STEM innovators

Coding for health

do more feel better live longer

Educator notes

Learning objectives

- Designing and creating a way to wear a micro:bit
- Creating a program to track movement so a micro:bit works as an activity tracker

Curriculum links

- Computing
  - Design, use and evaluate computational abstractions that model the state and behaviour of real-world problems and physical systems
  - Design and develop modular programs that use procedures or functions
- Design and technology / technologies:
  - Exploring, identifying and understanding user needs
  - Identify and solve their own design problems and understand how to reformulate problems given to them

Time needed: 60-90 minutes

Resources required

- Coding an activity tracker student sheet
- PC or Mac with Bluetooth 4.0, with **Scratch link** preloaded, and internet access, one per group or per student. (Note: Scratch link is not currently available for Chromebooks or tablets)
- Using the link above, follow the instructions and ensure Bluetooth is turned on (sometimes disabled by default) on the computers in use

Equipment needed

- micro:bits and battery packs (1 per small group)
- Velcro straps
- Something students can use to attach the micro:bit to themselves e.g. elastic bands, shoe laces, 3D printed micro:bit cases. You can provide multiple options if you like (commercial micro:bit cases are also available)

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Preparation

- Instructions about how to set up the micro:bits and PCs can be found here: https://Scratch.mit.edu/microbit
- This activity draws upon knowledge students would have gained from earlier schooling:
  - Experience of Scratch programming environment
  - Knowledge of writing block-based code including:
    - Declaring and using variables
    - Using basic loops (repetition)
- If you have time to spread these activities over two lessons, you could extend Activity 1: Make a micro:bit wearable by providing more materials to try, and add the optional extension activity on page 6

Starter activity
Activity tracker brainstorm

5 mins

- Get the class into small groups to brainstorm why people would want to wear an activity tracker

Discussion questions: Who has an activity tracker? And who is wearing one right now?

- If any students answered yes to these questions, and are comfortable sharing with the class, their reasons for wearing one could kick-start the following conversation
- Circulate around the room visiting each group and try to direct the discussion towards ideas of fitness levels and the effect of a sedentary lifestyle
- Bring the class back together for groups to feedback their discussion
- If more time is available, online research could be carried out on the negative effects of a sedentary lifestyle and associated health issues, and the range of activity trackers on the market and what different ones do

Did you know?

- Ask the class what they already know about activity trackers
- Share the following real world applications of activity trackers and the information they detect. Ask the discussion questions and use the potential answers to help the conversation
- **Use in clinical trials:** Activity trackers are also used to detect real world evidence in clinical trials, which is part of the research done on potential new medicines

Discussion question: Why do students think this is? Can they think of any information that an activity tracker captures which might be useful in a healthcare context, beyond measuring fitness levels?
Potential answers: The data captured by an activity tracker can be used alongside medical data to examine the effects of the medicine being tested

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Did you know? Continued…

- **Measuring activity while on medication:** Explain further that for doctors and pharmacists, it's useful knowing if a patient is more, or less, sedentary before, during and after taking a medicine (particularly if participating in a trial for a new medicine), because activity level has a major impact on health

Discussion questions: Can students think of any way a business could use activity trackers to help understand their staff and workplace better?
Potential answers: To find out how long employees are spending away from their desks, how much a meeting room is in use or not

- **Measuring company desk use:** Many staff at large companies, and even government offices, have 'hot desks'. Ask students if they know what hot desking is, and if not, explain the concept. At healthcare organisation GSK, one team used activity trackers to measure if a desk was in use or not, to look at desk furniture utilisation and understand people's working habits. This, and the other example answers, are all ways a business can make sure its office is working efficiently for the employees, and ensure budget is allocated correctly as well as looking after the health and wellbeing of employees.
- Let the class know they are going to make their own activity trackers today, with a focus on measuring steps

Discussion question: What features could they include in their activity tracker?
Potential answers: Count steps, display steps, warn if inactive for too long

- Divide the class into small groups of two or three students and distribute the **Coding an activity tracker student sheet**. Students can also do this independently. If groups of three or more are sharing one computer, it may help to assign an activity or role (Maker, Coder, Debugger, Tester) to each student, and then rotate roles after a short time

Activity 1
Make a micro:bit wearable

10 mins

- Students need to find a way to attach their micro:bit to their body. This might be using a printed case and velcro strap, elastic bands or whatever you have available, like shoelaces. Providing a range of options may require more time for the class to spend on this section of the lesson. They need to make sure it is secure enough to be worn in the tests they will conduct later
- The **Coding an activity tracker student sheet** encourages students to think about the practical side of wearing the tracker; its size, weight etc.

