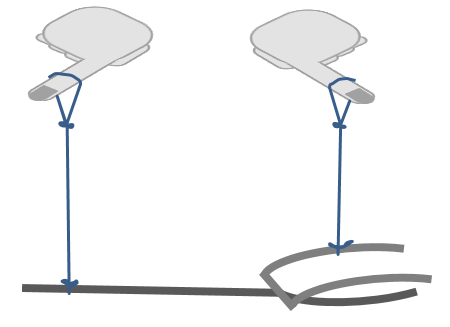
**String ears**

The metal clamp makes a sound when it is tapped gently.



**Predict**

What do you think will happen to the sound if you put your fingers in your ears?

**Explain**

Explain why you think this will happen.



|  |
| --- |
| **Now have a go** |

**Observe**

Describe how the sound changes.

**Explain**

Were your prediction and explanation correct?

If not, can you explain what you observed?

*Physics > Big idea PSL: Sound, light and waves > Topic PSL1: Sound and light > Key concept PSL1.1: Production and transmission of sound*

|  |
| --- |
| **Response activity** |
| **String ears** |

**Overview**

|  |  |
| --- | --- |
| Learning focus: | Sound needs a medium to travel through. It radiates out from a source in straight lines in all directions and when it strikes an object or new material it is transmitted, reflected, scattered or absorbed – or a combination of these. |
| Observable learning outcome: | Identify which materials sound travels best in. |
| Activity type: | Predict, explain, observe, explain - practical |
| Key words: | Solid, gas, vibrations, particles |

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

* Diagnostic question: Sound moves

**What does the research say?**

It is common for students to think that sound only travels through the air and not through solids or liquids.

The transmission of sound is difficult to understand. It is common for students to think of sound a material substance that moves from one place to another (Barman, Barman and Miller, 1996). Even at degree level (Linder (1992) found that some students thought of sound as a ‘lump’ of material travelling through a passive medium, similar to a surfer on a water wave.

In his study of twenty-eight 11-14 year olds Whittaker (2012) found that fewer than 30% used the idea of vibrations to correctly describe how sound travels through air. Half the students believed a gap around the door was necessary for sound to enter from the outside, which indicates a view of sound as a material substance. Only 20% were able to explain how sound vibrations can pass through the solid wall.

This activity shows students that sound travels best through a solid and gives them the opportunity to discuss the reasons why, before putting the correct answer into their own words.

**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.

To begin, each group should discuss the activity and use their scientific understanding, firstly to predict *what* they think will happen, and then to explain *why* they think they are going to be right. If students in any group cannot agree, you may be able to direct them with some careful questioning.

Students now carry out the short practical.

After the practical each group should be given the opportunity to change, or improve their explanation. A good way to review your students’ thinking might be through a structured class discussion. You could ask several groups for their *explanations* and put these on the whiteboard. Then ask other groups to suggest which explanation is the most accurate and the most clearly expressed, and through careful questioning work up a clear ‘class explanation’.

A useful follow up is for individual students to then write down explanations in their own words – without reference to the class explanation on the board (i.e. cover it up).

*Differentiation*

The quality of the discussions can be improved with a careful selection of groups; or by allocating specific roles to students in the each group. For example, you may choose to select a student with strong prior knowledge as a scribe, and forbid them from contributing any of their own answers. They may question the others and only write down what they have been told. This strategy encourages contributions from more members of each group.

**Equipment**

For each student/pair/group:

* Two pieces of string (each about 50 cm long)
* Metal clamp – or any similar metal object
* Something to tap the clamp with, such as a pen

**Expected answers**

The sound is louder because the vibrations travel through the metal and string more easily than through the air. The particles in a solid are joined together so they more easily pass on the vibration.

**Acknowledgments**

Developed by Peter Fairhurst (UYSEG), from an idea from the Institute of Physics’ Marvin and Milo experiment: Musical coat hanger <http://www.physics.org/marvinandmilo.asp?id=7> .

Images: UYSEG

**References**

Barman, C. R., Barman, N. S. and Miller, J. A. (1996). Two teaching methods and students' understanding of sound. *School Science and Mathematics,* 96(2)**,** 63-67.

Linder, C. J. (1992). Understanding sound:so what is the problem? *Physics Education,* 27**,** 258-264.

Whittaker, A. (2012). Pupils think sound has substance - well, sort of ... *School Science Review,* 94(346)**,** 3.