Year 3

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

The transfer of heat from one place to another is helped by some materials and hindered by others.

What concepts do I want my students to understand?

- Some ways heat can be produced are by friction, burning a substance or from electrical appliances.
- Heat can move from object to another, flowing from the hotter object to the cooler object
- Insulator and conductors affect the transfer of heat.
- Substances that allow heat energy to move through them easily, for example metals, are called conductors.
- Substances that do not allow heat energy to move through them easily, for example plastics, are called insulators.
- Adding heat makes things warmer and removing heat makes things cooler.
- Thermometers measure heat as a temperature.

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

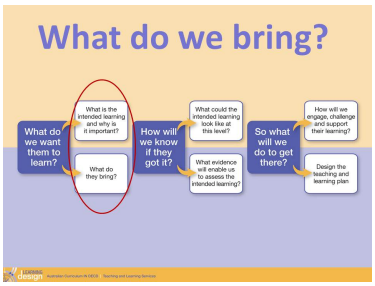
What might my students already know about this concept?

From past experience students are likely to know that bottles of cold drink will eventually warm to room temperature.

What content could I use to explore this concept?

There are many ways to investigate this concept. We could explore whether different coloured materials affect the amount of heat absorbed, or we could compare the amount of heat produced by burning different substances, or by placing long handled spoons made of plastic, wood and metal in warm water and asking how the handles feel after five minutes.

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 3, the focus is heat and we want our students to understand that heat can be produced in many ways and can move from one object to the other.

Year 3 example

In this example, I want my students to investigate different materials by wrapping them around their drink bottle to find out which one keeps their drink the coldest.

What do you notice?

How can I help my students make observations?

Using the BitL questions, I could ask:

- *What do you notice?*

In Year 3, I want my students to make observations that change over time. I want my students to observe that some materials slow heat loss, more than others. Questions I could ask my students are:

- *What do you feel after five minutes? One hour? Three hours?*
- *What was the temperature of the water in the drink bottles?*
- *In which bottle was the water hottest?*

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 do you think?*

In Year 3, I want my students to ask questions and look for the relationship between the material that the bottle was wrapped in, and the transfer of heat into the bottle. Questions I could ask my students are:

- *Which drink is the coldest after an hour of being in the classroom?*
- *What is different about each bottle?*

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 might happen if...?*

In Year 3, I want my students to make predictions from their observations and prior knowledge. Some questions I could ask my students are:

- *What do you think might happen if we used different materials to keep our drinks cool?*
- *What if we were trying to keep them warm?*

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 you explore?*

At Year 3, I want my students to suggest ways to plan and conduct their investigation.

- *How can you find out which drink bottle will keep your bottle coldest or hottest?*

I could prompt my students with:

- *What ideas do you have?*
- *Which is your best idea?*
- *How could you test your idea?*
- *How can you keep yourself and others safe when doing the investigation?*

How can you review and communicate?

How can I help students share their observations and questions?

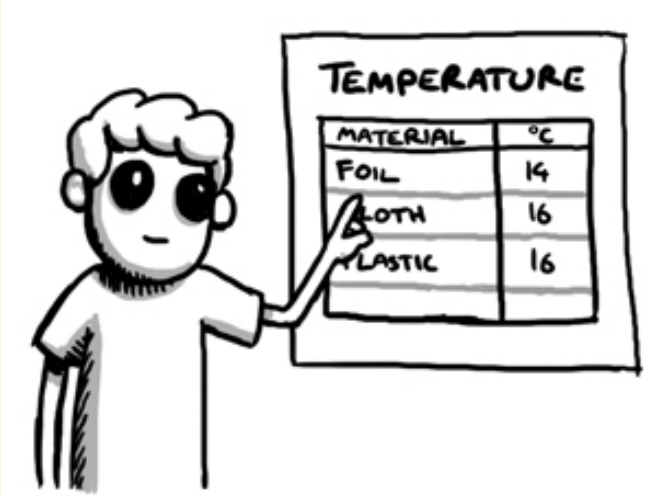
These questions stimulate student's reasoning and help them analyse, draw conclusions and make generalisations about the concepts.

Using the BitL questions, I could ask:

- *How can you review and communicate?*

At Year 3, I want my students to record their findings on which material would keep their drink bottle coldest or hottest using a simple table and communicate their reasoning in a simple report. Questions I could ask are:

- *How could you record your results?*
- *How will you communicate your thinking?*
- *How could we use this table to record our results? How does the table help us record?*



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 3, I want my students to describe how this science knowledge could help them explain their actions in everyday life. For example:

- *Why saucepans often have plastic handles?*
- *What container would you put a hot drink in to cool it down as quickly as possible?*

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 how heat energy is produced and is able to move from one object to another.

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 the 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.