

Electronics @ Play / Community (Micro:bits)

Programme: Applied Learning Programme / Project Work

Level: Secondary 1 Express
Secondary 2NA and 2NT

Theme / Challenge Statement: To promote appreciation and application of electronics, particularly in areas of play and community.

Summary

This is a 10-lesson micro:bits package that introduces the basics of electronics and programming through a series of hands-on teacher-guided activities and student tasks, and concludes with students developing their own projects in their respective groups. The students will then showcase their projects in the school.

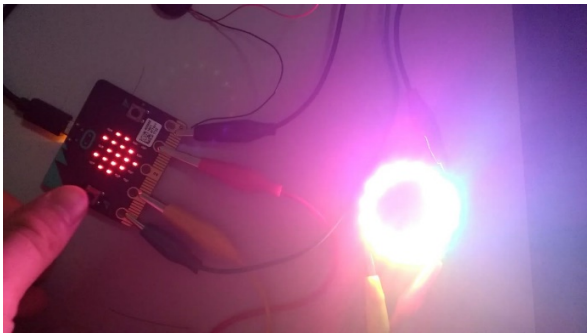
Prior Knowledge:	Students should already know: 1. some examples and applications of electronics in everyday life.
Learning Objectives:	By the end of the lessons, students should be able to: 1. read and write simple block-based algorithms for the micro:bit 2. use different types of sensors (both in-built and external) and output, 3. connect and apply these sensors and outputs to the micro:bit.

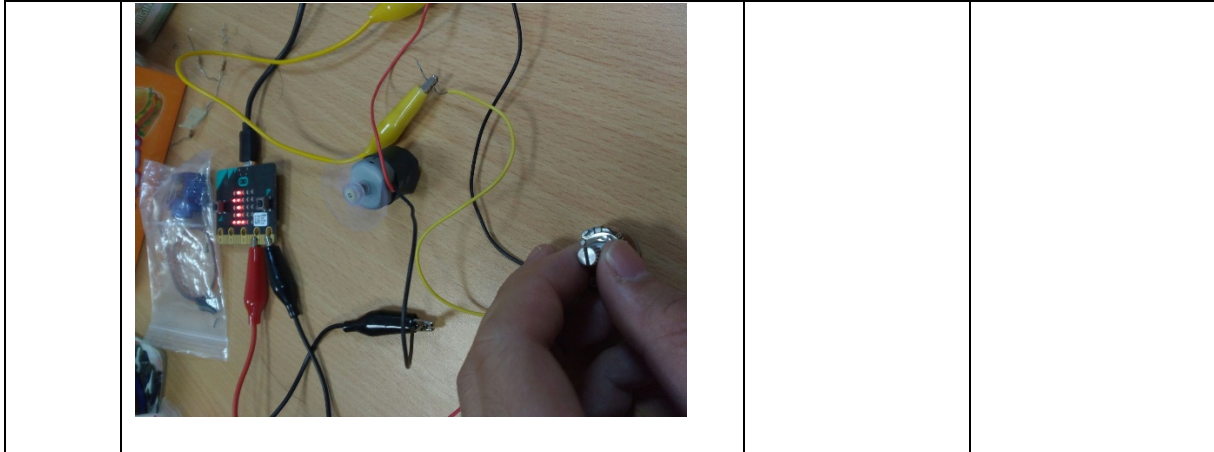
Time	Teacher Activities	Purpose	Resources Needed
Introduction / Pre-activity			
2 periods / 70 mins	Group Work Skills Builders <ul style="list-style-type: none"> Group students into groups of 4. Teachers will facilitate games where members in the group need to work together to complete tasks. Consolidate by highlighting some desirable behaviours needed for group work. 	<ul style="list-style-type: none"> To develop group work skills and behaviours needed for a good project work 	<ul style="list-style-type: none"> PW booklet Game sets
Lessons development / Main activities			
Lesson 1 – 70 mins	Introduction to Electronics <ul style="list-style-type: none"> Introduce different parts and functions of the micro:bit (including the buttons, LED display, and different in-built sensors). Activity: code the micro:bits to display numbers, strings of words, and icons on the LED display screen. Student task: code different shapes on the LED display screen 	<ul style="list-style-type: none"> To let students understand the available features / functionalities of the micro:bits 	<ul style="list-style-type: none"> PW booklet Laptops Micro:bit sets (including battery & USB cable)

