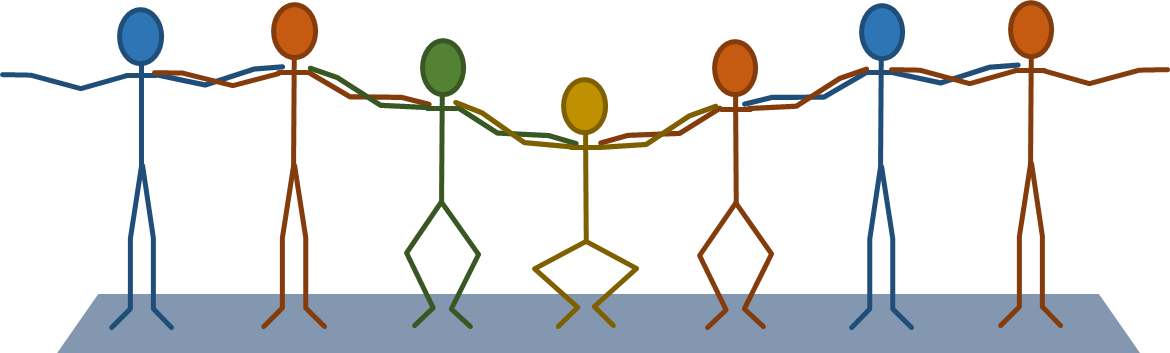
**Making waves**

Some students are modelling a wave on a rope.

They want to show how it is made.





**To answer**

1. State three ways in which this **is a good representation** of a wave on a rope.

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1. State three ways in which this is **not an accurate representation** of a wave on a rope.

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*Physics > Big idea PSL: Sound, light and waves > Topic PSL4: Waves > Key concept PSL4.1: Waves on water and ropes*

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| **Response activity** |
| **Making waves** |

**Overview**

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| Learning focus: | A transverse wave travelling across the surface of water (or along a rope) transfers energy, as particles of water (or rope) are successively made to vibrate at right angles to the direction in which the wave travels. |
| Observable learning outcome: | Recognise that as a transverse wave travels forward, the medium through which it travels does not.  Describe the movement of each ‘particle’ of a transverse wave as the wave moves forward.  Explain how movement of each ‘particle’ of a transverse wave causes a perturbation to move forward. |
| Activity type: | Critiquing a representation |
| Key words: | Waves, transverse waves |

This activity can help develop students’ understanding by addressing the sticking-points revealed by the following diagnostic questions:

* Diagnostic question: A moving wave
* Diagnostic question: Part of a moving wave
* Diagnostic question: Rope wave

**What does the research say?**

When waves move through a medium students often describe the movement of some entity (perhaps mass, matter or force) through the medium. The scientific explanation involves no such movement. A wave moves forwards when a perturbation passes through a medium, and after it has passed the material of the medium returns to its original position. This is what distinguishes the motion of a wave from the motion of an object. (Fazio et al., 2008)

The motion of waves is hard for students to understand because waves form from large numbers of small scale events, such as the up and down movement of water particles in a water wave that are quite different to the form and motion of the wave (Caleon and Subramaniam, 2010). This is seen clearly when spectators in a sports stadium stand up and sit down in sequence to produce a *Mexican wave* moving around the stadium. In a mechanical wave the disturbance of one particle has a direct effect the particles around it, causing them to move and progressively pass on the disturbance to adjoining particles. This process transfers energy through a medium, but without the transfer of any bulk substance.

**Ways to use this activity**

Students should complete this activity in pairs or small groups, and the focus should be on the discussions. It is through the discussions that students can check their understanding and rehearse their explanations.

Philosophically science can be said to be a description of the ‘best model’ we have for the world. In this activity students should identify ways in which this particular model is a good representation of the real world, and ways in which it is not.

Students should work together to answer the questions on either the worksheet or the PowerPoint. Giving each group one worksheet to complete between them is helpful for encouraging discussion, but each member should be able to report back to the class. Listening in to the conversations of each group will often give you insights into how your students are thinking.

Ending with the students completing the worksheet or questions from the PowerPoint individually, might help them to consolidate their learning.

*Differentiation*

You may choose to use simplified worksheets for some students, for example with gaps to fill in so they can focus on the science. In some situations it may be more appropriate for a teaching assistant to read and/or scribe for one or two students.

This activity can be extended to compare the model to a water wave, rather than a wave on a rope.

**Expected answers**

1. This is a good representation because:

* The students move only up and down, like each section of a rope, as the wave moves along.
* The students’ arms link together so when one moves down, the next one along is pulled down too, like connected sections of rope.
* When a student moves up, the next one along is pulled up too.
* The students arms show the shape of the wave, as it would be on a rope.

2. This is not an accurate representation because:

* The students move down and then back up to where they started; in a rope wave the rope moves above its starting height as well as below.
* To make a wave on a rope the rope needs to be forced to move; there is nothing making the first person in the line move up and down.
* In a rope each section is pulled up and down by the piece of rope moving next to it; the students can push themselves up and down.

**Acknowledgments**

Developed by Peter Fairhurst (UYSEG).

Images: Peter Fairhurst (UYSEG).

**References**

Caleon, I. and Subramaniam, R. (2010). Development and Application of a Three-Tier Diagnostic Test to Assess Secondary Students' Understanding of Waves. *International Journal of Science Education,* 32:7**,** 939-961.

Fazio, C., et al. (2008). Modelling Mechanical Wave Propogation: Guidelines and experimentation of a teaching-learning sequence. *International Journal of Science Education,* 30:11**,** 1491-1530.