

Teacher Guide

Physical Computing Kits

September 2023

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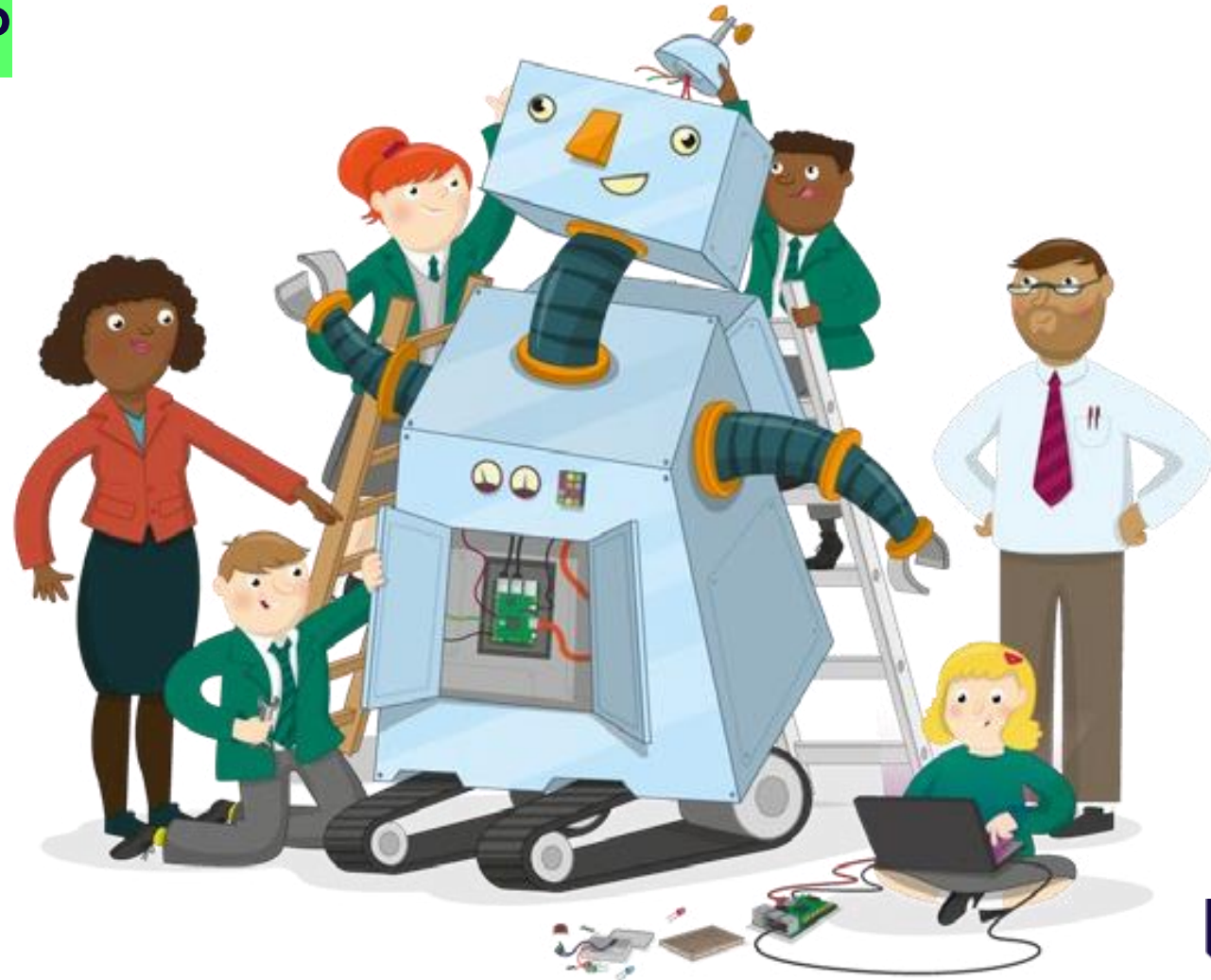
This Resource is based on works created by the Raspberry Pi Foundation as part of the National Centre and are licensed under the Open Government Licence v3.0. For more information on this licence, see [nccpe.io/ogl](https://www.nccpe.io/ogl).



Why physical computing?

Current research suggests that physical computing will play an important role in modern pedagogical approaches, both as a tool to engage learners and as a strategy to develop learner understanding in more creative ways. This approach also has the benefit of supporting and engaging a diverse range of learners in tangible and challenging tasks. There is also some evidence that girls engage more with physical computing, as a physical project has more immediate real world applications.

However, physical computing presents a challenge for schools and educators – both the financial cost and challenges around kit and classroom management. This is in addition to knowing how best to teach with and make effective use of such resources. The National Centre for Computing Education has developed a core Hub kit that can be loaned to schools. This guide has been developed to accompany the kit, and direct teachers to suitable resources.



What will physical computing help me teach?

Physical computing can be utilised to fulfil many areas of the computing curriculum at all key stages. Whilst primarily supporting the development of programming skills, it can also support more conceptual areas of the curriculum.

Through physical computing, learners can encounter, develop, and practice the whole range of programming skills and concepts, including sequences, loops, conditionals, functions, and data structures. Alongside applying these concepts, they will also encounter other languages, models of programming, and novel computer systems.

Physical computing projects can connect with all areas of computing curriculum, but commonly they will overlap with areas such as:

- **Computer systems** Each physical computing device is an example of a computing system with inputs, process, and outputs. Some offer storage, sensors or additional connectivity. Learning with these devices provides many opportunities for discussions and comparisons.

- **Data and information** Physical projects frequently involve some form of sensing as well as physical output, which provide great opportunities to discuss how the computers are capturing, representing, storing, and outputting that data.

