sequence overview

Background

These SPICE resources can be drawn together into a learning pathway for students to develop their understanding of properties of mechanical waves and how they relate.

The pathway has been designed for teachers of senior school physics but it may also be used with students in earlier years at the discretion of the teacher.

Links to the Australian Curriculum: Senior Secondary Science (Physics Unit 2)

Science understanding concepts include:

Waves are periodic oscillations that transfer energy from one point to another (ACSPH067)

Longitudinal and transverse waves are distinguished by the relationship between the direction of oscillation relative to the direction of the wave velocity (ACSPH068)

Waves may be represented by time and displacement wave diagrams and described in terms of relationships between measurable quantities, including period, amplitude, wavelength, frequency and velocity (ACSPH069)

Mechanical waves transfer energy through a medium; mechanical waves may oscillate the medium or oscillate the pressure within the medium (ACSPH070)

The mechanical wave model can be used to explain phenomena related to reflection and refraction (for example, echoes, seismic phenomena) (ACSPH071)

The superposition of waves in a medium may lead to the formation of standing waves and interference phenomena, including standing waves in pipes and on stretched strings (ACSPH072)

Science as a human endeavour concepts include:

Development of complex models and/or theories often requires a wide range of evidence from multiple individuals and across disciplines (ACSPH054)

Advances in science understanding in one field can influence other areas of science, technology and engineering (ACSPH055)

The use of scientific knowledge may have beneficial and/or harmful and/or unintended consequences (ACSPH057)

Scientific knowledge can enable scientists to offer valid explanations and make reliable predictions (ACSPH058)

Science inquiry skills concepts include:

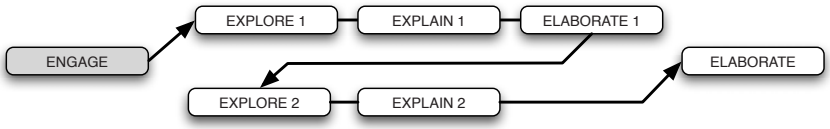
Identify, research and construct questions for investigation; propose hypotheses; and predict possible outcomes (ACSPH045)

Conduct investigations, including the manipulation of devices to measure motion and the direction of light rays, safely, competently and methodically for the collection of valid and reliable data (ACSPH047)

Learning pathway

The pathway is structured around a constructivist model based on the 5-Es where teachers can:

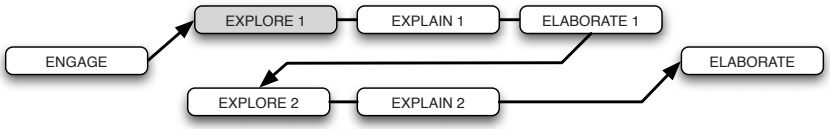
- **Engage** students interest and minds in the concepts. Students compare and contrast properties and characteristics of wind and tsunami waves.
- provide opportunities for students to **Explore** what they know about the concepts. Experiences and activities lay the foundation for students to establish concepts that waves transfer energy and have characteristic and related properties.
- **Explain** the concepts. A variety of wave representations are applied to displacement-time and displacement-distance graphs.
- provide opportunities for students to **Elaborate** on the concepts. Here students can apply their knowledge in different contexts and extend their knowledge of and about science. Problem solving and scientific investigation are used together with the work of a scientist searching to find a reason for whale beachings.
- **Evaluate** students' progress throughout the pathway.



Mechanical waves 1: The physics of tsunamis

The physics of tsunamis includes a video, teacher guide, fact sheet and background sheet.

This resource engages students by contrasting two different but dangerous waves: surfers riding giant waves, and the Boxing Day tsunami crashing ashore. See the teacher guide for detailed information on the purpose and use of this resource.



