



### About the lesson plans

- The numbers within the “Content” section relate to the corresponding slide on the lesson PowerPoint
- Each lesson will typically take a Y4/5 class around 35 minutes, which would include logging on to the machines, giving out devices, etc. Two lessons can therefore be combined for hour long sessions. The majority of sessions have been used with pupils from Y3 to Y6. For older or more able children, lessons 1, 2 and 3 could be taught as a single block, followed by 4, 5 and 6
- In the event more able pupils complete the challenges, they can:
  - Assist other pupils - encourage them to explain the required instructions / concepts, rather than simply undertaking the task for their peers
  - Experiment with other instruction blocks within the *JavaScript Block Editor (PXT)*
  - Increase the complexity of their program - for example, when making animations in lesson three, pupils might add additional images as part of their animation
  - Undertake tasks from future lessons independently. Pupils could subsequently lead the lesson introduction for their peers
  - Use text based languages to program the micro:bit, such as MicroPython - <http://microbit.org/code/>
- The lesson plans link well to the PSHE curriculum, with the micro:bit being used as a way to demonstrate thoughts / feelings about the topic being discussed. The micro:bit also makes an excellent name badge for English / drama presentations, or for when pupils are “in role” and introducing themselves to their peers

### Prior Learning

- Pupils should ideally be familiar with:
  - Opening a web browser and entering a URL (address of a website)
  - Copying files by dragging their icon from one location to another
  - Block based programming environment, such as *Scratch*
- Before each session, pupils could undertake *Computing Unplugged* activities away from the computer to reinforce the appropriate programming concepts. Example activities are available from Phil Bagge’s “Code-IT” website - <http://code-it.co.uk/csplanning.html> and Barefoot Computing - <http://barefootcas.org.uk/>

| Lesson | Lesson Objectives   | Content   | Example activities   |
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| 1      | <ul style="list-style-type: none"> <li>• Pupils can identify components of the micro:bit</li> <li>• Pupils can stay safe when using the micro:bit</li> <li>• Pupils can upload a program to the micro:bit</li> <li>• Pupils can scroll messages</li> <li>• Pupils can use forever loops</li> <li>• Pupils can clear the display</li> <li>• Pupils can display their own design on the display</li> <li>• Pupils can implement a pause between events</li> </ul> | <ul style="list-style-type: none"> <li>• 2 – Discuss objectives with pupils and show the micro:bit device</li> <li>• 3 – Explain to pupils the various features of the device, which include:                             <ul style="list-style-type: none"> <li>○ Accelerometer – detects the speed of movement</li> <li>○ Compass – detects the direction the micro:bit is pointing in</li> <li>○ Bluetooth – allows us to connect to other devices, including mobile phones</li> <li>○ LEDs – programmable lights to display information and images</li> <li>○ Buttons – to trigger events</li> <li>○ Edge connector – for completing a circuit and responding to touch</li> </ul> </li> <li>• 4 – Go through the main safety points with pupils, including the information at <a href="https://www.microbit.co.uk/safety-advice">https://www.microbit.co.uk/safety-advice</a> which includes guidance for pupils, parents and teachers</li> <li>• 5 – Show pupils the micro:bit website – <b>microbit.org</b> and how to get to the block editor (Let's code -&gt; JavaScript Block Editor (PXT)), which is similar to <i>Scratch</i></li> <li>• 6 – Explain to pupils the first lesson will involve scrolling (moving) messages across the screen forever. Show pupils how to drag the relevant blocks across and how the program runs on the emulator, which copies the behaviour of the physical device</li> <li>• 7 – Explain to pupils they now need to put the program onto their micro:bit. Demonstrate pressing <i>Download</i> and copying the file to the micro:bit (NB. the screenshots on the slides are from <i>Google Chrome for Windows 7</i>). Pupils will produce their program and transfer it to the micro:bit</li> <li>• 8 – Once complete, pupils will undertake the various challenges: implement a pause between messages, clear the screen and add an image between messages</li> </ul> | <p><b>Cross-curricular links</b></p> <p>PSHE – names badges to introduce pupils to peers; badge to show pupils' thoughts about a topic being discussed</p> <p>English / Geography / History / Drama – record the name of the character pupils are discussing as part of a text</p> |