- **Computer networks** Some devices offer additional connectivity, whether that be through GPIO (General-Purpose Input/Output), Ethernet, Bluetooth, or WiFi. Regardless of the means of transmission, having a class set of devices allows learners to explore how data is transmitted, the practical challenges, and possible solutions.

- **Impacts of technology** Physical computing is an area where we see direct interaction between humans and technology, where we can find and discuss many practical impacts of technology on people's lives. How can technology assist individuals and what are some of the risks?

- **Design and development** Physical computing provides great opportunities for project-based learning, with scope to develop students' skills in analysis, design, implementation testing, and evaluation. They are a great space in which students can select and apply what they have previously learnt, creating something new and/or solving a practical problem with computing.



What is in the primary physical computing kits?

The Hubs within the National Centre for Computing Education network have these packaged kits available for loan by schools in their region:

Bee-Bot Bag	Vu+ Data Loggers	Crumble Tray	Micro:bit Tray
<ul style="list-style-type: none"> ■ 6 Bee-Bots ■ 6 Bee-Bot wires ■ Docking station ■ Docking station wire ■ 2 Pen holders ■ Carry case 	<ul style="list-style-type: none"> ■ 5 vu+ data loggers ■ 5 safety lanyards ■ 5 temperature probes ■ 5 mini USB lead ■ 1 charging tray 	<ul style="list-style-type: none"> ■ 17 Crumble Controllers ■ 34 Sparkle LEDs ■ 17 switches ■ 17 light sensors ■ 17 buzzers ■ 17 micro-USB cables ■ 17 battery packs for 3x AA batteries ■ 34 Wheels and Motors ■ 204 croc clip wires <p>(Please note – schools will need to provide their own consumables 3 x AA batteries per device)</p>	<ul style="list-style-type: none"> ■ 17 micro:bits ■ 17 battery packs for 2 x AAA batteries ■ 17 USB cables ■ 36 croc clip wires ■ 17 micro:bit cases (in some cases – not all kits have these) <p>(Please note – schools will need to provide their own consumables 2 x AAA batteries per device if using the battery packs)</p>

Individual trays of the core kit can be loaned by contacting your [nearest NCCE Hub](#).



What is in the secondary physical computing kits?

The Hubs within the National Centre for Computing Education network have these packaged kits available for loan by schools in their region:

Micro:bit tray	Raspberry Pi Pico tray	Raspberry Pi 3B computer tray
<ul style="list-style-type: none"> ■ 17 micro:bits ■ 17 battery packs for 2 x AAA batteries ■ 17 USB cables ■ 36 croc clip wires <p>(Please note – schools will need to provide their own consumables 2 x AAA batteries per device if using the battery packs)</p>	<ul style="list-style-type: none"> ■ 10 Raspberry Pi Picos with 2 x 20 pin 0.1" headers pre-soldered ■ 10 micro-USB cables ■ 10 ultrasonic sensors ■ 20 wheels and DC motors ■ 10 H Bridge boards ■ 10 x 2 line tracking optical sensors ■ 10 battery packs for 6 x AA batteries ■ 10 breadboards ■ 40 LEDs ■ 20 croc clip wires ■ Jumper wires (140 x M-F, 100 x M-M) ■ 10 resistors (50 ohms) ■ 10 buttons <p>(Please note – schools will need to provide their own consumables 6 x AA batteries per device)</p>	<ul style="list-style-type: none"> ■ 10 Raspberry Pi 3B+ ■ 10 Raspberry Pi 3B+ power supplies ■ 10 Sense HATs ■ 12 SD cards ■ 21 LEDs, mixed colour ■ 10 Breadboards ■ 10 resistors ■ 50 buttons ■ Jumper wires

Individual trays of the core kit can be loaned by contacting your [nearest NCCE Hub](#).



Progression

The core kit contains hardware which can be used with all key stages. In this guide, you'll find lesson plans and activities for the following:

	Key Stage 1	Key Stage 2	Key Stage 3	Key Stage 4
Bee-Bot	✓			
Vu+ Data Logger		✓		
Crumble		✓		
micro:bit		✓	✓	
Raspberry Pi			✓	✓
Raspberry Pi Pico				✓




Physical computing lessons within the Teach Computing Curriculum




The screenshot shows the top navigation bar of the National Centre for Computing Education website. The logo is on the left, and 'Create an account' and 'Log in' are on the right. Below the logo is a menu with 'Primary school', 'Secondary school', 'Training and support', 'Teaching resources', and 'About us'. The main content area has a dark blue background with a white box containing 'Year 1' and a larger white box containing 'Programming A – Moving a robot'.

[Curriculum](#) > [KS1](#) > Unit

This unit introduces learners to early programming concepts. Learners will explore using individual commands, both with other learners and as part of a computer program. They will identify what each floor robot command does and use that knowledge to start predicting the outcome of programs. The unit is paced to ensure time is spent on all aspects of programming and builds knowledge in a structured manner. Learners are also introduced to the early stages of program design through the introduction of algorithms.

 [Unit guide](#)
(DOCX, 141 KB)
Updated: 22 Feb 2022

 [Learning graph](#)
(PDF, 131 KB)
Updated: 22 Feb 2022

The [Teach Computing Curriculum](#) acknowledges that physical computing plays an important role in modern pedagogical approaches in Computing, both as tools to engage learners and a strategy to develop learners' understanding in more creative ways. Therefore, it has been included as an approach for teaching computing in the following units:

- **Year 1** [Moving a Robot](#) (Bee-Bot)
- **Year 2** [Robot Algorithms](#) (Bee-Bot)
- **Year 5** [Selection in physical computing](#) (Crumble)
- **Year 6** [Sensing Movement](#) (micro:bit)
- **Year 9** [Applying Programming Skills with Physical Computing](#) (micro:bit)
- **KS4** [Programming Part 5 Strings and lists](#) (Raspberry Pi)
[Physical Computing Project](#) (Raspberry Pi Pico)



Data and Information lessons within the Teach Computing Curriculum



The screenshot shows the National Centre for Computing Education website. The header includes the logo and navigation links for 'Primary school', 'Secondary school', 'Training and support', 'Teaching resources', and 'About us'. A 'Year 4' tab is selected, and the main heading reads 'Data and information – Data logging'.

