**Getting active**

**Lesson 2: Using variables in programs**

**Introduction**

In this lesson, pupils apply their understanding of variables by creating and using variables when recording the number of star-jumps each member of the group does in thirty seconds. They consider how the variables were changed and used, and sequence instructions to create an algorithm to represent this. Pupils are introduced to a program using variables and identify the goal of specific parts of the program before using this understanding to debug a program so the BBC micro:bit can be used to record an activity.

**Time:** @60 minutes

**Learning objectives**

* To write algorithms that use variables
* To explain how variables are used in programs
* To debug programs containing variables

**Materials needed:** lesson presentation, mini-whiteboards and dry-wipe pens, printouts of slides 6 and 9, MakeCode editor, optional micro:bits, MakeCode hex program files:

* [star jump counter](https://makecode.microbit.org/#pub:_dwTUkmU2HdCM)
* [variables debug](https://makecode.microbit.org/#pub:_6ipg3x9f9RpD)
* [variables debug support](https://makecode.microbit.org/#pub:_UX1MHYFDDJf3)
* [variables-debug challenge](https://makecode.microbit.org/#pub:_dgrWKmR191Xe)

**Lesson summary**

1. Introduction: Ready, steady, star-jump! (15 minutes)
2. Reviewing variables (15 minutes)
3. Using variables in programs (10 minutes)
4. Debugging (20 minutes)

**Introduction activity 1: Ready, steady, star-jump! (15 minutes)**

* Arrange pupils into small groups (5-6) and explain that each group is going to have a competition to see which member can do the most star-jumps in 30 secs (slide 3).
* Explain you will provide the thirty-second timer, but the pupils will need to identify all the other information that needs to be recorded. Invite suggestions on what variables they could use. These should include player’s name, score and current leader (the person who has at a given point completed the most star-jumps).
* Ask pupils to carry out the activity and use **slide 4** to provide a thirty-second timer. After pupils have finished recording the star-jumps for each member, ask each group to identify who completed the most jumps.

**Activity 2: Reviewing variables (15 minutes)**

* Display **slide 5** and ask pupils to think/pair/share the variables they used and how the variables were set, changed and used.
* Explain to pupils the statements on **slide 6** are the steps to create an algorithm to show how to use the variables score and high score when recording the number of star jumps a person does in thirty seconds and identifying the highest number of star jumps completed by one person in the group.
* Give pairs copies of the **variable algorithm to sort**worksheet and time to sort the statements into an algorithm that represents how they might have used variables when recording the number of star-jumps completed.
* Once they have completed ordering the steps of the algorithm, display solution **slide 7** (also on second page of handout) so they can compare their algorithm. If pupils have sequenced their algorithm differently, invite suggestions on why their algorithm differs and how either algorithm could be improved.
* Recap the computing concept of ‘selection’ by inviting pupils to explain their understanding of the term and ask them to identify where it is used in the algorithm. (Selection is the process by which a computer only carries out specific parts of a program if certain conditions are met).

**Activity 3: Using variables in programs (10 minutes)**

* Show pupils [**the star jump counter program**](https://makecode.microbit.org/#pub:_dwTUkmU2HdCM) on **slide 8** and explain that it uses variables to program a micro:bit to be used as an activity counter.
* Give out copies of **slide 9** and ask pairs to identify the purpose of each part of the program by drawing an arrow from the purple circle next to a section of the program to a statement in the adjacent table. A completed copy of the slide has been provided on slide 13.
* Display **slide 10** and invite suggestions from pupils on how a micro:bit, when running this program, could be used to count the number of star jumps completed. Ask questions such as, how is the counter set to zero (press button A), how is a jump recorded (press button B), when is the score displayed (when micro:bit is shaken). Test pupils’ ideas by using the **star jump counter hex**file in the MakeCode editor (see speaker notes for an explanation of pause block).

**Activity 4: Debugging (20 minutes)**

* Use **slide 11** to recap pupils’ understanding of the term ‘debug’ and establish that it is the process of finding and fixing errors in programs and algorithms.
* Explain to pupils that they are going to use the example program on **slide 9** to debug a program so it can be used as an activity counter.
* Give pupils access to the [**variable debug hex file**](https://makecode.microbit.org/#pub:_6ipg3x9f9RpD) and ask them to work in pairs to debug the program so it can be used as an activity counter. Remind pupils to make use of the simulator in the MakeCode editor to see of their debug has had the desired impact.
* If you have access to physical micro:bit devices, you could ask pupils to download and transfer the program to their micro:bits and use them to count how many times an activity can be completed.
* Display **slide 12** and invite pupils to demonstrate their understanding of variables and highlight how they have used them in the lesson (both in the forms of algorithms and programs) and to reflect on their debugging work.
* If you wish, use **slide 13** to review the learning objectives of the lesson.

**Extension ideas**

* Once programed, pupils could transfer the file to a micro:bit and use it to record the group completing various physical activities. If pupils are recording a new type of activity (after completing sit-ups, recording burpees) they will need to press the reset button on the reverse side of their micro:bit to reset the high score.

**Differentiation**

**Support:** Pupils could use the [**variables debug support hex file**](https://makecode.microbit.org/#pub:_UX1MHYFDDJf3) which contains hints on how the program might be debug.

**Stretch & challenge:** Pupils could use the [**variables debug challenge hex** **file**](https://makecode.microbit.org/#pub:_dgrWKmR191Xe) which contains more bugs.

**Opportunities for assessment**

* Informal observation of pupils understanding of how variables are used in algorithms and programs through class discussions and paired activities.
* More formal assessment of pupils’ use of variables through the debugging activity if wished.