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| <p><b>2</b></p>         | <ul style="list-style-type: none"> <li>• Pupils can display their own design on the display</li> <li>• Pupils can trigger events based on button presses</li> <li>• Pupils can clear the display</li> <li>• Pupils can implement a pause between events</li> </ul>   | <ul style="list-style-type: none"> <li>• 2 – Discuss objectives for the sessions. Remind pupils how to get to the micro:bit website and how to transfer their programs on to the device (use slides from the start of lesson one as a prompt if required)</li> <li>• 3 – Show pupils an example of the program they’re going to be making and ask them to discuss the function of the instructions displayed on the screen. Demonstrate to pupils how to show different LEDs based on a button press and ask them to implement a program to show an image when button A is pressed</li> <li>• 4 – Once complete, pupils will implement a different image when button B is pressed, clear the screen after a period of time and also have an additional image when A and B are pressed together</li> </ul> |  |
| <p><b>3</b></p>         | <ul style="list-style-type: none"> <li>• Pupils can display their own design on the display</li> <li>• Pupils can trigger events based on button presses</li> <li>• Pupils can clear the display</li> <li>• Pupils can implement a pause between events</li> <li>• Pupils can scroll messages</li> <li>• Pupils can alter the brightness of the display</li> </ul> | <ul style="list-style-type: none"> <li>• 2 – Discuss objectives with pupils and explain they’re going to build on their work from last time by producing a short animation, which should be shown forever</li> <li>• 3 – Show pupils an example animation and discuss the required instructions. Pupils will implement their animation and transfer it to the device</li> <li>• 4 – Once complete, pupils will add a message to scroll after their animation, use button A to reduce the brightness of the LEDs, followed by using B to increase the brightness, and A and B to turn off the LEDs</li> </ul>  |  |
| <p><b>4 &amp; 5</b></p> | <ul style="list-style-type: none"> <li>• Pupils can alter the brightness of the display</li> <li>• Pupils can trigger events based on button presses</li> <li>• Pupils can trigger events when they shake the device</li> <li>• Pupils can alter the value of variables</li> <li>• Pupils can use selection</li> </ul>   | <ul style="list-style-type: none"> <li>• 2 – Show pupils the session objectives</li> <li>• 3 – Explain to pupils they’re going to implement a heart fading in and out. Remind pupils how to alter the brightness of the display and ask them to discuss the required instructions to make the heart flash</li> <li>• 4 – Pupils will implement the animation and transfer it to their device</li> <li>• 5 – Once complete, pupils will make the heart fade more gradually by adding additional <i>set brightness</i> blocks</li> <li>• 6 – Pupils will discuss how they could reduce the number of instructions within their program using a variable</li> </ul>  |  |

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|   | <ul style="list-style-type: none"> <li>Pupils can use forever loops</li> </ul>  | <ul style="list-style-type: none"> <li>7 – Pupils will view an example of the program and alter their own program accordingly</li> <li>8 – Pupils will alter the speed of the fade by changing the length of the pause and altering the brightness increase each time</li> <li>9 &amp; 10 – Once complete, pupils will alter the program so the heart only displays when they shake the device, followed by altering the program so the heart goes bright if they press button A, or darker on button B, or off on A+B. Pupils will also experiment with turning the device up and down to alter the brightness</li> </ul>   |   |
| 6   | <ul style="list-style-type: none"> <li>Pupils can create random numbers</li> <li>Pupils can complete a circuit using the micro:bit pins</li> <li>Pupils can alter the value of variables</li> <li>Pupils can use selection</li> </ul> | <ul style="list-style-type: none"> <li>2 – Show objectives and explain to pupils were going to make a “Friend Tester”</li> <li>3 - Demonstrate to pupils how a circuit can be made using the pins on the micro:bit. Show pupils how to set a variable to a random number and display this on the LEDs. Ask pupils to copy this program to their device</li> <li>4 – Ask pupils to discuss how they could display a different message depending on the number selected. Show pupils how to display a different message using an <i>if, then, else</i> block. Pupils will implement further messages based on different numbers being selected</li> <li>5 – Once complete, pupils will make the micro:bit display messages when P2 is pressed, such as to monitor their level of hunger or choose their favourite football team</li> </ul> |   |
| <b>Independent Project (Step counter)</b> | <ul style="list-style-type: none"> <li>Pupils can develop a micro:bit step counter</li> </ul>   | <ul style="list-style-type: none"> <li>2 – Show objectives and explain to pupils they’re going to be producing their own project using the concepts and features they’ve examined in previous lessons</li> <li>3 – Explain to pupils the NHS recommends adults take 10,000 steps per day, which is the default target on most step counters, such as FitBit. Ask pupils to discuss what features step counters have, including those that are essential and those than are desirable / optional</li> <li>4 – Show pupils the list of essential and desirable features. Discuss what other desirable features the step counter could have (e.g. record time spent walking; stopwatch; emergency call feature)</li> </ul>  | <p><b>Cross-curricular links</b></p> <p>PSHCE – Healthy living</p> <p>Science – importance of exercise / changes in the body; function of heart, muscles, etc</p> |

