**Electrical conductors**

**Lesson 2: Decision boxes**

**Introduction**

In this ‘unplugged’ lesson, pupils develop their understanding of selection by exploring the use of decision boxes. Initially, they undertake activities where they are required to read and respond to decision boxes before they use decision boxes as part of a flowchart algorithm.

**Time:** @60 minutes

**Learning objectives**

* To understand how selection is represented in flowcharts
* To understand and use decision boxes
* To create flowcharts algorithms

**Materials needed:** range of electrical components and materials used in the previous lesson, cards made from slide 20 - 27 of the lesson presentation, printouts of blank flowchart algorithm and algorithm support sheet, lesson presentation.

**Lesson summary**

1. Introduction: Flowchart algorithms (5 minutes)
2. Decision boxes (10 minutes)
3. Electrical circuits (15 minutes)
4. Algorithms with decision boxes (20 minutes)
5. Evaluating Algorithms (10 minutes)

**Introduction: Flowchart algorithms (5 minutes)**

* Use **slide 3** to show pupils a basic algorithm, in the form of a flowchart, for making a glass of squash. Invite suggestions for what the algorithm is and what problem it is solving.
* Ask pupils to think/pair/share their previous learning of flowcharts from the **Volcano animations** unit (where they first saw this flowchart).

**Decision boxes (10 minutes)**

* Show **slide 4** and ask pupils to think/pair/share the questions on selection.
* Use **slide 5** to introduce decision boxes as a way to record selection in a flowchart and show pupils an example related to the previous lesson. Discuss how it is different to other boxes they have used in flowcharts (answers are provided in the speaker notes for the slide).
* Display the decision box on **slide 6** and ask pupils to identify the condition and the outcomes if the condition is/isn’t met. If helpful, invite other suggestions from pupils’ everyday lives.

**Electrical circuits (15 minutes)**

* Ensure pupils have access to the same range of materials as the previous lesson and give each group a set of decision cards (**printed from slides 20-27**).
* In small groups, ask pupils to build an electrical circuit that contains an output from the components on their tables, selecting any of the given materials and test if it is an electrical conductor.
* Display **slide 7** and ask them to respond by selecting the action to carry out based on whether or not there is an output in their circuit. Groups who select a material that is a conductor should be counting to 30 in threes. While those who selected a material that is an insulator should be counting back from 20 in twos.
* Explain that you would like pupils are going to repeat this process by selecting a decision card (**printouts of slides 20 - 27**) and a material, connecting it their circuit and carry out the action dependent on whether or not the condition is met (the circuit has an output).
* Review their learning briefly as a class once groups have finished.

**Algorithms with decision boxes (25 minutes)**

* Show pupils **slide 8**, a scenario used in the previous session, and invite ideas on how to create a decision box to represent the use of selection. Use the questions on **slide 9** to support pupils’ ideas and then transfer to the blank decision box on **slide 10**.
* Display **slide 11** and ask pupils to recall the selection statement they made about the materials at the end of the previous lesson. Is there is an electrical output in the circuit? If the answer is yes, then the material is an electrical conductor. If the answer is no, then the material isn’t an electrical conductor.
* Use the blank decision box on **slide 12** and invite ideas on how to represent the selection statement. An example of this could be completed in included on **slide 13**.
* Explain to pupils that they are going to write an algorithm, in the form of a flowchart, to show someone how to test if a material is an electrical conductor (**slide 14**).
* Display **slide 15**, which shows a blank flowchart and invite pupils to suggest what type of information goes in each box (oval for start and stop, rectangular for actions, rhombus for decision boxes, arrows to connect boxes, yes and no arrows from decision boxes).
* Explain that pupils are going to use this frame to help them write a flowchart that shows someone else how to use an electrical circuit to test if a material is an electrical conductor. Establish how many actions will be needed in the flowchart (two) and invite suggestions on the two activities that could be added.
* Draw attention to the decision box and invite suggestions from pupils on the condition that could be added to the decision box and the statements to go in the yes and no boxes.
* Give out copies of the **blank flowchart algorithm sheet** to pairs and ask them to construct a flowchart algorithm to show how to test if a material is an electrical conductor.

**Evaluating algorithms (10 minutes)**

* When pupils have completed their algorithms, show an example using **slide 16** and discuss if this is accurate (would it allow someone to complete the task if they followed it?).
* Ask pupils to share the steps they created (displaying their flowcharts to the class if possible) and decide if they are also accurate. Use **slide 17** to discuss what should be done to algorithms that are difficult to follow and invite pupils’ suggestions on how this can be done (debugging their algorithms).
* After sharing several examples, establish that the algorithm could be written in different ways and discuss that if the flowchart instructs someone to complete the task, then it is accurate.
* Display **slide 18** and ask pupils to select the action which represents their understanding of selection. Invite pupils to recap with a partner the meaning of selection and review the learning objectives on **slide 19** if you wish.

**Extension ideas**

If pupils carried out the selection-walk in the previous lesson, they can reflect on their findings and try and use decision boxes to represent the items/systems observed. Or, they could create decision boxes for teachers to use to reinforce the school’s behaviour rules and identify the positive and negative consequences of actions.

**Differentiation**

**Support:** The actions in the decision boxes could be changed to ones that suit the abilities of the pupils and focus on helping pupils to gain an overall understanding of selection and decision making. Pupils could use sort the command in the **algorithm support sheet** and use these to create their flowchart algorithm.

**Stretch & challenge:** Pupils could be challenged to write a more detailed algorithm that requires additional steps and to construct their own flowchart.

**Opportunities for assessment**

* Informal assessment of pupils’ understanding and use of decision boxes.
* More formal assessment of pupils’ flowchart algorithms.