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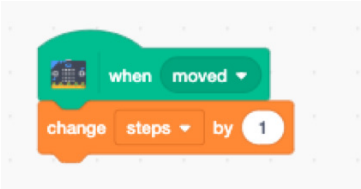
Activity 2
Programming the micro:bit

40 mins

- Now that they've decided how their tracker will be worn, they need to program it. The **Coding an activity tracker student sheet** takes them through this activity; it is also laid out here with some extra information that you may use to provide help along the way
- They should be able to run through their sheets independently while you are circulating, helping as required
- Students should load up Scratch, check that Scratch Link is working and connect their micro:bit
- Make sure to encourage all students in a group to test the micro:bit as they go, as this will help once they get towards step 4

1. Setting up a variable

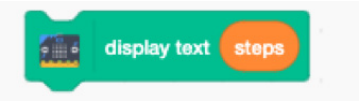
- Students are going to set up the program, shown below, by creating a variable called 'steps'. This will enable the micro:bit to store the number of steps taken when someone wears it



- Test the different input options: moved, shaken and jumped. Encourage students to try each one (note that using the micro:bit's 'moved' function is usually the most effective)
- Students should take a few steps, with input set to each: moved, shaken and jumped. They need to decide which one most accurately tracks your steps
- Circulate and encourage students to read the top tip on their **Coding an activity tracker student sheet** which encourages them to only change one thing at a time to make sure it is a fair test
- Next the class should try attaching the micro:bit to different parts of their body to see if it makes a difference, again taking a few steps to see which is the most accurate
- Groups can record their chosen input and location on their **Coding an activity tracker student sheet**

2. Program the micro:bit to display the number of steps

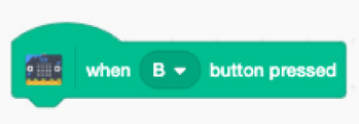
- Students need to programme the display to show the number of steps, as per the below:



- The number will scroll across the display. It will also show the value on the screen in Scratch
- Circulate as they test the program, helping students as required

3. Adding a reset button

- Next, groups will use 'When button pressed' to reset the 'steps' variable to 0
- Continue to circulate as groups test their devices



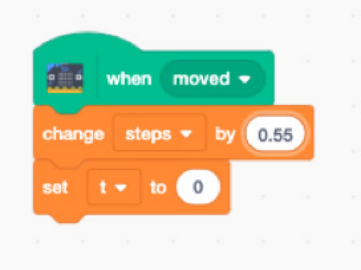
4. Improving the accuracy

- Make sure all students have tried out the activity tracker
- Discuss with the class how accurately their micro:bit activity trackers record their steps
- If you need to, you may demonstrate using one of the trackers yourself and comparing with a student
- Explain that sometimes the 'move' input is too sensitive to use as a measure of a person's sets, so they can use maths operators in Scratch to improve it

Activity 2
Programming the micro:bit Continued…

40 mins

- One student in each group should walk 10 steps with the tracker and record how many steps the micro:bit shows that they took
- They can then calculate how to make the micro:bit accurately measure that person's steps as per the below example:
  - Student has walked: 10 steps but micro:bit shows: 18 steps
  - The programs should include an operator 10/18=0.55
  - Code for this example is here:



5. Understanding and debugging an existing program

- There is an activity tracker program on the **Coding an activity tracker student sheet** the class should now read, and if they like, load this program to their micro:bit (this could be pre-loaded in Scratch)
- Students need to work through the program, answering the questions about the features, identifying the different variables and their roles on their **Coding an activity tracker student sheet**
- A blank version of the following table is provided in the **Coding an activity tracker student sheet**, use these answers to help the class as required

Variable	Role
steps	Stores a value of how many movements the micro:bit has detected
is_displaying	Depending on the value it changes the display between two options
t	Stores how many times the program has looped. There is a delay of one second, so it is approximately recording time in seconds

6. Evaluate results

- Ask the groups to reflect on the activity tracker they have made
- Groups need to think of two things they like and two they would improve if they had more time/ materials, filling out the table on the **Coding an activity tracker student sheet**
- Get each group to feed back their evaluation to the group, making sure each member of the group shares something