[Curriculum](#) > [KS2](#) > Unit

In this unit, pupils will consider how and why data is collected over time. Pupils will consider the senses that humans use to experience the environment and how computers can use special input devices called sensors to monitor the environment. Pupils will collect data as well as access data captured over long periods of time. They will look at data points, data sets, and logging intervals. Pupils will spend time using a computer to review and analyse data. Towards the end of the unit, pupils will pose questions and then use data loggers to automatically collect the data needed to answer those questions.



[Unit guide](#)

(DOCX , 84.9 KB)
Updated: 14 Feb 2023



[Learning graph](#)

(PDF , 119 KB)
Updated: 03 Feb 2022



[Rubric](#)

(DOCX , 139 KB)
Updated: 03 Feb 2022

[The National Centre for Computing Education](#) acknowledges the prevalence of data within our lives. Many of our daily activities are influenced by data and information: from looking up a weather forecast so you can decide what to wear, to making important financial decisions, or simply choosing what to watch next on your chosen streaming service. To participate effectively in modern society, data skills and an awareness of how data is used are essential for our learners. [The Teach Computing Curriculum](#) includes lessons on Data and Information for each year group to support teachers in teaching these vital skills.

Although data logging isn't technically physical computing, it has been included within this guide as it requires additional kit that you may not have readily available to you in your school.

The Year 4 Data and Information unit requires the use of data loggers. Vu+ Data Loggers are now available to loan from your local NCCE Hub to support the successful teaching of the Year 4 Data Logging unit. Cross-curricular links can also be made to maths and science.

■ Year 4 [Data Logging](#) (Vu+ Data Logger)



Getting started with Bee-Bot (KS1)

A Bee-Bot is a fixed-movement floor robot with a limited range of functions, designed for young learners. Bee-Bot can move in steps of 15cm, turn in 90° turns, and can be programmed with up to 200 commands, teaching control, directional language and programming.

What do you need?

- Bee-Bot bag from the NCCEHub kit

Teach Computing Curriculum lessons

- [Year 1 Planning - Moving a Robot](#)

This unit introduces learners to early programming concepts. Learners will explore using individual commands, both with other learners and as part of a computer program. They will identify what each floor robot command does and use that knowledge to start predicting the outcome of programs. The unit is paced to ensure time is spent on all aspects of programming and builds knowledge in a structured manner. Learners are also introduced to the early stages of program design through the introduction of algorithms.

- [Year 2 Planning - Robot Algorithms](#)

This unit develops learners' understanding of instructions in sequences and the use of logical reasoning to predict outcomes. Learners will use given commands in different orders to investigate how the order affects the outcome. They will also learn about design in programming. They will develop artwork and test it for use in a program. They will design algorithms and then test those algorithms as programs and debug them.

CPD

- [Physical Computing Kits KS1 Bee-Bots](#)

During this CPD, you'll explore how Bee-Bots can be used in the classroom to teach simple algorithms and programming. You'll find out how to use the device to introduce children to programming, why physical computing devices help pupils understand debugging and explore how to use the device with children. The CPD will help you gain confidence in teaching using Bee-Bots, and the free Teach Computing Curriculum.

Find out more

Visit the [TTS website](#) for more information on Bee-Bots.



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Getting started with Vu+ Data Loggers (KS2)

A data logger is a digital device that can collect data over time and store it. The Vu+ data logger has 3 built-in sensors :

- Sound
- Light
- Temperature

Data can be collected without being connected to a computer, with 14 days of logging on one charge. The Vu+ data logger has an intuitive, large graphical display menu which makes it easy for younger learners to collect data. It can be connected to a computer using the EasySense2 software via Bluetooth or USB. The EasySense2 software has features specific to primary education which allows the easy analysis of data on screen.

What do you need?

- Loan kit: Vu+ Data Loggers
- [Software: EasySense2 App](#) (Click download to select your device's operating system)
Available on OSX Store, Android, iOS Store, Chromebook Store and Windows 10 Store



Image used with kind permission of Data Harvest

Getting started with the Vu+ Data Logger (KS2) cont.

Teach Computing Curriculum lessons

■ [Year 4 Data Logging](#)

In this unit, pupils will consider how and why data is collected over time. Pupils will consider the senses that humans use to experience the environment and how computers can use special input devices called sensors to monitor the environment. Pupils will collect data as well as access data captured over long periods of time. They will look at data points, data sets, and logging intervals. Pupils will spend time using a computer to review and analyse data. Towards the end of the unit, pupils will pose questions and then use data loggers to automatically collect the data needed to answer those questions.

CPD

■ [Physical computing kits - KS2 data loggers](#)

During this CPD, you'll explore how data loggers can be used in the classroom to support the teaching of the KS2 computing curriculum. You'll find out how the data loggers and their related software work, gain hands-on experience of using them to collect a range of data and how to use them with pupils to collect, analyse, evaluate and present a range of data.

Safety

- You can connect the Vu+ data loggers to lanyards which learners can wear around their neck to support the safe transit of devices in and around school. These are equipped with safety release catches.
- Consider risk assessments for practical experiments based on your own school's protocols.



Find out more

Visit the [Data Harvest Website](#) for more information about the Vu+ data loggers.



Getting started with Crumble (KS2)

The Crumble is an easy-to-use programmable controller that is capable of driving two motors. Equipped with 4 IO (input/output) terminals, the Crumble device enables users to connect LEDs, switches, and more.

