

Conceptual narrative Science: Energy

In the physical sciences sub-strand, there are two main conceptual threads being developed from Foundation through to Year 10, energy and forces and motion.

Big ideas

Light and sound are produced by sources and travel to us.

What concepts do I want my students to understand?

- Light is produced by globes, burning things and the sun.
- Light travels to us where we see it with our eyes.
- We need a light source to see things.
- Sound is produced by a range of things.
- Sound travels to our ears where we hear it.

Appendix 1 shows how the three interwoven strands, Science Understanding, Science as a Human Endeavour and Science Inquiry Skills, work together to build the sophistication and complexity of the science concepts from Foundation to Year 10.

This conceptual narrative illustrates one of the nine science concepts from the Australian Curriculum: Science Content structure. It tells the story of the concept in isolation of the eight others. However, there are situations when it is advisable to teach both concepts, (energy and forces and motion) together, because they complement each other.

Note: Not all concepts are specifically addressed in each year level.

Introduction

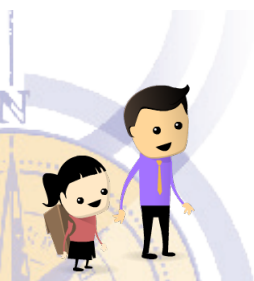
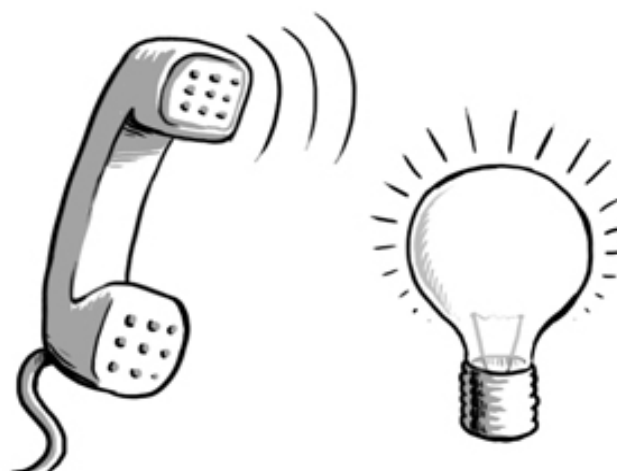
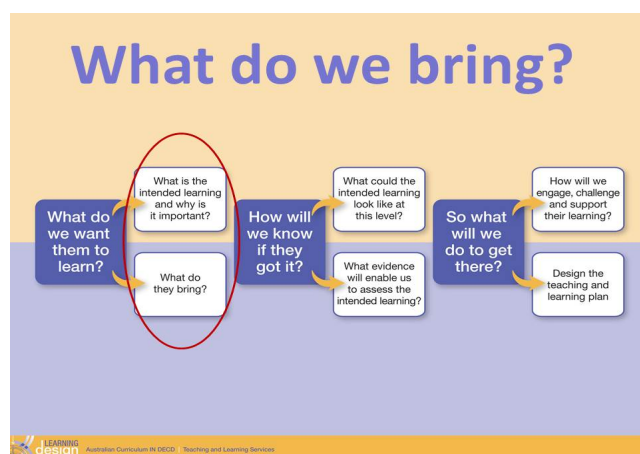
What might my students already know about this concept?

Students are likely to have experienced darkness and the inability to see and have experience in making a range of sounds.

What content could I use to explore this concept?

We could explore sound using musical instruments, animal calls at the zoo and battery operated toys. We could explore light through playing with torches, Christmas lights and solar powered devices. We want our students to understand that light and sound are produced by these sources and travel with us where we sense them with our eyes and ears.

Now to bring the essence of scientific understanding to life, let's think about this concept through the six questions from the Bringing it to Life tool (BitL).



At Year 1, we want our students to understand that the light and sound they sense are produced by a range of sources.

Year 1 example

In this example, I want my students to learn about sound. I will get them to explore the properties of sound by making instruments.

What do you notice?

How can I help my students make observations?

Using the BitL questions, I could ask:

- *What do you notice?*

At Year 1, I want my students to make observations of the musical instruments using our senses.

Questions I will ask my students are:

- *What do you hear?*
- *What do you see?*
- *What do you feel?*
- *What is different about the sound?*
- *Which instruments make similar sounds?*
- *Which instruments make the loudest sounds?*

SAFETY - Children should be warned that loud sounds including loud music can damage the ear.



What do you think?

How can I help students to see patterns and relationships? What questions might my students ask?

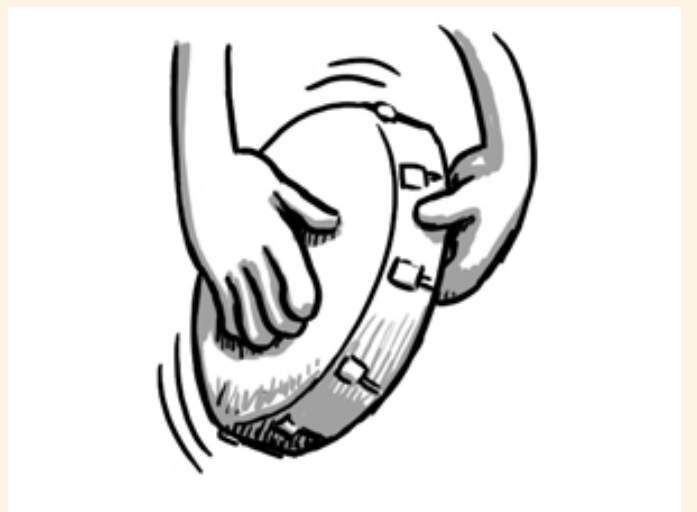
Students' curiosity leads them to ask questions. These questions help students to order their findings into a pattern, to be able to make comparisons, or find relationships. These questions support students to be more precise, and foster analysis and classification of the observations.