Lesson 2 – 70 mins	Programming Logic I <ul style="list-style-type: none"> • Introduce the use of variables and loops (if, for, while). • Activity: write a number counter program that increases or decreases the number when a button is pressed. • Student task: write a counter timer program. • Optional challenge: write a stopwatch program. • Activity: write a program to display an animation of rain drops falling on the LED display. • Student task: modify the code to make the raindrops go upwards • Student task: write a code to make an animation on the LED display. 	<ul style="list-style-type: none"> • To let students understand commonly-used coding functions, and apply them in micro:bits 	<ul style="list-style-type: none"> • PW booklet • Laptops • Micro:bit sets
Lesson 3 – 70 mins	Electronics Sensors I <ul style="list-style-type: none"> • Introduce A and B buttons and in-built accelerometer. • Activity: write a program to display the angle the micro:bit is tilted at when button A is pressed • Activity: write a program to display an icon when the micro:bit is shaken. • Student task: write a step-counter program that increases a displayed number by 1 when the micro:bit is shaken. • Optional challenge: make the step-counter count down instead of count up. 	<ul style="list-style-type: none"> • To introduce buttons and accelerometers as input sensors, and make use of these sensors to perform a function. 	<ul style="list-style-type: none"> • PW booklet • Laptops • Micro:bit sets
Lesson 4 – 70 mins	Electronics Sensors II <ul style="list-style-type: none"> • Introduce in-built light sensor and NeoPixel strip and ring. • Activity: write a program to detect light levels and display these levels on the LED screen. • Explain how to connect the NeoPixel to the micro:bit using coloured crocodile clips. • Activity: make the NeoPixel light up with different colours. • Student task: make the NeoPixel light up with rainbow colours. • Student task: write a program that switches on the NeoPixels when it's dark. 	<ul style="list-style-type: none"> • To introduce light sensors and output light sources to students. 	<ul style="list-style-type: none"> • PW booklet • Laptops • Micro:bit sets • NeoPixels ring and strip

Lesson 5 – 70 mins	Electronics Sensors III <ul style="list-style-type: none"> • Introduce in-built temperature sensor and buzzer. • Activity: write a program to detect temperature levels and display on the LED screen. • Activity: produce simple sounds and music on the buzzer using the in-built buttons. • Student task: write a program that plays Mary Had a Little Lamb by pressing the buttons. • Student task: write a fire alarm program that plays sound when temperature gets too hot. 	<ul style="list-style-type: none"> • To introduce temperature sensors and output sound to students. 	<ul style="list-style-type: none"> • PW booklet • Laptops • Micro:bit sets • Buzzer
Lesson 6 – 70 mins	Electronics Sensors IV <ul style="list-style-type: none"> • Introduce touch sensors • Activity: write a program that displays a smiley face on the LED display when the cloth is touched. • Student task: make a burglar alarm that lights up or makes a sound when touched. • Introduce potentiometer as a variable resistor. • Activity: write a program that displays different numbers when potentiometer is turned. • Activity: make a DJ turntable using buzzer and potentiometer. 	<ul style="list-style-type: none"> • To introduce touch sensors and potentiometer to students. 	<ul style="list-style-type: none"> • PW booklet • Laptops • Micro:bit sets • Touch sensor • Resistors • NeoPixels strip/ring • Buzzer • Potentiometer
Lesson 7 – 70 mins	Electronics Sensors V <ul style="list-style-type: none"> • Introduce moisture sensor and DC motor • Activity: write a program that displays moisture levels on the LED display • Activity: write a Tamiya car program that activates a DC motor when a button is pressed • Student task: write a program that activates a shelter when it starts to rain. 	<ul style="list-style-type: none"> • To introduce moisture sensors and DC motors 	<ul style="list-style-type: none"> • PW booklet • Laptops • Micro:bit sets • Moisture sensor • DC motor
Lesson 8 – 70 mins	Programming Logic II <ul style="list-style-type: none"> • Introduce the built-in magnetometer. • Activity: write a compass program that displays NSEW. • Introduce the use of random variables in programming. 	<ul style="list-style-type: none"> • To introduce the built-in magnetometer, and the use of random variables in programming. 	<ul style="list-style-type: none"> • PW booklet • Laptops • Micro:bit sets • NeoPixels strip/ring • Buzzer