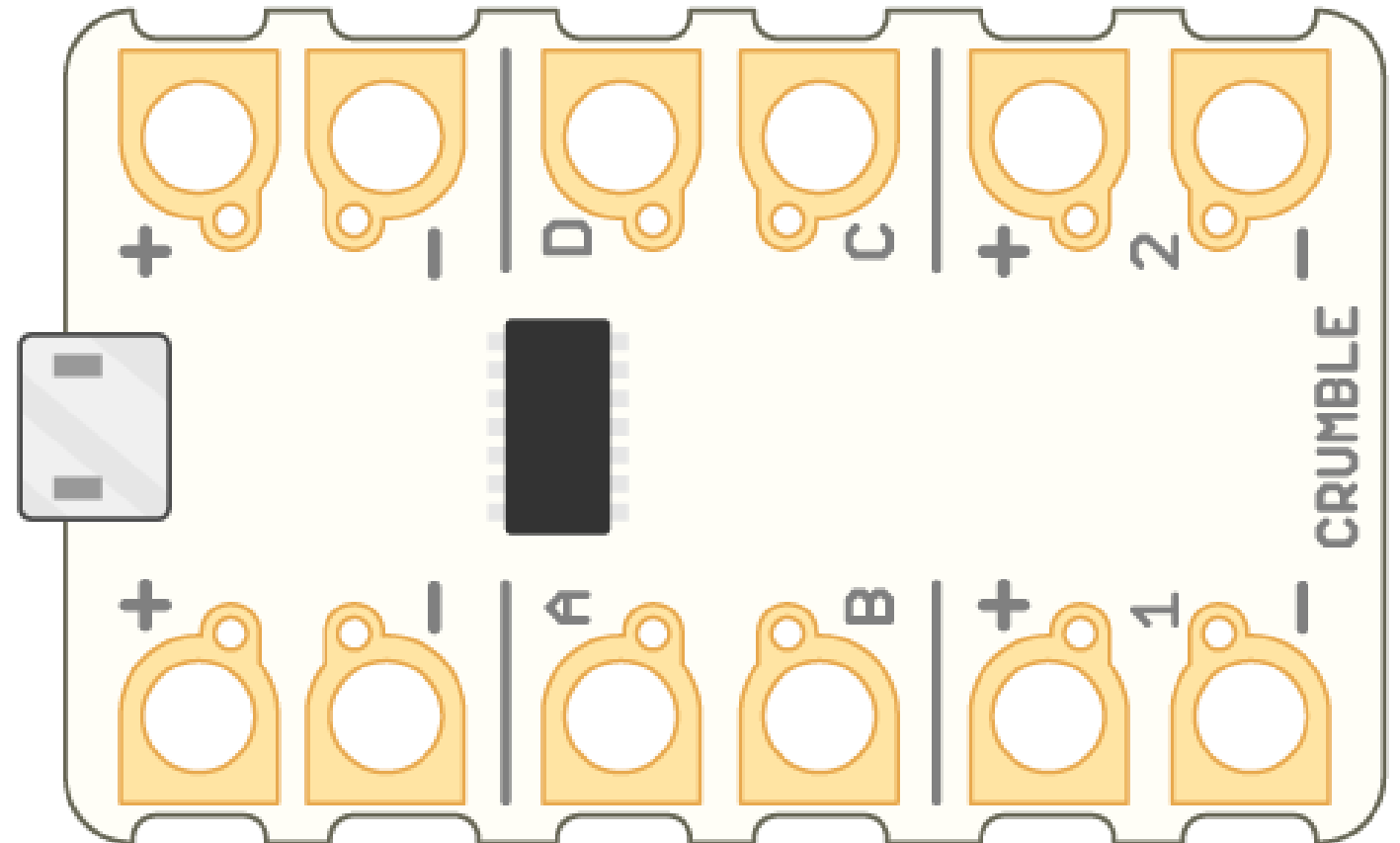
[The Crumble software](#) is available for Windows, Mac OS, Chrome OS and Raspberry Pis or other Linux-based computers. It offers a block-based programming environment with blocks of code 'snapping' together. Programs are sent to the device via the supplied USB lead.

What do you need?

- Crumble tray from the NCCE Hub kit
- [Crumble software](#)
- 3 x AA batteries per device

Extra equipment you may need to deliver the activities are:

- Headphones or speakers for sound
- Craft materials such as: cardboard, rubber bands, scissors, tin foil and glue



Getting started with Crumble (KS2) cont.

Teach Computing Curriculum lessons

- [Year 5 - Programming A – Selection in physical computing](#)

In this unit, learners use physical computing to explore the concept of selection in programming through the use of the Crumble programming environment. Learners are introduced to a microcontroller (Crumble controller) and learn how to connect and program components (including output devices – LEDs and motors) through the application of their existing programming knowledge.

Learners are introduced to conditions as a means of controlling the flow of actions, and explore how these can be used in algorithms and programs through the use of an input device (push switch). Learners use their knowledge of repetition and conditions when introduced to the concept of selection (through the 'if... then...' structure) and write algorithms and programs that utilise this concept.

To conclude the unit, learners design and make a working model of a fairground carousel that will incorporate their understanding of how the microcontroller and its components are connected, and how selection can be used to control the operation of the model. Throughout the unit, pupils apply the stages of programming design.

CPD

- [Physical computing kit - KS2 Crumble - short course](#)

During this CPD you'll explore how Crumble can be used in the classroom, with blocks of code 'snapping' together in an easy-to-use, Scratch-like environment suitable for key stage 2. You'll find out how to setup the device, how to make use of input and output terminals and explore how to use the device with children.

