

Teaching with the BBC micro:bit in Wales

CURRICULUM	AGE GROUP	AIM OF THE GUIDE
Curriculum for Wales 2021	Progression Step 3 Year 4, 5, 6 Age 8 - 11	To support teachers in Year 4, 5 and 6 classes to use the BBC micro:bit to help deliver key aspects of the Science and Technology area of learning and experience with a focus on the statement of what matters: Computation is the foundation for our digital world. It also aims to signpost opportunities to use the micro:bit in other areas of learning and how it can support cross-curricular skills.

THE BENEFITS OF USING BBC MICRO:BIT
The micro:bit is a small computing device with a variety of sensors that facilitates practical and engaging learning. Learners can write code to utilise these sensors and build programs that are meaningful and relevant to them. It is a tangible way to develop computational thinking and coding skills, as well as creativity as they can develop ideas to solve problems in the world around them.

Using the BBC micro:bit to support learning in science and technology

STATEMENT OF WHAT MATTERS – COMPUTATION IS THE FOUNDATION FOR OUR DIGITAL WORLD			
DESCRIPTIONS OF LEARNING PROGRESSION STEP 3	CODING AND PROGRAMMING IDEAS TO INTRODUCE KEY CONCEPTS	SHORT MICRO:BIT PROJECTS WITH VIDEO	MICRO:BIT UNITS OF WORK / DESIGN CHALLENGES *
I can use conditional statements to add control and decision-making to algorithms .	<ul style="list-style-type: none"> Use data collected from sensors or user input to control how an algorithm selects or decides what to do next based on when a specific condition has been met. 	<ul style="list-style-type: none"> Clap lights 	<ul style="list-style-type: none"> First lessons unit of work

	<ul style="list-style-type: none"> Program the micro:bit to react to the specific condition of sensing a loud noise (an input from the sound sensor) and switch on the LED display. 		
I can identify repeating patterns and use loops to make my algorithms more concise .	<ul style="list-style-type: none"> Use repeat loops to program a repeating LED display output that behaves like an animation. Use repeat loops to play a sequence of notes and create musical output from the speaker. Look for patterns in algorithms and code where a sequence is repeated, and then use repeat loop blocks to make the code more concise and efficient, using the least number of blocks. 	<ul style="list-style-type: none"> Beating heart Dance steps Frère Jacques loops 	<ul style="list-style-type: none"> Wildlife animations unit of work
I can explain and debug algorithms .	<ul style="list-style-type: none"> Create a simple algorithm using flowchart notation to explain how a simple project program works. Annotate screenshots of the project code explaining how the algorithm has been translated into code. Use the MakeCode simulator in debug mode and step through a beginner program block by block to detect errors or bugs. Refer back to the original task algorithm and correct the bugs. 	<ul style="list-style-type: none"> Name badge Shining sunbeams 	<ul style="list-style-type: none"> First lessons unit of work
I can use sensors and actuators in systems that gather and process data about the systems' environment .	<ul style="list-style-type: none"> Use data from the environment collected from sensors to control how a program selects or decides what to do next. Program the micro:bit to process input data from the sound sensor to react to a loud noise and switch on the LED display. Gather data from the accelerometer to sense whether the micro:bit is level and provide sound feedback to the user. 	<ul style="list-style-type: none"> Clap lights Spirit level 	<ul style="list-style-type: none"> Litter hunt unit of work
I can identify positive and negative design elements that affect user interactions .	<ul style="list-style-type: none"> Create a labelled/annotated diagram of the micro:bit identifying the different types of user interaction that can be programmed, including the touch logo, buttons, sensor input etc. Ask peers to give positive and negative feedback on how they interacted with the micro:bit in the Touch stopwatch project. Modify the device code and/or the device construction based on feedback. 	<ul style="list-style-type: none"> Touch stopwatch 	
I can explain how digital devices can be interconnected locally and globally.	<ul style="list-style-type: none"> Model sending and receiving messages using sticky notes and discuss possible problems with the system. Explore how micro:bits can send and receive messages and data using the built-in radio antennae. 	<ul style="list-style-type: none"> Teleporting duck Send a smile 	<ul style="list-style-type: none"> Protecting animals on land