Activity: modelling waves

The **purpose** of this activity is for students to:

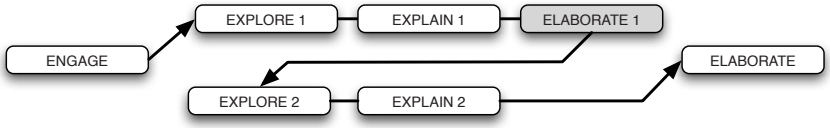
- experience waves practically by trying to make waves similar to the ones that they have seen,
- reflect and summarise what they have learned, and
- use existing knowledge to speculate about other waves.

The activity:

Either demonstrate, or allow students to use slinky springs, rope and a tank of water to replicate what they have seen in the video included in *Mechanical waves 1: The physics of tsunamis*.

Use a group strategy, such as a placemat, for students to clarify what they know about waves in relation to these focus questions.

- Explain the difference and similarities between the waves that they have seen and made.
- Is energy transferred by waves and how do you know?
- What other kinds of waves are there?



Mechanical waves 3: Graphing waves – optional

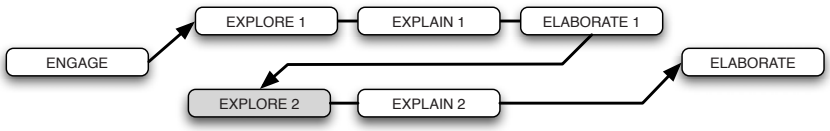
Graphing waves comprises a teacher guide and two student worksheets.

Students deepen their understanding of wave properties further through graphics calculator activities. See the teacher guide for further information on the purpose and use of this resource.

Mechanical waves 4: Tsunami problems

Tsunami problems comprises a teacher guide, student fact sheet and student worksheet.

This resource reinforces student understandings of relationships between wave characteristics. See the teacher guide for further information on the purpose and use of this resource.



Activity: sound cannons (optional)

The **purpose** of this activity is to:

- build the concept of waves as energy transfer mechanisms, and
- raise awareness of the use and misuse of sound.

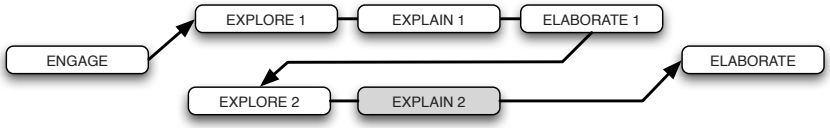
The activity:

To challenge preconceptions students use a slinky spring and/or sound cannon to explore the concept of energy transfer without particle displacement.

Discuss examples of energy transferred by waves and link to sound as a potentially damaging wave.

Pearl Jam guitarist Stone Gossard says he isn't affected but that bassist Jeff Ament, guitarist Mike McCready and drummer Matt Cameron all have hearing loss or tinnitus[1].

1) Jonathan Ringen (18 Nov 2005). Music making fans deaf? *Rolling Stone Magazine*. Retrieved 6 May 2008, from http://www.rollingstone.com/news/story/8841090/music_making_fans_deaf.



Activity: wave energy

The purpose of this activity is to:

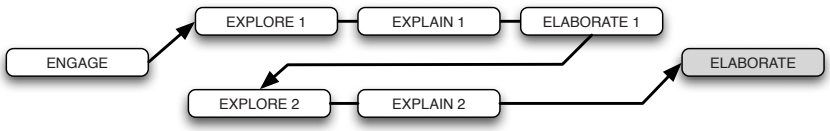
- consolidate student understanding that energy is transferred by wave motion.

The activity

Students hold a group discussion of the following questions.

- What evidence do we have that energy is transferred by wave motion?
- How does the amount of energy transferred depend on the nature of the wave?
- How do waves transfer energy?

If necessary, students should revisit *Wave explorer* in *Mechanical waves 2: Wave properties*.



Mechanical waves 5: The physics of whale stranding

The physics of whale stranding comprises a teacher guide, video, background sheet for teachers and student fact sheet.

This activity extends and applies students' understandings of wave properties and the role of science in society. See the teacher guide for further information on the purpose and use of this resource.

Acknowledgements

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