Additional resources

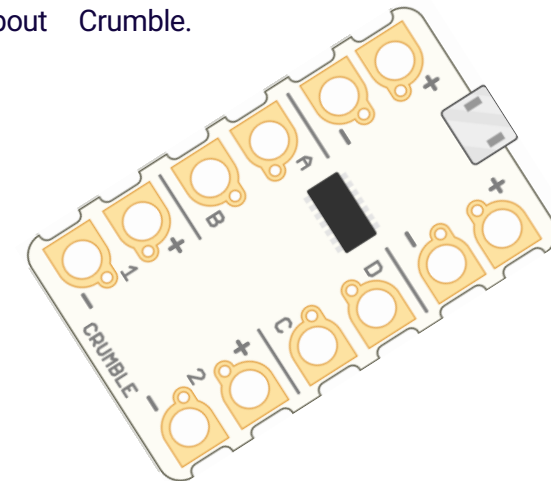
- [Getting started with Crumble](#)
- [Crumble projects](#)

Safety

- Always ensure care is taken when connecting croc leads to terminals
- Be mindful to place batteries in the battery pack correctly

Find out more

Visit [Redfern Electronics](#) for more information about Crumble.



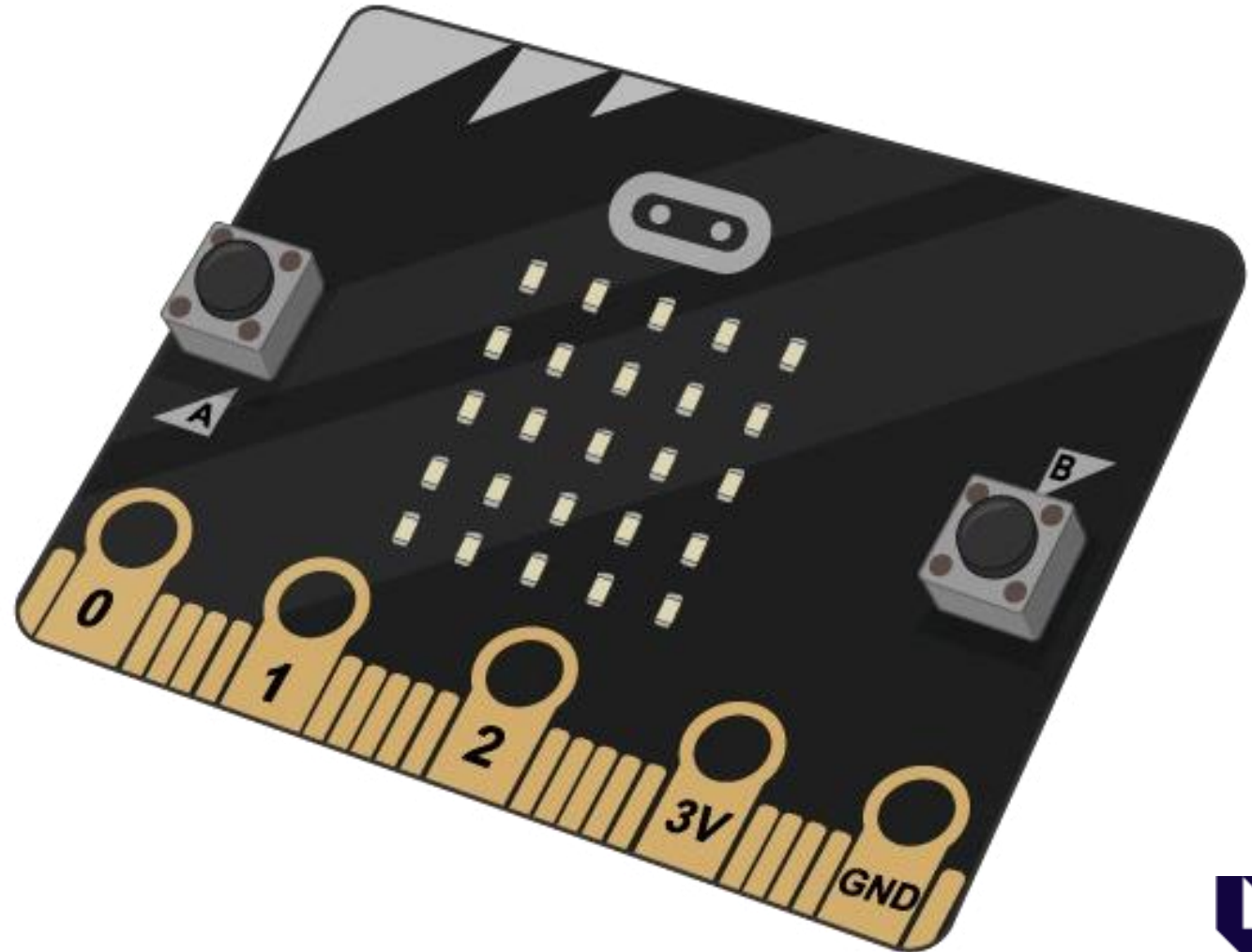
Getting started with micro:bit (KS2 & 3)

The micro:bit is a microcontroller device that you can use in digital making projects. It has two buttons, 25 red LEDs in a 5 × 5 grid, and sensors for detecting movement and light, and for measuring temperature. You can also attach other input and output components to it, for example buttons, coloured LEDs, and speakers. The micro:bit is suitable for use with students at key stage 2 and key stage 3.

To program the micro:bit, you need to connect it to a laptop or desktop computer via a micro-USB cable. The micro:bit is powered through this same USB cable; to make your micro:bit project portable, you can also power it using a battery pack.

What do you need?

- The micro:bit tray from the NCCE Hub kit
- AAA Batteries x 2 per device if you need to use the battery pack



Getting started with micro:bit (KS2 & 3) cont.