	<ul style="list-style-type: none"> • Activity: write a program that displays randomly generated numbers or letters when a button is pressed. • Student task: write a simple math addition question game. • Optional challenge: make a NeoPixel light up or play a music for each correct answer. 		
Lesson 9 – 70 mins	Project Development I <ul style="list-style-type: none"> • Recap on the different sensors, outputs and programming functions learnt in the previous lessons. • In their groups, students brainstorm on possible ideas for their group project. • Teacher to go through assessment rubrics. 	<ul style="list-style-type: none"> • To consolidate what students have learnt, and apply these to a novel project. 	<ul style="list-style-type: none"> • PW booklet • Laptops • Micro:bit sets • Other sensors & outputs
Lesson 10 – 70 mins	Project Development II <ul style="list-style-type: none"> • Students to build their prototype and write their program for their project. • Students to work on their presentation slides. 	<ul style="list-style-type: none"> • To allow students to work on their project ideas. 	<ul style="list-style-type: none"> • PW booklet • Laptops • Micro:bit sets • Other sensors & outputs
Closure and consolidation/Post-activity			
2 periods / 70 mins	Reflection, Self & Peer Evaluation <ul style="list-style-type: none"> • Get students to reflect talk about challenges / improvements to be done. • Evaluate their group members as well as themselves. 		

List of Projects (5 – 10 projects if possible) created by Students			
Project	Brief Description & How It Works	Resources	Remarks / Tips
1	<p>Step-counter</p> <p>What: A Fitbit that counts the number of steps taken by the wearer.</p> <p>How: Programme the micro:bit to add one to a variable and display it when the micro:bit is shaken.</p>	Laptop, micro:bit set	
2	<p>Night lamp</p> <p>What: A lamp that turns on automatically when it gets dark.</p> <p>How: Programme the micro:bit to detect light levels on its light sensor, and turn on a NeoPixels strip/ring when light levels fall below a defined threshold.</p> 	Laptop, micro:bit set, NeoPixels strip/ring, crocodile clips	Need to add the NeoPixels code package on the code editor
3	<p>Fire alarm</p> <ul style="list-style-type: none"> • What: An alarm system that rings in a fire. • How: Programme the micro:bit to detect temperature levels on its sensor, and plays sounds on the buzzer when temperature rises above a defined threshold. 	Laptop, micro:bits set, buzzer, crocodile clips	
4	<p>Burglar alarm</p> <ul style="list-style-type: none"> • What: An alarm system that rings when an intruder touches it. • How: Programme the micro:bit to detect touch on its touch sensor, and plays sounds or lights up upon touch. 	Laptop, micro:bits set, buzzer, NeoPixels strip/ring, crocodile clips	
5	<p>Automatic rain shelter</p> <ul style="list-style-type: none"> • What: A shelter that unfolds when it rains • How: Programme the micro:bit to detect moisture on its moisture sensor, and runs the DC motor to deploy a shelter when it detects moisture. 	Laptop, micro:bits set, moisture sensor, DC motor, crocodile clips	

**Additional Remarks:**

These lessons are incorporated within the Project Work curriculum. Adopting the mode of a lesson study, the team of teachers will provide continual feedback to customise learning experiences suitable for the students.

Contributed by:

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