Year 5

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 travels in straight lines and its transfer is hindered or helped by the materials it passes through.

What concepts do I want my students to understand?

- Light is produced by a range of sources including electricity, burning, the sun.
- Light travels in straight lines.
- Opaque materials cast shadows by preventing light from passing through.
- Reflective materials bounce light off their surface.
- Transparent materials let light pass through.
- Translucent materials bend light as it passes through.
- Some translucent and transparent materials separate white light into its colours.

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

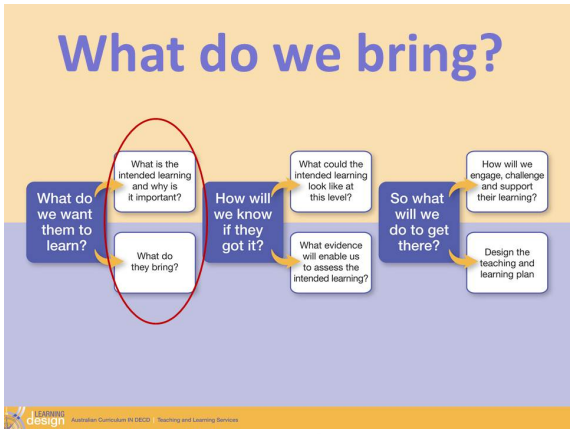
What might my students already know about this concept?

Students know that light is produced by sources and travels to our eyes. Students may know how heat is transferred through materials.

What content could I use to explore this concept?

There are many ways to investigate this concept. We could look at shadows and how they change, using mirrors to control a beam of light or how stained glass windows change light.

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).



In Year 5, we return to light energy and look in more detail at phenomena related to its transfer such as reflection and refraction.

Year 5 example

In this example, I want my students to investigate the shadows created by different objects. Students use a torch and a simple cardboard shape to trace shadows on paper taped to the wall.

What do you notice?

How can I help my students make observations?

Using the BitL questions, I could ask:

- *What do you observe?*

At Year 5, I want my students to make observations in order to develop their curiosity around the phenomena of shadows. Questions I may ask my students are:

- *What did you notice about the shape and size of the shadow?*
- *How do you get the darkest shadow?*
- *What happens if you move the torch? Move the card?*
- *What happens if you make a shadow on a coloured surface? An uneven surface?*

What patterns and relationships can you see?

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

Student's 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 patterns and relationships can you see?*

In Year 5, I want my students to notice that the shadow, card and light source lie in a straight line:

- *How can you control where the shadow will be?*
- *How can you change its size?*

What do you predict?

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 predict?*

Questions I could ask my students:

- *How can you predict where the shadow will be?*
- *How can you predict its size?*
- *What do you predict might happen if we cut a hole in the shape?*
- *What do you predict will happen to the shadow if we put the card on an angle?*
- *What questions could you ask about shadows?*
- *Which of these could you investigate by using the shadow making equipment?*

How can you test it?

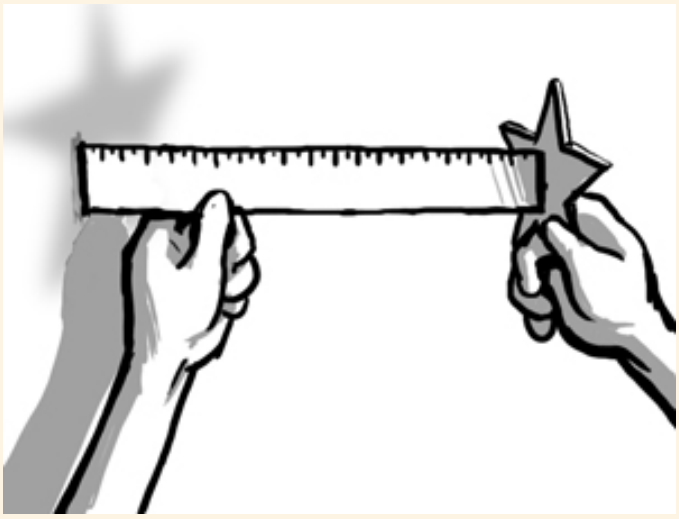
These questions support students to develop science inquiry skills and problem solve.

Using the BitL questions, I could ask:

- *How can you test it?*

At Year 5, I want to guide students to plan investigations to answer their questions. Questions I might ask are:

- *How could you find your own answer to that question?*
- *What could you do?*
- *What will you change?*
- *What will you measure?*
- *What will you keep the same?*
- *How will you record this?*



How can you review and communicate?

How can I help students share their observations and questions?

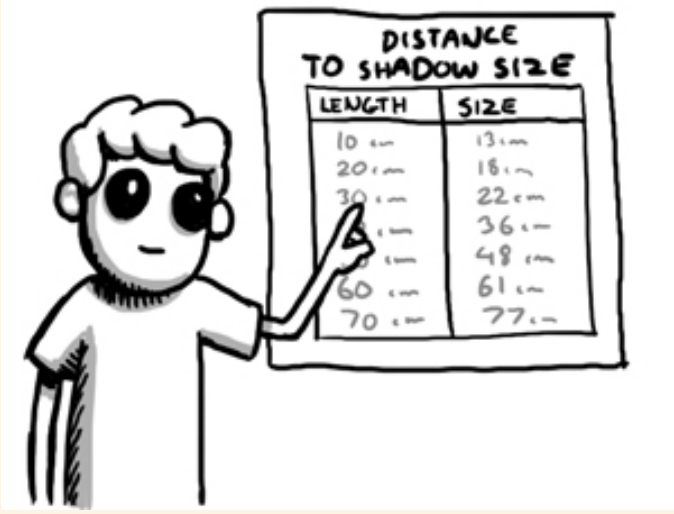
These questions stimulate student's reasoning and help them analyse, draw conclusions and make generalisations about the concepts.

Using the BitL questions, I could ask:

- *How can you review and communicate?*

At Year 5, I want my students to choose and construct appropriate ways of recording their data. I might ask:

- *How will record your data?*
- *Would a table be useful?*
- *Would a graph help display your findings?*
- *How will you summarise and explain your findings for others to see?*



So what? What next?

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

These questions support student's 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? What next?*

In Year 5, I want my students to describe how science knowledge might solve problems that directly affect people's lives. I might ask:

- *Who needs to know about shadows? Why?*
- *When do they cause problems? How do we get around this?*
- *When do we want them?*
- *Who needs to control them? Why?*

Concluding comments

By exploring this science understanding through these questions, we can help our students to be able to think, work and process scientifically Students can connect science to their world and consider why they need to learn that the world is made up of different materials scientifically. Students can connect science to their world and consider how light from a source can be reflected, retracted and absorbed.

Appendix 1

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. 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 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.