


DIGITAL LITTERACY

 60-90 minutes

 Grade 5 and up

 Team

 Advanced

Micro:bit Code Breaker

This activity will introduce students to the original texting method – the telegraph. Students will code a micro:bit to send and receive Morse code characters (dots and dashes). They will use Morse code to create messages, which they will send to a classmate to decode.

Goals

1. Write a program that connects two micro:bit devices.
2. Use the micro:bit program to understand the history of one of the first technological telecommunications devices.
3. Experience encoding and decoding messages using the Morse code alphabet.

Skill development

- Collaboration
- Communication
- Critical thinking
- Problem Solving

Prerequisites

- The facilitator should have a basic knowledge of micro:bits.
- Participants should have completed some introductory activities with MakeCode software.

Equipment

Each participant requires:

- Micro:bit
- USB cable
- Battery Pack
- Batteries
- Computer
- Morse Code Alphabet

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.



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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
on start	An event that runs when the program starts
radio set transmit power (7)	Makes the radio signal of the micro:bit stronger or weaker The signal strength can be between 0 and 7 Strength of the radio signal is dBm or decibel-milliwatts
radio set group	Make a program. Have the group ID for sending and receiving information with radio. A group is like a cable channel, and a group ID is the channel number. If you load the same program onto two different micro:bits, they will be able to talk to each other. The ID is a number from 0 to 225.
on button pressed	Something happens when the button is pressed Works when the button is pushed down and released within 1 second
show leds	Shows a picture on the LED screen LED is a string that controls which LEDs are on and off. A string is a sequence of characters.
radio send number	Broadcast a number to other micro:bits connected via radio
pause	Pause the program for the number of milliseconds you indicate Can be used to slow your program down ms is the number of milliseconds that you want to pause (100 milliseconds = 1/10 seconds)
on shake	Something will happen when you shake the micro:bit
on radio received (receivenumber)	Run part of the program when the micro:bit receives a number of radio
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	Variable
receivednumber	Variable



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Preparation

First, students should go through the intro to micro:bit activities before moving on to this activity, so that they have an understanding of how the make-code program works and the functions of the basic blocks.

Before beginning to code this activity, have students write out their message using the Morse code alphabet, see the one before last page.

Students should be divided in pairs for this activity, so they can take turns sending and receiving messages. Each pair will need their own Radio Set Number (any number between 0 and 225). This will ensure that partners are only sending and receiving each other's messages.

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

Load the tutorial: **Code Breaker**

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

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).

Facilitation

Present the activity

You may think of texting as a modern technology, but did you know that a form of texting has existed for more than a century? In 1837, Samuel Morse invented a special code using sets of short and long sounds to represent the alphabet. One telegrapher would spell out a message by "tapping" on a telegraph key. A telegrapher at the other end would receive the auditory Morse Code sequence and decode its message. These sounds are visually represented by dots and dashes, and can be easily reproduced and sent using micro:bit.

The telegraph was created to send encoded messages made up of dots and dashes. Each letter of the alphabet has its own series of dots and dashes. This is known as Morse code.

Morse code can be understood as units of measurement of time duration. The dot is the basic unit of measurement, and the dash is three times the length of the dot. Each dot and dash within a letter is followed by a pause equal to one dot. The letters of a word are separated by a pause equal to three dots, and the words are separated by a pause equal to seven dots.



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Before starting

1. Distribute the Morse Code Legend document (page 6).
2. Distribute one micro:bit, one USB cable, and one battery holder (with battery) per student.
3. Assign students to teams of two.
4. Have students write out their message in Morse code before beginning.



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 Morse code tutorial at **Code Breaker**
3. Each student will have to code their own micro:bit to send and receive messages.
4. Remind students that it is important to pause between letters and words, so that the person receiving the message knows when letters and words end.

Some questions that students might have:

1. Why am I not receiving my partner's messages?
 - a. Check to make sure the radio set group numbers are the same.
2. Why am I receiving other classmates' messages?
 - a. Check to make sure your radio set number is the one you were assigned.
3. How many squares should I select for my dot?
 - a. If you click the hint, it will show you a 3x3 square for the dot. It doesn't matter how many you select, it just has to be clear to your partner that it's a dot or square.
4. How many squares should I select for my dash?
 - a. If you click the hint, it will show you a line with three squares selected. Again, it doesn't matter how many you select so long as your partner knows it's the dash.

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Assessment

List of questions to ask participants, to assess if the goals were met.

1. Were you able to send a message to your partner?
2. Were you able to receive a message from your partner?
3. Were you and your partner able to decode the messages you each sent correctly?
4. In several of the steps, you were asked to add a blank LED block to your sequence. Can you explain why you had to do this?
5. Why is the radio block important for this code?
6. 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 an imaginative telegrapher key and receiver in which the micro:bit will fit.



Source: Ingenium collection, Artifact no. 1996.0336.001
<https://ingeniumcanada.org/ingenium/collection-research/collection-item.php?id=1996.0336.001>



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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.
- **Radio functions:** Data are sent from one micro:bit to another using radio waves. Specific blocks will allow you to create distinctive channels for communicating between devices, or send specific types of data.
- **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 through the various blocks of input functions.

Terminology	Definition
Variable	A data item that may take on more than one value during the runtime of a program.
Sequence	A basic algorithm, a set of logical steps carried out in order.
Function	A block of organized, reusable code that is used to perform a single, related action.
Telegraph	A system for transmitting messages from a distance along a wire, especially one creating signals by making and breaking an electrical connection.