Preparations for programming micro:bit

- [Getting started with micro:bit](#)

Teach Computing Curriculum Lessons

- [Year 6 – Programming B – Sensing movement](#)

This unit is the final KS2 programming unit in the curriculum and brings together elements of the four programming constructs: sequencing from Year 3, repetition from Year 4, selection from Year 5 and variables, introduced in Year 6 – Programming A. It offers learners the opportunity to use all of these constructs in a different, but familiar environment whilst also utilising a physical device – the micro:bit. The unit begins with a simple program which learners build and test in the programming environment before transferring it to their micro:bit. Learners then take on three new projects in lessons 2, 3 and 4, with each lesson adding more depth.

- [Year 9 – Applying programming skills with physical computing](#)

This unit applies and enhances the learners' programming skills in a new engaging context: physical computing, using the BBC micro:bit. In the first half of the unit, learners will get acquainted with the host of components built into the micro:bit, and write simple programs that use these components to interact with the physical world. In the process, they will refresh their Python programming skills and encounter a range of programming patterns that arise frequently in physical computing applications. In the second half, learners will work in pairs to build a physical computing project. They will be required to select and design their project purposefully, apply what they have learnt by building a prototype, and keep a structured diary throughout the process. The Year 8 and 9 programming units are prerequisites for this unit. It is assumed that learners are already able to write Python programs that use variables and data structures to keep track of information. They are also expected to be able to combine sequence, selection, iteration, and function/method calls to control the flow of program execution.

Transferring (flashing) code to the Micro:Bit

- [Drag and Drop](#)
- [Direct Flashing](#)
- [Transfer from the mobile app](#)

CPD

- [Introduction to the micro:bit in key stage 2 - short course](#)
- [Physical computing kit - KS3 micro:bit - short course](#)

Additional resources

Beginner

- [Magic 8 Ball](#)
- [Rock, Paper, Scissors](#)

Intermediate

- [Sensitive Step Counter](#)
- [Teleporting Duck](#)

Advanced

- [Reaction Game](#)

Find out more

Visit the [Micro:bit website](#) for more information.



Getting started with Raspberry Pi (KS3 & 4)

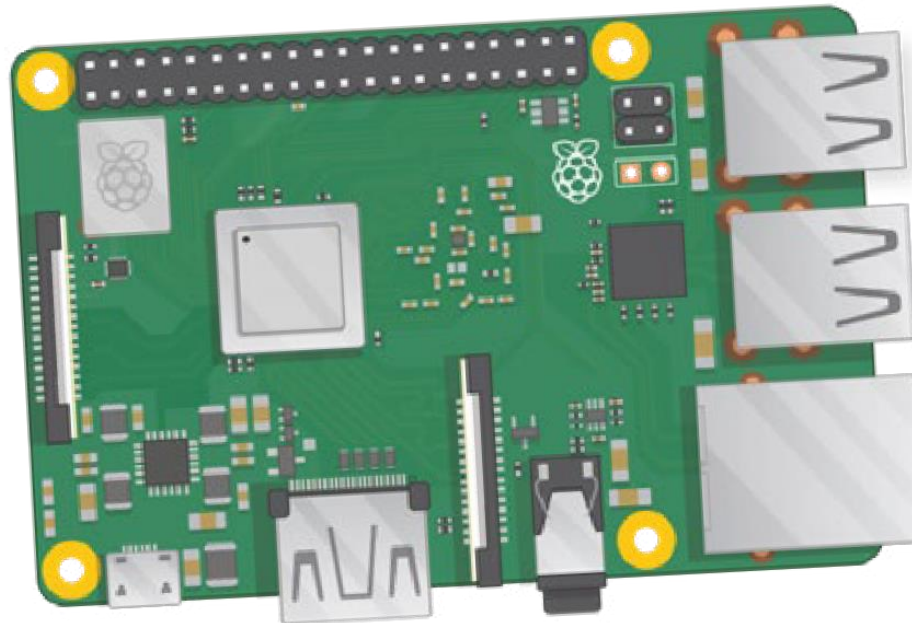
A Raspberry Pi is a single-board computer that can be used for everyday tasks and for learning how to code. Thanks to its size, processing power, and General-Purpose Input/Output (GPIO) pins, it can be used in physical computing projects and as a general-purpose computer. Included in the Hub kit are the third-generation model of the computer, Raspberry Pi 3 Model B+, and a Sense HAT.

Raspberry Pi 3 Model B+

- 1.4GHz 64-bit quad-core processor
- Dual-band wireless LAN
- Bluetooth 4.2/BLE
- Faster Ethernet
- Power-over-Ethernet support (with separate PoE HAT)

Sense HAT

The Sense HAT is an add-on board for Raspberry Pi, made especially for the [Astro Pi](#) mission – it launched to the International Space Station in December 2015 and is now widely available.



The Sense HAT has an 8 × 8 RGB LED matrix, a five-button joystick and includes the following sensors:

- Gyroscope
- Accelerometer
- Magnetometer
- Temperature
- Barometric pressure
- Humidity

There is also a [Python library](#) provided.

Note: Raspberry Pi Zero and Raspberry Pi Zero W are smaller and require less power, so they're useful for portable projects, such as robots. It's generally easier to start a project with Raspberry Pi 3, and to move to Raspberry Pi Zero when you have a working prototype that the smaller Raspberry Pi would be useful for. Raspberry Pi 4 is the newest, fastest, model coming in 1GB, 2GB, and 4GB models.



Getting started with Raspberry Pi (KS3 & 4) cont.

What do you need?