Using the BitL questions, I could ask:

- *What do you think?*

At Year 1, I want my students to ask questions and start noticing patterns by comparing the different sounds

- *Can you feel the instrument move when it makes a sound?*
- *Do all the instruments make the same sound?*
- *What is different about the sound on each instrument?*



What do you think if?

How can I help students to identify and formulate investigable questions?

Students ask testable questions that help them to narrow the focus of the inquiry. These questions provide opportunities for students to make predictions.

Using the BitL questions, I could ask:

- *What do you think if...?*

Questions I may ask my students so they start predicting what might happen are:

- *What do you think would happen if we put peas into the bottle and shook it?*
- *What do you think would happen if we changed the amount of peas in the bottle and shook it?*
Would it sound the same?



How can you explore?

These questions support students to develop science inquiry skills and problem solve.

Using the BitL questions, I could ask:

- *How can we explore?*

In Year 1, I want my students to start exploring their questions and predictions.

- *If we set up five bottles and put different amounts of peas in each, which one do you think will make the loudest sound when it was shaken?*
- *What else could you try?*
- *How could you record this?*
- *How might a video camera help you capture this?*

It is important for teachers to help children to be sensitive to those who are hearing impaired.



Hearing impaired children will need particular support in this unit. They will be helped by visual demonstrations of the properties of musical instruments and by attention to the vibrations as sounds produced. It is important for teachers to help children to be sensitive to those who are hearing impaired.

How can you share?

How can I help students share their observations and questions?

These questions stimulate students' reasoning and help them analyse, draw conclusions and make generalisations about the concepts.

Using the BitL questions, I could ask:

- *How can you share?*
- *How can you draw diagrams of what you have found out about sounds produced by the bottles?*
- *Were the results the same or different to what you predicted?*
- *How could you show me on the video which bottle made the loudest sound?*



So what?

How can I help students apply the concepts in a range of authentic contexts?

These questions support students' reasoning, to expand or change their ideas from their experience and evidence, and generalise to new contexts.

Using the BitL questions, I could ask:

- *So what?*

It is important to connect the concept to their everyday life so they can see why it is important to know this. Questions I could ask:

- *Are musical instruments the only things that make music?*
- *How is sound useful?*
- *What can you do to hear something better?*
- *Who might be interested in different sounds?*



Concluding comments

What concepts might students develop through working with the BitL questions in this way?

By exploring this science understanding through these questions, we can help our students to think, work and process scientifically. Students can connect science to their world, and consider why they need to learn that light and sound are produced by a range of sources.

Appendix 1

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This conceptual narrative illustrates one of the nine science concepts from the Australian Curriculum: Science Content structure. These concepts develop in depth and breadth of understanding from Foundation to Year 10. This conceptual narrative tells the story of the concept in isolation of the eight others. However, there are situations when it is advisable to teach both concepts (energy and forces and motion) together, because they complement each other.

Note: Not all concepts are specifically addressed in each year level.

Physical sciences

In the physical sciences sub-strand, there are two main conceptual threads being developed from Foundation through to Year 10. They are the concepts energy and forces and motion. Let's look at the concept energy.

Year 1

This begins in Year 1, where students investigate familiar forms of energy, such as light and sound. Students learn that objects can only be seen when they are illuminated by light. Students sense light coming from the sun, and sound coming from a phone. Students explore how they can make sounds, such as clapping their hands.

Year 3

In Year 3, students learn about heat, another form of energy. They learn that things produce heat, and heat moves from one object to another. For example, if you are feeling cold, you can stand in front of a fire to warm up. The heat from the fire moves to your body.

Year 5

At Year 5, there is a deeper understanding of how light energy is transferred. The focus is on how light can be reflected, such as when a light beam reflects off a mirror, or refracted, such as when a light beam is bent as it moves from the air into water so a ruler looks bent in a glass of water, and absorbed, such as when the curtains get warmed up as the light shines on them. Students also learn how light from a source forms shadows.

Year 6

In Year 6, the energy focus is on electricity and students learn that it can come from many different sources such as wind,

solar cells or from burning fossil fuels. They also learn electrical circuits provide a means of transferring electrical energy through wires, and electrical energy can be transformed into light energy to light up a globe.

Year 8

In Year 8, students learn to classify the different forms of energy, such as kinetic, potential and heat energy which cause change to systems. Students learn that heat energy is often produced as a by-product of energy transfer, which can be illustrated in flow diagrams showing energy transformations that occur in every day appliances. For example, an iron transforms electrical energy into heat energy to iron your clothes.

Year 9

In Year 9 more abstract thinking is required for students as they need to explain energy transfer through different media using the wave and particle models. They can link the particle model to situations like conduction and convection of heat, and use waves to compare the transfer of sound through air and other media.

Year 10

In Year 10, students generalise their thinking to use the law of conservation of energy, where they learn that energy cannot be created or destroyed. They account for energy transfer and transformation within systems and explain how no system is 100% efficient.

So from Year 1 to Year 10, students broaden and deepen their understanding of energy as they move from concrete to abstract thought. They use laws and models to describe predict and generalise.