	<ul style="list-style-type: none"> Find out how messages received from another micro:bit can be used in a program to trigger a response. Create a flow diagram to show the way that data passes between connected digital devices in a micro:bit project. 	<ul style="list-style-type: none"> Indoor-outdoor thermometer 	<ul style="list-style-type: none"> design challenge Nature art unit of work
I can explain the importance of securing the technology I use and protecting the integrity of my data .	<ul style="list-style-type: none"> Discuss how apps use encryption and other security methods to secure messages sent between devices to protect the data integrity. Use the micro:bit radio group system to send data securely to other micro:bits by specifying which channel will receive the data. Program the micro:bit to send a coded message to another micro:bit where only the recipient knows the code/cipher to read the message. Use the micro:bit to generate random phrases that could be used as a secure but easy to remember password. 	<ul style="list-style-type: none"> Secure messaging Poetry generator 	
I can explain how my data is used by services , which can help me make more informed decisions when using technology .	<ul style="list-style-type: none"> Discuss the many ways that personal data is collected and used by different types of services, tools, apps and platforms in the digital world. Program the micro:bit to send and receive secure coded messages using the radio antennae and radio groups. Introduce the topics of machine learning and AI and how machine learning and AI apps collect and use data. Try the machine learning activity from the BBC micro:bit playground survey to explore the way micro:bit technology can learn from your data and use it. 	<ul style="list-style-type: none"> Secure messaging 	<ul style="list-style-type: none"> BBC micro:bit playground survey Exploring machine learning
I can explain how data is stored and processed .	<ul style="list-style-type: none"> Examine the micro:bit board with magnification, identify the processor and how it is connected to other components. Create a flow diagram to explain the processes involved when data is collected, processed and stored. Use variable blocks in a program to enable the micro:bit to process and store input data and respond to it e.g. display the total number of times a button is pressed, or an item is selected from a list. 	<ul style="list-style-type: none"> Species counter Activity picker 	<ul style="list-style-type: none"> First lessons unit of work
I can effectively store and manipulate data to produce and give a visual form to useful information .	<ul style="list-style-type: none"> Discuss the differences between measuring, recording and logging data. Use the micro:bit data logging capabilities to measure, record and store data either from built-in sensors or direct user input. There are specific code blocks in MakeCode to write this type of program – the code can be downloaded from the project page. 	<ul style="list-style-type: none"> Environment data logger Traffic data logger 	<ul style="list-style-type: none"> Data logging user guide

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| | <ul style="list-style-type: none">• This information can then be viewed in visual form as tables and graphs by connecting the micro:bit to a computer and viewing the data file. Students can then manipulate the data to answer questions. | | |
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* Design challenges are aligned with the UN Global Goals and support the development of design thinking skills – [click here for more information and CPD courses in design thinking](#).

Digital Competence Framework: The micro:bit activities outlined above will also support learning skills in the Data and computational thinking strand elements shown below.

Problem solving and modelling

- I can create and refine algorithms and flowcharts to solve problems, making use of features such as loops, Boolean values and formulae.
- I can understand the importance of the order of statements within algorithms.

Data and information literacy

- I can construct, refine and interrogate data sets within tables, charts, spreadsheets and databases to test or support an investigation.

Cross-curricular opportunities using the BBC micro:bit

AREA OF LEARNING, STATEMENTS OF WHAT MATTERS, AND DESCRIPTION OF LEARNING AT PROGRESSION STEP 3	MICRO:BIT HARDWARE	CONCEPTS	SUGGESTED TOPICS AND ACTIVITIES	SHORT MICRO:BIT PROJECTS WITH VIDEOS	MICRO:BIT UNITS OF WORK / DESIGN CHALLENGES*
<p>Humanities Enquiry, exploration and investigation inspire curiosity about the world, its past, present and future.</p> <ul style="list-style-type: none"> I can use appropriate methods to gather information related to my enquiries and I am able to interpret the information obtained in the context of the enquiry question. <p>Our natural world is diverse and dynamic, influenced by processes and human actions.</p> <ul style="list-style-type: none"> I can locate and give simple explanations for the distinctive features of places, spaces and landforms in my locality and in Wales, as well as in the wider world. <p>Informed, self-aware citizens engage with the challenges and opportunities that face humanity, and are able to take considered and ethical action.</p> <ul style="list-style-type: none"> I have planned and taken an active role in response to challenges and opportunities in my local community, or in Wales or the wider world, and I have done so individually or as part of a team. 	Accelerometer Magnetometer Buttons Temp. sensor	Algorithms Conditionals Processing data Storing data Sensors User interaction	<p>Local area fieldwork: Use the micro:bit as a counter to help record a biodiversity survey of local wildlife – test different types of user interaction – e.g. on shake, buttons, touch logo</p> <p>Compass directions: Use the magnetometer as a compass to help navigate a local route and locate specific places.</p> <p>Mapping the playground: Use the micro:bit to measure playground dimensions to create a scale map – use to support investigations into environmental conditions and projects to improve them – e.g. litter/recycling/wildlife.</p>	<ul style="list-style-type: none"> Distance calculator Which way now Species counter 	<ul style="list-style-type: none"> Saving sea creatures design challenge Energy awareness unit of work BBC micro:bit playground survey