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|                                  |   | <ul style="list-style-type: none"> <li>• 5 – Ask pupils to discuss in pairs / small groups how they might implement the essential features using the micro:bit. Pupils can record their thoughts on individual whiteboards if required</li> <li>• 6 &amp; 7 – Explain to pupils they need a variable to record the number of steps. The variable should increase each time a step is taken, which is detected when we “shake” the micro:bit. An image can also be displayed to acknowledge a step has been taken</li> <li>• 8 &amp; 9 – Explain to pupils they can display the value of the variable recording our steps when pressing button A, followed by clearing the screen</li> <li>• 10 &amp; 11 – Remind pupils of the desirable features and ask them to implement the required code.</li> <li>• 12 – Challenge more able pupils to more accurately detect whether a step has been taken, such as through looking at the Y axis values of the accelerometer</li> </ul>                        |  |
| <p><b>Radio introduction</b></p> | <ul style="list-style-type: none"> <li>• Send and receive messages using the micro:bit radio</li> </ul> | <ul style="list-style-type: none"> <li>• 2 – Show objectives and explain to pupils they will need to use two micro:bits for the session. Pupils should be put into pairs as appropriate</li> <li>• 3 – Explain to pupils the micro:bit radio can be used to both send and receive messages, which is known as a transceiver. Messages have to be sent using a specific channel, which we set using the <i>radio set group</i> block</li> <li>• 4 – Show pupils how we can send text using the <i>radio send string</i> block. The instructions should be downloaded on to the first micro:bit</li> <li>• 5 – Show pupils how the <i>on radio received</i> block allows text to be received and displayed. The instructions should be downloaded on to the second micro:bit</li> <li>• 6 – Once complete, pupils will undertake a number of challenges, including making both devices able to send / receive; sending numbers, including random numbers; making a rock, paper, scissors game</li> </ul> |  |

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| <p><b>Independent Project (remote temperature monitor)</b></p> | <ul style="list-style-type: none"> <li>• Develop a micro:bit based remote temperature sensor</li> </ul> | <ul style="list-style-type: none"> <li>• 2 – Show objectives and explain to pupils they're going to be developing a remote temperature sensor</li> <li>• 3, 4, 5 – Describe the problem facing NASA's Earth orbiting system and how the micro:bit could be used to solve this issue. Ask pupils to discuss in pairs / small groups what features are essential and which are desirable.</li> <li>• 6 – Show pupils the list of features and add further desirable features if required.</li> <li>• 7 - Ask pupils to discuss in pairs / small groups how they might implement the essential features using the micro:bit. Pupils can record their thoughts on individual whiteboards if required</li> <li>• 8 &amp; 9 – Explain to pupils they need to set the radio group ID, then regularly send the temperature data, which is a numerical value</li> <li>• 10 &amp; 11 – Explain to pupils we need to ensure we have the same radio group ID, then show the number received</li> <li>• 12 &amp; 13 – Remind pupils of the desirable feature to only show the temperature when a button is pressed. Ask pupils how this could be achieved using an <i>if, then</i> block</li> <li>• 14, 15, 16 &amp; 17 – Challenge more able pupils to implement further desirable features</li> </ul> | <p><b>Cross-curricular links</b></p> <p>Science – climate change; habitats</p> <p>Geography – weather and climate; environments; locational knowledge</p> |
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