**Current or voltage?**

|  |  |
| --- | --- |
| **1.5**  **+** | **1.5**  **+** |
| Circuit with one bulb | Circuit with two bulbs |

**To do**

Fill in the gaps to describe what happens in these circuits.

You should only use the words **current** and **voltage**.

**Circuit with one bulb**

The battery has a ………………………………………….. marked on it. This tells me how hard the battery can push ………………………………………….. around the circuit.

To make the bulb brighter I can use a battery with a bigger ………………………………………….. . This will push more ………………………………………….. through the bulb.

**Circuit with two bulbs**

If I add another bulb, it will make the ………………………………………….. smaller. This is because it is harder to push ………………………………………….. through two bulbs than one.

To make two bulbs as bright as one bulb was, I will need to use a bigger …………………………………………. .

*Physics > Big idea PEM: Electricity and magnetism > Topic PEM1: Simple electric circuits > Key concept PEM1.3: Voltage*

|  |
| --- |
| **Diagnostic question** |
| **Current or voltage?** |

**Overview**

|  |  |
| --- | --- |
| Learning focus: | The voltage, of batteries and power supplies, is a measure of their ‘strength’. |
| Observable learning outcome: | * Describe voltage, measured with a voltmeter, as the strength with which a battery can ‘push’ current around a circuit. * Use the idea of an ‘electrical push’ to explain the effect of different battery voltages on a circuit. |
| Question type: | Diagnostic, focused cloze |
| Key words: | current, voltage |

**What does the research say?**

Many researchers such as Driver et al (1994), Gott (1984) and Shipstone (1985) have found that students’ explanations, at an early stage, are likely to use the words current, voltage, electricity and energy to mean the same thing. To advance their understanding of electric circuits it is necessary for students to distinguish between: the current flowing through the circuit (that is conserved); the energy that is stored in the battery and then transferred elsewhere; and the voltage.

Driver et al (1994) suggest that to develop a good understanding of voltage, it is better, at this stage, to describe it as a measure of the strength of a battery’s ‘push’. In one study of 14-15 year old students in England, it was found that that 31% thought of voltage as something that flowed around a circuit (Shipstone, 1985). Driver *et al* (1994) note that embedding this clear distinction between current and voltage is a very important foundation for a clear understanding of electricity, and should be a focus of the learning at this stage.

**Ways to use this question**

Students should complete the activity individually as a pencil and paper exercise.

How students fill in the gaps will show you whether they understood the concept sufficiently well to apply it correctly.

If there is a range of answers, you may choose to respond through structured class discussion. Ask one student to explain why they gave the answer they did; ask another student to explain why they agree with them; ask another to explain why they disagree, and so on. This sort of discussion gives students the opportunity to explore their thinking and for you to really understand their learning needs.

*Differentiation*

You may choose to read the sentences to the class, so that everyone can focus on the science. In some situations it may be more appropriate for a teaching assistant to read for one or two students.

**Expected answers**

Circuit with one bulb

The battery has a **voltage** marked on it. This tells me how hard the battery can push **current** around the circuit.

To make the bulb brighter I can use a battery with a bigger **voltage**. This will push more **current** through the bulb.

Circuit with two bulbs

If I add another bulb, it will make the **current** smaller. This is because it is harder to push **current** through two bulbs than one.

To make two bulbs as bright as one bulb was, I will need to use a bigger voltage.

**NB** Although voltage is the best answer for the last space, students may argue that current is correct, because a bigger current does make the bulb brighter. However to make the current bigger they will need to *add* a bigger voltage. This sentence has been deliberately included to provoke further discussion on the detail of the differences between voltage and current.

**How to respond - what next?**

Wrong answers suggest that students are not clearly distinguishing between current and voltage.

If students have misunderstandings about this, it might be effective to model what is happening and then give the students an activity in which they can practise using the concept so that they can consolidate their understanding. The following BEST ‘response activities’ could be used in follow-up to this diagnostic question:

* Response activity: String loop model (voltage)
* Response activity: Adding batteries (1)

In the string loop model, stronger students who can push the string round harder have a bigger voltage. Adding more students gripping the wire (as bulbs) slows down the movement of the string (current). Pushing harder (bigger voltage) increases the current again.

**Acknowledgments**

Developed by Peter Fairhurst (UYSEG).

Images: EPSE

**References**

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Gott R. (1984). *Electricity at age 15: a report on the performance of pupils at age 15 on questions in electricity*. London: Dept. of Education and Science, Welsh Office, Dept. of Education for Northern Ireland.

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