

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...
<ul style="list-style-type: none"> computers take input and produce output algorithms are a set of instructions programs are algorithms written in a language a computer can understand instructions/commands can be repeated AI involves computers doing tasks computers can learn data is necessary for training models but does not grasp the importance of data quality AI systems in our daily lives 	<ul style="list-style-type: none"> identify when it is possible to use the repeat command create algorithms with steps, some of which are repeated suggest what I think might happen if an algorithm or program were executed (not always accurately) identify less common or incorrect examples of AI train a machine learning model with support test a machine learning model with support 	<ul style="list-style-type: none"> difference between the internet and internet services e.g. the world wide web computers store data as numbers AI involves computers or machines performing tasks that usually require human intelligence computers learn from input data high-quality, varied data leads to more accurate and reliable machine learning models 	<ul style="list-style-type: none"> use sequence, selection and repetition in computer programs 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 identify examples of AI in everyday life explain the process of machine learning, as a process by which 	<ul style="list-style-type: none"> instructions and commands can be repeated different services use the internet (e.g. email) a computer takes input, processes it and produces output computers store and manipulate data as a series of ones and zeros and that this is called binary AI is integrated into our lives and the technology we use the importance of the quality and variety of data in training models effectively 	<ul style="list-style-type: none"> write an algorithm to produce a given effect using repetition accurately predict the outcome of a range of algorithms and programs explain how a programmed effect has been achieved 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 describe AI as not just computers performing

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...

- computers learn from data
- ☞ train a simple machine learning model
- ☞ test a simple machine learning model

- tasks, but also as they learn and making decisions based on data
- ☞ give a range of examples of AI, explaining how they use AI
- ☞ explain that computers learn from examples (data) and improve over time as they are given more data
- ☞ define machine learning and give examples
- ☞ talk about the impact of poor-quality on the performance of AI and suggest ways to ensure quality
- ☞ train a machine learning model with good quality data
- ☞ robustly test a machine learning model
- ☞ make improvements to training data

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...
<ul style="list-style-type: none"> computer programs contain commands that achieve a specific action internet search engines search for websites keywords should be precise and specific to obtain the most relevant results the world wide web is all of the content online linked online content is displayed on a website or webpage 	<ul style="list-style-type: none"> Write or amend computer programs to produce specific actions with assistance use a search engine use keywords as search terms navigate online using links 	<ul style="list-style-type: none"> a variable is a value that can be changed a conditional statement means something happens 'if' something is true (e.g. if..then..else) testing systematically makes finding bugs easier World Wide Web consists of many websites and that web pages can be accessed using the internet web pages are formatted using a type of 'code' 	<ul style="list-style-type: none"> write and amend computer programs program a number of algorithms that achieve a specific outcome use repetition, variables and conditional statements in computer programs test computer programs and correct any errors use search technology to find things out use precise keywords and operands to search online 	<ul style="list-style-type: none"> programs should be designed abstraction means taking the detail out of a problem to find a solution a procedure is chunks of code that can be reused the World Wide Web is one of a number of services provided on the internet HTML tells the computer what to put where on a web page Understand that CSS tells the computer how content inside HTML tags should be styled 	<ul style="list-style-type: none"> write and amend more complex programs to create a variety of outcomes program algorithms that achieve a range of specified outcomes create efficient programs by designing solutions using abstraction (e.g. using procedures in the form of broadcasts in Scratch) Test, debug and refine computer programs use search technology and clear search terms to find things out create basic web content using HTML style text using CSS

Computer Science – Knowledge Components

Working Towards

Meeting

Greater Depth

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...
<ul style="list-style-type: none"> the same 'problem' can be solved in different ways that commands can be given in shorter form the internet is a network a computer network is a group of computers that are connected search engines order the results they return computers can be taught to learn data is used to train computers AI can respond to a range of inputs, including movement 	<ul style="list-style-type: none"> write or amend computer programs to produce specific actions use iteration (repeats and loops) in algorithms and programs use a search engine to find information online organise data into categories with support create input data for machine learning models, sometimes with support train machine learning models to recognise and respond to text, 	<ul style="list-style-type: none"> decomposition means splitting a problem down into smaller parts to make problems easier to solve iteration means repeats and loops a variable is a value that can change conditional statements mean something will happen 'if' something is true the internet is an example of a computer network use search technology to find things out and check for reliability 	<ul style="list-style-type: none"> write and amend more complex computer programs to create a variety of outcomes decompose 'problems' by splitting them into smaller 'problems' and designing solutions for each part use iteration(repeats and loops), variables and conditional statements (if..then) in computer programs test computer programs and correct most errors classify data 	<ul style="list-style-type: none"> Boolean variables can only be true or false variables can be numbers, text or lists conditional statements can be nested (e.g. if..then..if) working systematically makes bugs easier to find and fix internet search engines list search results in order of popularity special devices and services are required to connect to the internet 	<ul style="list-style-type: none"> create and use efficient methods of iteration, and nested conditional statements systematically test computer programs for bugs and make them work as expected critically analyse algorithms and programs and suggest more elegant solutions create procedures that call on other procedures (e.g. by using broadcasting blocks) use search technology and clear search terms

Computer Science – Knowledge Components

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...
	movement and emotion with support	<ul style="list-style-type: none"> machine learning is a method used to train AI models the significance of training data on the accuracy of a machine learning system the output from an AI model is a prediction based on its training human bias can influence machine learning outcomes 	<ul style="list-style-type: none"> create input data for machine learning models train AI systems to recognise and respond to text, movement and emotion 	<ul style="list-style-type: none"> the pervasive role of AI in modern life and can give examples computers are taught to learn by people using a process called machine learning predictions made by AI models are based on the data they have been trained on the quality and type of training data affect the accuracy and reliability of machine learning systems bias in data can affect AI decisions the role of AI in society, including ethical considerations 	<ul style="list-style-type: none"> classify a range of data into distinct categories identify potential bias in data train a variety of AI systems using a wide range of quality, unbiased, input data (incl. text, images and motion)

Computer Science – Knowledge Components

Working Towards

Meeting

Greater Depth

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...
<ul style="list-style-type: none"> some components of the micro:bit but may confuse their functions what an input or output is but struggles to apply these terms to real-world examples basic coding concepts like sequence but struggles with selection and repetition 	<ul style="list-style-type: none"> follow step-by-step instructions but struggles with independent coding tasks use sequence, selection, and repetition in programming with support transfer a program to the micro:bit debug or adapt code with support apply logical reasoning to predict the outcome of programs or solve problems with support 	<ul style="list-style-type: none"> how to use random numbers and variables to make programs more dynamic how algorithms work using logical reasoning and give real-world examples a micro:bit is a tiny computer micro:bit's can be programmed micro:bits have multiple functions programs involve using sequence, selection, repetition and variables programs need to be tested and debugged 	<ul style="list-style-type: none"> write and debug programs use sequence, selection, and repetition use variables and inputs to create programs that control micro:bit's transfer and test programs on the micro:bit use logical reasoning to explain how algorithms work can detect and correct errors in code 	<ul style="list-style-type: none"> deeper understanding of how micro:bit components work together in complex programs. how variables, inputs, and outputs interact to control programs in physical systems more complex coding structures, such as nested loops and conditional logic how algorithms solve specific problems and predict the outcomes of programs 	<ul style="list-style-type: none"> design, write, and debug more complex programs use all key constructs: sequence, selection, repetition, and variables modify and adapt existing code to create original programs, debug programs efficiently use the MakeCode environment, experimenting with advanced features and functions.