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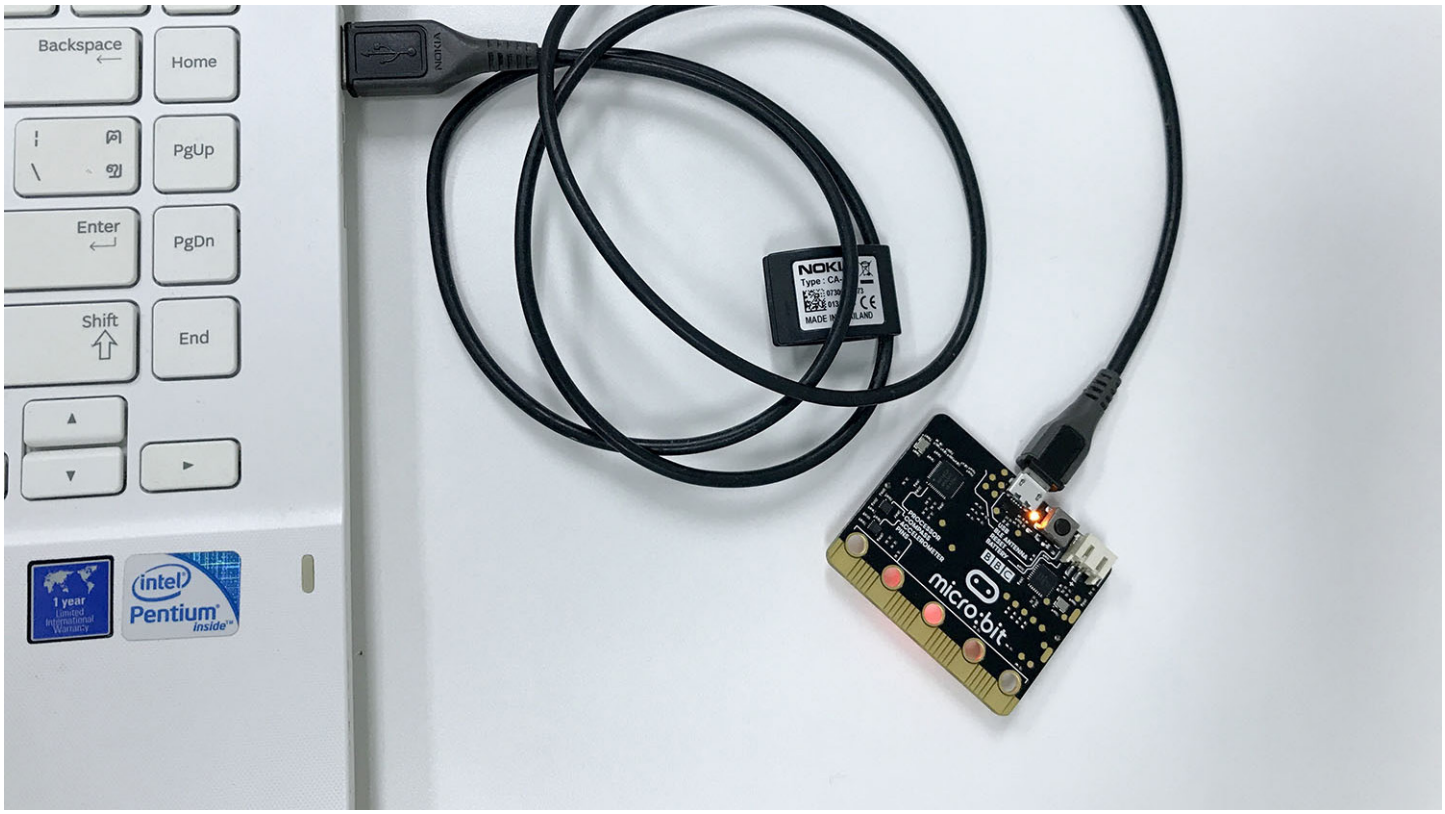
Optional extension activity: Improvements

- Consider adding this in if you have time, particularly if working with an older or more able group
- This is an open task, which should encourage students to use their creativity and problem-solving skills
- Students should think about the possible improvements they identified while evaluating their results and select one to work through
- Ask the students to record what their improvement does and why they have included it on the **Coding an activity tracker student sheet**
- If you have time, the groups could explain their improvement to the rest of the class and show how they did it