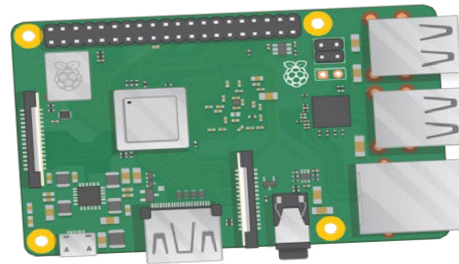
- Raspberry Pi computer tray from the NCCE Hub kit
- Monitors
- Keyboards
- Mice
- Cables to connect Raspberry Pi computers to monitors

Extra equipment you may need to deliver the activities are:

- Headphones or speakers for sound
- Network connect via Ethernet, WiFi or Bluetooth
- Craft materials such as: cardboard, rubber bands, scissors, tin foil and glue
- USB memory stick to back up students' work
- The SD Card provided comes with the operating system, Raspbian, pre-installed. From time to time you may need to format the cards and reinstall the software. Check with the Hub that you have loaned the kit from if you have any questions about this.

Preparations for programming Raspberry Pi

- [Setting up your Raspberry Pi](#)
- [Using your Raspberry Pi](#)
- [Getting started with the Sense HAT](#)



Teach Computing Curriculum Lessons

- [KS4 GCSE Unit 7 – Programming Part 5 Strings and lists](#)

This extensive programming unit takes learners from being complete novices to having the confidence to tackle any GCSE level programming challenge. Essential programming theory is also interleaved into the practical elements of programming to provide tangible links between required knowledge and skills.

Additional resources

- [Build a music box](#)
- [Python quick reaction game](#)
- [Node-red LED](#)
- [Compass maze](#)
- [Rainbow predictor](#)

Find out more

Visit the [Raspberry Pi Foundation](#) for more information.



Getting started with Raspberry Pi Pico (KS4)

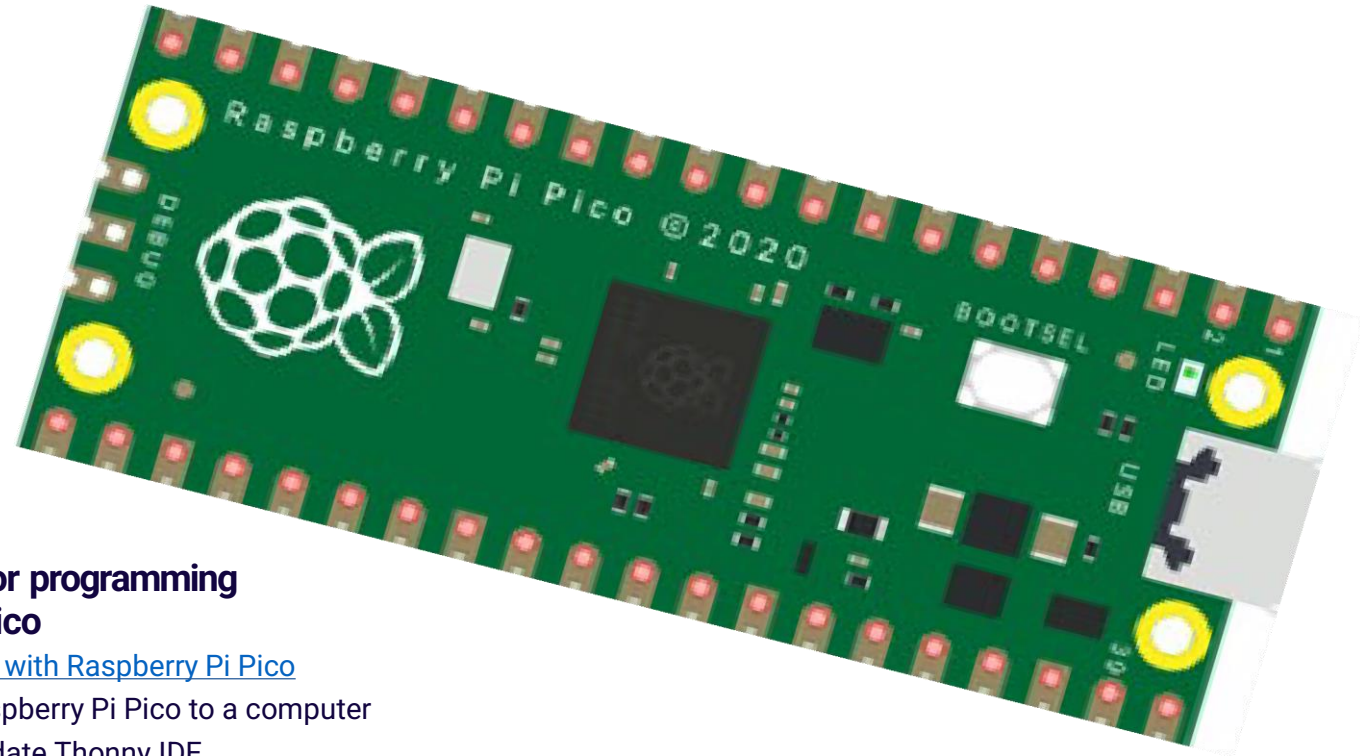
Raspberry Pi Pico is a low-cost microcontroller device. Microcontrollers are tiny computers, but they tend to lack large volume storage and peripheral devices that you can plug in (for example, keyboards or monitors). Raspberry Pi Pico has GPIO pins, which means it can be used to control and receive input from a variety of electronic devices. It is suitable for use with key stage 3 and 4 students who have experience of writing text-based code.

What do you need?

- Raspberry Pi Pico tray from the NCCE Hub kit
- Computers running the Thonny IDE
(one per pair of learners)
- 6 x AA batteries per Raspberry Pi Pico
- 1 powerbank
- 1 mini cross-head screwdriver

Preparations for programming Raspberry Pi Pico

- [Getting started with Raspberry Pi Pico](#)
- Connect Raspberry Pi Pico to a computer
- Install or update Thonny IDE
- A copy of the latest [micropython UF2 file](#) for learners to access



Getting started with Raspberry Pi Pico (KS4)

Teach Computing Curriculum lessons

- [KS4 - Physical computing project](#)

This unit introduces learners to physical computing through six lessons culminating in a finished working robotic buggy. Using the Raspberry Pi Pico microcontroller, learners will explore inputs and outputs utilising a range of hardware components including motors, reflective optical sensors, LEDs, and an ultrasonic sensor. This unit of work allows learners to practically experience the use of embedded systems in support of the GCSE computer science specifications.

