Co-funded by the
Erasmus+ Programme
of the European Union

Project number: 2021-1-IE01-KA220-SCH-000027825

Let’s measure the light

Iliana Ntovolou

Ellinogermaniki Agogi

2023

This project has been funded with support from the European Commission. This communication reflects the views only of the author, and the Commission cannot be held responsible for any use which may be made of the information contained therein.

Co-funded by the Erasmus+ Programme of the European Union

Project Information

PROJECT: CliC-PoliT

PROJECT TITLE: Engaging students and the society in environmental and climate change activities to raise awareness and strengthen responsible citizenship.

ACRONYM: Climate Action and Light Pollution Threat

PROJECT WEBSITE: https://www.clicpolit.eu/

PROJECT NO.: 2021-1-IE01-KA220-SCH-000027825

PROJECT COORDINATOR: CIT Blackrock Castle Observatory, Cork, Ireland

Project Partners

BLACKROCK CASTLE OBSERVATORY
The Space For Science

NUCLIO
Núcleo Interativo de Astronomia e Inovação em Educação

FTP - Europlanet gUG

ΑΙΕΝ ΑΡΙΣΤΕΥΕΙΝ
ELLINOGERMANIKI AGOGI

WROHellas
ΟΡΓΑΝΙΣΜΟΣ ΕΚΠΑΙΔΕΥΤΙΚΗΣ ΡΟΜΠΟΤΙΚΗΣ & ΕΠΙΣΤΗΜΗΣ

This project has been funded with support from the European Commission. This communication reflects the views only of the author, and the Commission cannot be held responsible for any use which may be made of the information contained therein.

Let's make a photometer!

Topic Title: Light Pollution	
Lesson Plan Title: MEASURING THE LIGHT OF A BULB	
Duration: 45 minutes	
Short Description of the Lesson	Students will gain an understanding of how they can program a BBC microbit and measure the light of a bulb or different types of bulbs and make conclusions about the energy consumption of each type
Learning Goals	• Program a micro:bit light meter to measure light levels • Understand the importance of baseline measurements and calibration when collecting data
Green Competences Linked	• Gain an understanding of the Sustainable Global Goal 13 (climate action), the importance and why it's relevant to us • Understanding the importance and the impact of our energy usage on climate change • To consider, plan and monitor our energy use at home or at school and understand how awareness can drive changes in behaviour
Target Group	Primary school students aged 10-12 years old High school students aged 12-14 years old
Educational Approach	Inquiry based learning Project based learning
Link to School Curricula (if applicable)	Physics, Electricity, Robotics, Technology
Facility/ Equipment	• Classroom • Internet access • BBC microbits • micro:bit battery packs
Tools/ Materials	• student work from previous lesson • paper - writing (optional) • pens (optional) • spreadsheet (optional)
Main Tasks **10 minutes each**	**Task 1: Introduction** **Task 2: Make a light meter** **Task 3: Test the light meter** **Task 4: Use the light meter** **Task 5: Review**

This project has been funded with support from the European Commission. This communication reflects the views only of the author, and the Commission cannot be held responsible for any use which may be made of the information contained therein.

Extracurricular Activities	This activity is part of the main topic of activities of Light Pollution **Differentiation** • They could collect more data in more locations, justifying their decisions. • Students could make improvements to the light meter code, for example calculating the average of multiple readings on the micro:bit itself • They can try to measure the light of different types of bulbs

This project has been funded with support from the European Commission. This communication reflects the views only of the author, and the Commission cannot be held responsible for any use which may be made of the information contained therein.

Introduction

- Invite students for brainstorming and ideas about how can they monitor electric light usage around the school.
- Discuss practical considerations and reach consensus about the best places to place a light meter.
- They will make a light meter to take readings of the light level to find out how much light is measured when the lights are on or off. They will then use the measurements to decide which locations allow reliable collection of data.
- Highlight the need to take accurate baseline light readings when the lights are on and off

Make a light meter

- Ask students to make predictions about what the program below does
- Write the code below in the MakeCode https://makecode.microbit.org/
- Ask students to demonstrate changing light levels and what happens when you press the buttons A and B