<p>Science and technology</p> <p>Being curious and searching for answers is essential to understanding and predicting phenomena.</p> <ul style="list-style-type: none"> I can identify questions that can be investigated scientifically and suggest suitable methods of inquiry. I can evaluate methods to suggest improvements. <p>The world around us is full of living things which depend on each other for survival.</p> <ul style="list-style-type: none"> I can describe how living things compete for specific resources and depend on each other for survival. <p>Matter and the way it behaves defines our universe and shapes our lives.</p> <ul style="list-style-type: none"> I can recognise that our planet provides natural materials and can explain why they may have been processed to make them useful. <p>Forces and energy provide a foundation for understanding our universe.</p> <ul style="list-style-type: none"> I can explain how the properties of sound and light will affect how they are experienced. I can describe how magnetic fields behave and explore a range of practical uses for them. <p>Design thinking and engineering offer technical and creative ways to meet society's needs and wants.</p> <ul style="list-style-type: none"> I can use design thinking to test and refine my design decisions without fear of failure. 	<p>Light, temp. and sound sensors</p> <p>Buttons</p>	<p>Algorithms</p> <p>Conditionals</p> <p>Repetition</p> <p>Storing data</p> <p>User Interaction</p> <p>Sensors</p> <p>Decomposition</p>	<p>Collecting and recording data: Use the micro:bit to measure temperature as part of an investigation into thermal conductivity of different materials and link to their uses.</p> <p>Measuring physical properties: Use the micro:bit to measure electrical conductivity of different materials.</p> <p>Comparing results: Use the accelerometer to record body movements when carrying out different exercises over time.</p> <p>Designing a product to solve a problem: Build a device that will alert you to movement and act as an intruder alarm – create a prototype and modify after testing.</p> <p>Writing a computer program to control a device: Use the MakeCode programming language to write a program that uses the micro:bit's sensors to trigger a</p>	<ul style="list-style-type: none"> Thermometer Conductivity tester Sensitive step counter Simple door alarm Sensory toy Nightlight 	<ul style="list-style-type: none"> Electrical conductors unit of work Protecting animals on land design challenge Night safety design challenge
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<ul style="list-style-type: none"> I can consider how my design proposals will solve problems and how this may affect the environment. I can combine component parts, materials and processes to achieve functionality and improve the effectiveness of my outcomes. 			<p>response for the user – e.g. a turn on a light.</p>		
<p>Maths Algebra uses symbol systems to express the structure of mathematical relationships.</p> <ul style="list-style-type: none"> I can demonstrate an understanding of the idea of input, application of a rule (including inverse operations) and output, using a function machine or other appropriate methods, and I have applied this idea to solve problems. <p>Measurement focuses on quantifying phenomena in the physical world.</p> <ul style="list-style-type: none"> I can estimate and measure length, capacity, mass, temperature and time, using appropriate standard units. I can convert between standard units, inc. apply understanding of place value to convert between metric units. <p>Statistics represent data, probability models chance, and both support informed inferences/decisions.</p> <ul style="list-style-type: none"> I can collect different types of data to answer a variety of questions that have been posed, demonstrating an understanding of the importance of collecting relevant data. 	<p>Processor memory</p>	<p>Manipulating data</p> <p>Visual forms of data</p> <p>Logical thinking</p>	<p>Carrying out calculations using simple formula: Use simple calculation formula to make a times tables tester.</p> <p>Measuring distance: Use the micro:bit as a step counter that can measure distance – calibrate using standard units.</p> <p>Analyse collected data: Collect and record data using the built-in sensors and then analyse using charts/graphs.</p> <p>Carrying out calculations using simple formula: Use simple calculation formula to make a measurement unit converter.</p>	<ul style="list-style-type: none"> Times table tester Environment data logger Fahrenheit thermometer 	<ul style="list-style-type: none"> Data handling unit of work
<p>Expressive arts Exploring the expressive arts is essential to developing artistic skills and knowledge</p>	<p>LED display</p> <p>Speakers</p>	<p>Algorithms</p> <p>Patterns</p>	<p>Explore the use of ICT as an art medium: Design images and</p>	<ul style="list-style-type: none"> Beating heart Animated animals 	<ul style="list-style-type: none"> Wildlife animations unit of work