CPD

- [Physical computing kit - KS4 Raspberry Pi Pico - short course](#)

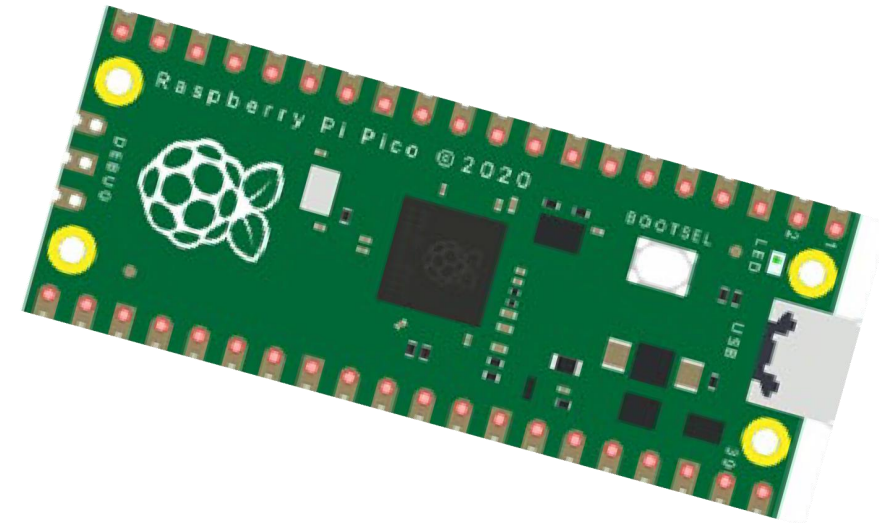
During this CPD you'll explore how the Pico, which is equipped with general-purpose input and output (GPIO) pins, can be used to control and receive input from a huge variety of electronic components and digital devices. It is suitable for use with students at key stage 3 and 4 who have experience of writing text based code. You'll find out how to setup the device, how to make use of the GPIO pins for sensor input and actuator output, and explore how to use the device with students

Additional resources

- [Blink the built-in LED of Raspberry Pi Pico](#)

Find out more

Visit the [Raspberry Pi Foundation](#) for more information.



Additional resources: Primary enrichment tray cont.

The Kitronik primary enrichment tray helps you to enrich your computing curriculum by extending the capabilities of the micro:bit. The LAB:bit board (shown below) allows pupils to investigate inputs and outputs, control traffic lights, create musical instruments and much more through creative projects. The LAB:bit is packed with features including a motor, an ultrasonic distance sensor, a microphone, programmable ZIP LEDs and more.



What's in the kit?

- 11 LAB:bit
- 11 spoke injection moulded Wheel and tyre for the motor
- 11 3xAA Battery cage
- 11 Printed A3 Build instructions
- 11 Micro:bit
- 11 Micro USB cables
- 11 Micro:bit cases

What do you need?

- Primary Enrichment Tray – Lesson in a Box
- 3 x AA batteries per devices if using battery packs
- Tape/Glue
- Time to explore and adapt resources for your learners

Additional resources

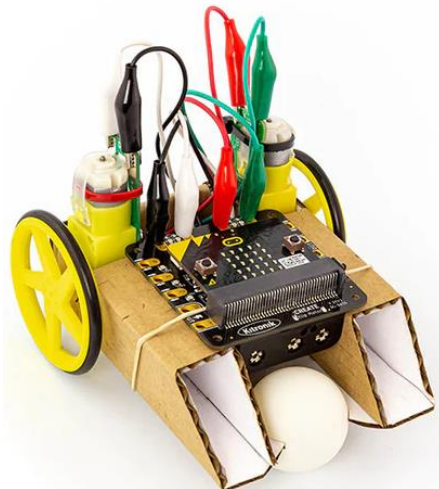
The Kitronik LAB:bit comes with 7 tutorials

- [Make your own switch.](#)
- [Making a Dice.](#)
- [Colouring a rainbow.](#)
- [Traffic lights.](#)
- [Controlling motor speed.](#)
- [Scare the micro:bit, using sound to drive LEDs.](#)
- [Parking sensor](#)



Additional resources: Secondary enrichment tray

The Kitronic secondary enrichment tray helps to enrich your curriculum by introducing students to simple robotics. Using the kit, students can create robots which utilise the BBC micro:bit and the Klip Motor Driver board. Accompanied by a handy guide to support teachers and technicians with the initial setup, it requires no soldering as connections are made using crocodile clips. It is suitable for a range of cross-curricular projects linking computing to design technology and physics.



Images used with kind permission of Kitronic Ltd

What's in the kit?

- 11 x Kitronic klip motor driver boards for BBC micro:bit
- 22 x Kitronik clippable TT motor boards (with screws)
- 22 x right angle geared hobby TT motors
- 22 x 5 spoke injection moulded wheels for TT motors
- 11 x set of 10 clip leads
- 11 x ping pong balls for robot castor
- A simple chassis template
- 11 micro:bits
- 11 micro:bit cases



What do you need?

- Secondary Computing Enrichment Tray
- 3 x AA batteries per device
- Cardboard for making the chassis templates (2-3mm is ideal) A paper template for manual cutting and DXF file for laser cutting are included
- Cable ties
- Rubber bands
- Tape
- Glue
- Time to explore and adapt resources for your learners

