**Musical micro:bit**

**Lesson 1: Musical algorithms**

**Introduction**

In this unplugged lesson, pupils widen their experiences of algorithms by identifying ways that people are given instructions to play music. They evaluate the effectiveness and identify strengths and weaknesses of a variety of algorithms before creating a short musical composition based on given criteria. Finally, they write an algorithm to communicate their composition to a person who cannot read music.

**Time:** @60 minutes

**Learning objectives**

* To read and interpret a range of algorithms
* To evaluate algorithms
* To write algorithms for a given audience

**Materials needed:** lesson presentation, printouts of algorithm evaluation sheet (slide 8), printouts of composing musical phrases and algorithms and composing musical phrases and algorithms support sheet, pitched musical instruments such as glockenspiels.

**Lesson summary**

1. Introductory activity: Fill the gap (10 minutes)
2. Evaluating algorithms (15 minutes)
3. Reading musical algorithms (15 minutes)
4. Composing musical phrases and algorithms (15 minutes)
5. Evaluating algorithms (5 minutes)

**Introduction: Fill the gap (10 minutes)**

* Give out the pitched musical instruments. Ask pupils to listen, and then join in, as you clap a beat of four then rest for a beat several times (**slide 3**).
* Once pupils are confident with the sequence, explain that when you point to a pupil then need to play a musical phrase on their pitched instrument that will fill the gap. Repeat this several times, the pupils continue ‘clapping and resting’ if they have not been chosen to play a musical phrase.
* Recap pupils’ understanding of selection from the **Data handling** unit by presenting the algorithm on **slide 4**. Identify what computing concepts are represented in the algorithm (repetition and selection) and invite pupils to complete it by identifying the activities they did when certain conditions were met. Discuss why **forever** has been added and what the effect of removing it from the algorithm would be (you would only check if the conditions have been met once).

**Evaluating algorithms (15 minutes)**

* Use **slide 5** to recap the meaning of the term algorithm (definition in slide notes) and invite pupils to give examples of algorithms that they have previously written.
* Display **slide 6** and ask pupils to discuss with their partner if allow the images are examples of algorithms. Explore pupils’ ideas and establish that all give pupils instructions on how to play a piece of music.
* Display **slide 7** and explain to pupils that they are going to evaluate each algorithm. Recap what evaluation means: identifying how well something does the job it was made to do (give instructions to humans) and how it can be improved. Using each algorithm in turn, invite brief suggestions on the positives and negatives of that algorithm - examples are included in the speaker notes section of lesson presentation.
* Give out copies of the algorithm evaluation sheet (**slide 8**) and ask pupils to work with a partner to identify at least one positive and negative for each type of musical algorithm.
* When pupils have completed their evaluations, discuss which algorithm they think would be most useful for a person that doesn’t know how to read music and to justify why they think that.

**Reading musical algorithms (15 minutes)**

* Display **slide 9** and ask pupils what instructions they think the algorithm is giving. Pupils responses should focus on which notes need to be played and the sequence in which the notes should be played. Invite pupils to follow the algorithm and play the musical phrase using their instruments.
* Display **slide 10** and invite pupils’ ideas on what the statements about the musical phrase created by the algorithm relate to (see speaker notes for explanation).
* Present pupils with the algorithms on **slides 11 & 12** and ask them to create statements, similar to those on slide 10, about each musical phrase. Use the questions on the slide to guide pupils’ responses.

**Composing musical phrases and algorithms (15 minutes)**

* Explain to pupils that they are going to compose a piece of music that matches the criteria displayed on **slide 13**.
* Review the terminology used and highlight they need to write an algorithm to instruct someone who cannot read music how to play each musical phrase they create.
* Give pupils time to work with a partner to create musical phrases that meet the criteria and write their algorithm for each phrase. Pupils can choose the form their algorithm will take but it must be for a person who cannot read music.

**Evaluating algorithms (5 minutes)**

* Invite pupils to share their algorithms with the class and ask for volunteers to test out the algorithms by playing the pieces of music.
* After playing the piece of music, ask pupils to comment on the effectiveness of the algorithm and suggest what could be changed to improve it. Use the questions on **slide 14** to guide pupils’ evaluation and feedback.
* If you wish, use **slide 15** to review the learning objectives of the session.

**Extension ideas**

* Pupils could be given a help sheet on how to read sheet music and the sheet music to a popular children’s song (e.g. *happy birthday*) and asked to re-write it in the form of an algorithm that would allow someone who cannot read music to play it.

**Differentiation**

**Support:** Pupils could be given simplified criteria for their musical phrases and use a specified algorithm - see **musical phrases support** sheet.

**Stretch & challenge:** Pupils could explore different ways of writing algorithms for people who cannot read music by creating different style algorithms for each musical phrase. They should then evaluate their algorithms to select the one they think is most effective and state why.

**Opportunities for assessment**

* Informal observation of pupils understanding and evaluations of algorithms through whole class and group discussions.
* More formal assessment of pupils’ algorithms if wished.