⧗ *60-90 minutes*   *Grade 5 to 8*   *Individual*   *Intermediate*

Micro:bit Light Detection

The LED display on the micro:bit can also be used to measure the amount of light shining on it. This means the micro:bit can make different things happen depending on how light or dark it is.

The purpose of this activity is to learn how program the micro:bit to react to light, and then experiment with different ways to use this ability.

Goals

1. Write a program that allows the micro:bit to measure and react to light and darkness.

2. Design, build and test a prototype and explain what improvements can be made.

Skill development

- Collaboration
- Communication
- Critical thinking
- Problem Solving

Equipment

Each participant requires:
- Micro:bit
- USB cable
- Battery Pack
- Batteries
- Computer with internet access

Curriculum links

All grades	A1. Apply to the best of their ability, a variety of social-emotional learning skills to support their use of the mathematical process and their learning in connection with the expectations in the other five stands of the mathematics curriculum.
Grade 5	C3.1 Solve problems and create computational representations of mathematical situations by writing and executing code C3.2 Read and alter existing code, and describe how changes to the code affect the outcomes.
Grade 6	C3.1 Solve problems and create computational representations of mathematical situations by writing and executing efficient code. C3.2 Read and alter existing code that involves events influenced by a defined count and/or sub-program and other control structures, and describe how changes to the code affect the outcomes and the efficiency of the code.
Grade 8	C2. Students will investigate a working system and the ways in which components of the system contribute to its desired function C3.2 students will identify the purpose, inputs, and outputs of various systems.

Coding Concepts

To build an understanding of coding language and logic, here are the blocks students will use in this activity, along with the purpose they serve:

Block	Description
forever	An event that runs continuously.
if true then	Run code depending on whether a Boolean condition is true or false. A Boolean has one of two possible values: true or false
(0) = (0)	Compares two variables to see whether one is greater than, less than, or equal to the other
light level	A variable that represents the brightness of light measured by the micro:bit's LEDs
change (variable) by (1)	Increase the value of the specified variable by a specified amount (can be negative).
show LEDS	Shows a picture on the LED screen

Preparation

Load the tutorial: ***Light Detection***

- https://makecode.microbit.org/beta#tutorial:github:exploratekcat/rent-a-tech_tech-a-louer/Light_Detection

Confirm that Makecode is set to the participants' language. Click the gear logo on the top right, and choose the language tab to modify it (if required).

Discuss the meaning of the words 'input' and 'output'. Ask students to think about an example, like a computer, and identify specific inputs (e.g., clicking the mouse, typing, voice command, etc.) and outputs (e.g., screen display, sound, etc.).

Each student will need a micro:bit, USB cable, battery pack, and batteries for this activity.

Facilitation

Present the activity

Technology is everywhere in our everyday lives. Security sensors, night lights, and smart devices in our homes can all measure light intensity and respond in different ways to changes in brightness. By creating our own simple version using a micro:bit, we will learn how a light sensor receives an input (measurement of brightness), and turns it into an output (turning a light on or off, sounding an alarm, etc.).

Before starting

Distribute one micro:bit, one USB cable, and one battery holder (with battery) per student.

Safety notes

The micro:bit is an exposed circuit board. This allows you to see all the electrical parts and understand how computers work. This does pose a small risk of parts being damaged, so remind students to handle with

During the activity

1. Instruct students to plug in the micro:bit to their computer, using the USB cable.
2. Ask your participants to open the Light Sensor tutorial, using the URL provided.
3. Each student will have to code their own micro:bit to measure light intensity.

Some questions that students might have:
1. Why isn't my micro:bit working?
    a. Make sure the code is saved and downloaded to the micro:bit. It needs to be updated every time you make a change to the code.
2. Why doesn't it respond to the light/dark properly?
    a. Check that you're using the correct sign (< or >) when comparing variables. To light up in response to bright light, the light level must be greater than (>) the threshold value. To light up in response to darkness, light level must be less than (<) the threshold value.
    b. The threshold value in your code might need to be changed to suit the lighting conditions around you. Experiment with larger or smaller numbers. Remember to download the code to the micro:bit each time you make a change.

Assessment

List of questions to ask participants, to assess if the goals were met.
1. Were you able to make your micro:bit respond to changing light levels?

2. How would you use this light sensor to make your home or classroom safer or more energy efficient?

3. What was the most challenging part of the activity? Why was it difficult? How did you navigate the challenge?

Tinker with this activity

Using tinkering supplies, such as cardboard and paper, task your participants to create a way to incorporate the light sensor into their home or classroom.

Appendix

Overview of tutorial block functions

- **Basic functions:** These consist of pieces of code preprogrammed to do specific actions, such as launching programming, displaying on the micro:bit screen, or repeating the code that will be inserted.

- **Logic function:** These blocks account for different possible outcomes, and program their next action.

- **Variable function:** This is what the micro:bit software remembers and refers to, when requested. It can be a text, known as a string, or a series of functions. The first step to using a variable is to define what it is.

- **Input functions:** Each micro:bit device has buttons and integrated sensors that detect movement, light, temperature, and magnetic field; all of these can be activated though the various blocks of input functions.

Terminology	Definition
Function	Function refers to a category of blocks that are pre-programmed to perform one or many specific tasks.
Block	A block is a command container that holds ready-to-use code. Once added to other blocks, like a puzzle, the blocks create the program. If learners click on Javascript, they will see the long code written for each block.
Radio	Radio refers to the radio emitter embedded in the micro:bit device.
Variable	A variable is an "object" coded by the user in the micro:bit program.
Sequence	A sequence is a series of programming blocks.
Decomposition	Decomposition is an aspect of computational thinking, which consists of the breakdown of a complex problem into smaller tasks.