<p>and it enables learners to become curious and creative individuals.</p> <ul style="list-style-type: none"> I can explore and experiment independently and demonstrate technical control with a range of creative materials, processes, resources, tools and technologies showing innovation and resilience. <p>Creating combines skills and knowledge, drawing on the senses, inspiration and imagination</p> <ul style="list-style-type: none"> I can draw upon my design knowledge and make connections with greater independence to modify and develop my creative designs. 	<p>Micro-phone</p> <p>Output pin</p> <p>Touch sensor</p>	<p>Loops</p> <p>Processing data</p> <p>Visual data</p> <p>Abstraction</p>	<p>animations that can be displayed using the LED display, taking into account the limitations of the 5x5 grid.</p> <p>Create and edit musical sequences: Design and create a musical note sequence – play on speaker/headphones.</p> <p>Listen to different types of music: Create a digital jukebox using the touch sensor or create your own guitar interface.</p>	<ul style="list-style-type: none"> Sound emotion badge Frère Jacques loops Jukebox Guitar 1 Guitar 2 Guitar 3 	<ul style="list-style-type: none"> Nature art unit of work Musical micro:bit unit of work
<p>Health and wellbeing</p> <p>Developing physical health and well-being has lifelong benefits</p> <ul style="list-style-type: none"> I can motivate myself to engage confidently in regular physical activity and sport and am aware of my own progress. 	<p>Accelerometer</p> <p>Processor memory</p>	<p>Storing data</p> <p>User interaction</p> <p>Sensors</p>	<p>Record their own movements for comparison: Measuring movement of arms/legs during different PE activities like tennis, football etc. and comparing the data over time to see how they are developing skills and stamina.</p>	<ul style="list-style-type: none"> Step counter Kick strength logger 	<ul style="list-style-type: none"> Getting active unit of work Being active unit of work

* Design challenges are aligned with the UN Global Goals and support the development of design thinking skills – [click here for more information and CPD courses in design thinking](#). All these activities will also support learning in the four integral skills of creativity and innovation, critical thinking and problem solving, personal effectiveness and planning and organising.

Key resources

KEY RESOURCES FROM THE MICROBIT.ORG WEBSITE

Lessons, units of work and design challenges:

- A set of 16 [units of work](#) with detailed lesson plans and resources.
- Including [First lessons with MakeCode and the micro:bit](#) – a set of six introductory lessons which is a perfect way to get started with the micro:bit in your classroom. (This set of lessons is also supported by a [40-minute teacher professional development course](#)).
- Our [Design challenge](#) lesson plans and resources are linked to the UN Global Goals.

Short projects:

- Our [Make it: code it projects](#) are short projects themed by topic and features. They are an easy way to bring a bit of micro:bit into most lessons.

Short courses for teachers:

- Our free, teacher [Professional development courses](#) are designed to support teachers building confidence with using the micro:bit including wider learning like talking about computational thinking and design thinking.
- Our [Practical tips course](#) contains lots of tips and tricks for using the micro:bit successfully in your classroom.

Classroom management tool:

- Our [micro:bit classroom](#) platform is great for presenting lessons to the class and sharing code with students so they can explore the activities independently.

Other useful resources:

- [Features of the micro:bit](#)
- [Glossary](#)
- [Classroom resources](#)

Other schemes of work that you can use the micro:bit with

Resource	
Barefoot Computing	<ul style="list-style-type: none"> • Barefoot meets micro:bit resources and lesson plans for Progression Step 3. • Computational thinking resources to support development of skills and approaches.
Twinkl UK micro:bit	<p>Free resources to support the use of the micro:bit including:</p> <ul style="list-style-type: none"> • Teacher CPD presentations and guides on using the BBC micro:bit. • Help cards for students, display posters and resources.
Purple Mash	<ul style="list-style-type: none"> • Units of work with lessons covering how to program the micro:bit using 2Code. • All activities are mapped to the Curriculum for Wales.
HWB Resources Repository	<ul style="list-style-type: none"> • A collection of selected third party teaching resources mapped to the Computational Thinking statement in the Curriculum for Wales, including links to some micro:bit activities.
Twinkl Wales	<ul style="list-style-type: none"> • Computational Thinking activities and resources mapped to the Curriculum for Wales Descriptions of Learning. • Digital Competence Framework Resources and lesson activities.

Using micro:bit hardware features across the curriculum