Figure 1 Programming Light meter, step 1

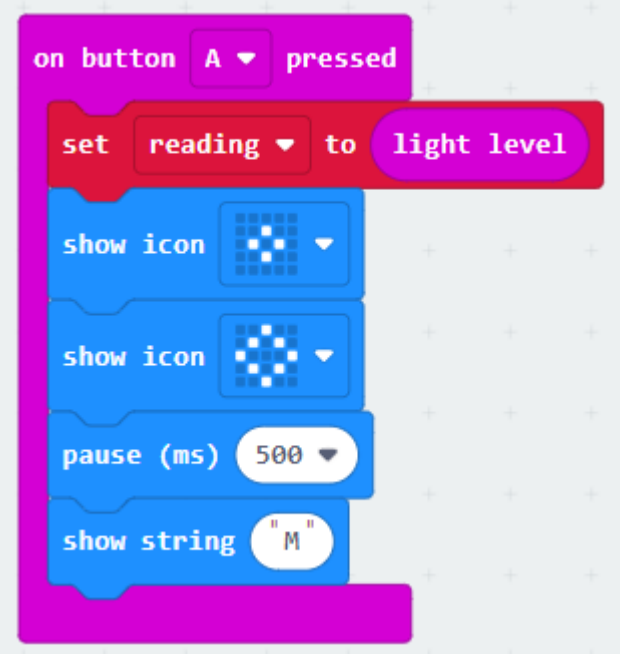

Figure 2 Programming Light meter, step 2

This project has been funded with support from the European Commission. This communication reflects the views only of the author, and the Commission cannot be held responsible for any use which may be made of the information contained therein.

Figure 3 Programming Light meter, step 3

What the program does:

- It uses a variable called reading to store the light level recorded by the micro:bit's light sensor
- When you press button A it takes a new light level reading and stores it in the reading variable
- When you press button B the light level reading is shown on the micro:bit's LED display

Test the light meter

- Invite students to test out their light meters
- Ask students to download the program to their micro:bits
- Attach battery packs to their micro:bits and use the light meter
- Ask students to take test readings at their desks with the micro:bit uncovered. Then to simulate lights being turned on and off cover the micro:bit with paper or a book
- The light sensor is into the LED display, so you need to place the micro:bit's front to be pointing towards the light source.
- Place your micro:bit where you want to take the light reading, cover it over or turn the lights off and **press button A**.
- Uncover it and **press button B** to see the light reading. This will be a number between 0 and 255.
- You can press B again if you're not sure of the reading.
- To **record another reading** with the lights on (or with it uncovered) press button A again and then press button B to see the number.
- You should see a consistent difference between the values

Lower numbers when the lights are off or micro:bit is covered and higher values when the lights are on and the micro:bit is uncovered

This project has been funded with support from the European Commission. This communication reflects the views only of the author, and the Commission cannot be held responsible for any use which may be made of the information contained therein.

Use the light meter

- Recap with students the different areas chosen to take light readings
- Take at least 4 readings in each area.
- Highlight that for the readings to be useful, they need the difference between when the lights are on and off to be as large as possible.
- Gather information about the wattage and type of lighting used in each location
- Students could collate and calculate averages from their own or class results using paper or the sample spreadsheet provided which shown above.

Location	**Wattage**	**Light type**
Cupboard	60W	Incandescent
Readings	**Readings with lights on**	**Readings with lights off**
Reading 1	176	10
Reading 2	193	0
Reading 3	186	12
Reading 4	188	9
Average	**186**	**8**

Review

- Recap the learning objectives
- Invite students to share and explain:
  - their views on the best locations for recording light usage data
  - why their choices will allow the most reliable collection of data
  - if they encountered any problems and how they approached and overcame them
  - what they would change were they to do this again

Differentiation

- Students could work in pairs or small groups to record and collect data together.
- Students could use the spreadsheet on a laptop or tablet to record their data or use a voice recorder
- Students could use Python instead of MakeCode blocks
- They could collect more data in more locations, justifying their decisions.
- Students could make improvements to the light meter code, for example calculating the average of multiple readings on the micro:bit itself
- They could use different types of bulbs to see the difference of the light readings

This project has been funded with support from the European Commission. This communication reflects the views only of the author, and the Commission cannot be held responsible for any use which may be made of the information contained therein.

Opportunities for assessment

Informal assessment of students' approach and data collection.

- Did the students record more than one reading in each location?
- Were the values consistent?
- Did they correctly calculate average readings for a given location? If not, did they take steps to account for this or fix it?
- Have students collectively found at least one good location to record light usage data next time?

ANNEXES

Excel worksheet

Location	Wattage	Light type
Cupboard	60W	Incandescent

Readings	Readings with lights on	Readings with lights off
Reading 1	176	10
Reading 2	193	0
Reading 3	186	12
Reading 4	188	9
Average	**186**	**8**

This project has been funded with support from the European Commission. This communication reflects the views only of the author, and the Commission cannot be held responsible for any use which may be made of the information contained therein.