Year 2

Conceptual narrative Science: Forces and motion

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

A force can change the movement or shape of an object.

What concepts do I want my students to understand?

- A force is a push or a pull.
- An object can move when it is pulled or pushed.
- An object can change shape when it is pushed or pulled.

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

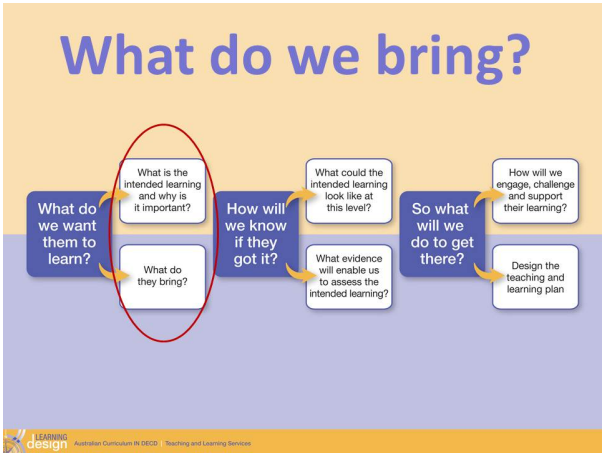
What might my students already know about this concept?

From past experience students are likely to know that the size and shape of an object affects how it moves.

What content could I use to explore this concept?

This concept could be explored by pushing and pulling toy cars on a table, floating and sinking objects in a bucket of water and flying paper planes and kites.

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 2, we want our students to understand that objects can change shape or move when they are pushed or pulled.

Year 2 example

In this example, I will give my students some play dough to manipulate

What do you notice?

How can I help my students make observations?

Using the BitL questions, I could ask:

- *What do you notice?*

I want my students to make observations using their senses, while pushing and pulling the play dough. Questions I could ask my students are:

- *What do you see and feel when you squeeze the play dough or stretch it?*
- *What does the play dough do? What is happening to it?*
- *If you put a grain of rice in the play dough, what happens to it when you push the dough?*

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?*

In Year 2, I want my students to ask questions and look for the relationship between the push and the pull force, and changing shape of the play dough. Questions I could ask my students are:

- *How do you think you might change the play dough shape?*
- *How do you think it will change with rolling, pushing, pulling, punching and dropping it?*
- *What is different about the play dough after?*
- *Is there anything unusual?*
- *What questions do you have?*
- *How could you change the shape without touching it?*

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?*

At Year 2, I want my students to start making predictions about their experiences of pushing and pulling play dough. Some questions I could ask my students are:

- *What do you think might happen if we threw the play dough at a target?*
- *What if we threw it gently?*
- *What if we threw it as hard as we could?*
- *Will you always be able to see the grain of rice?*

How can you explore?

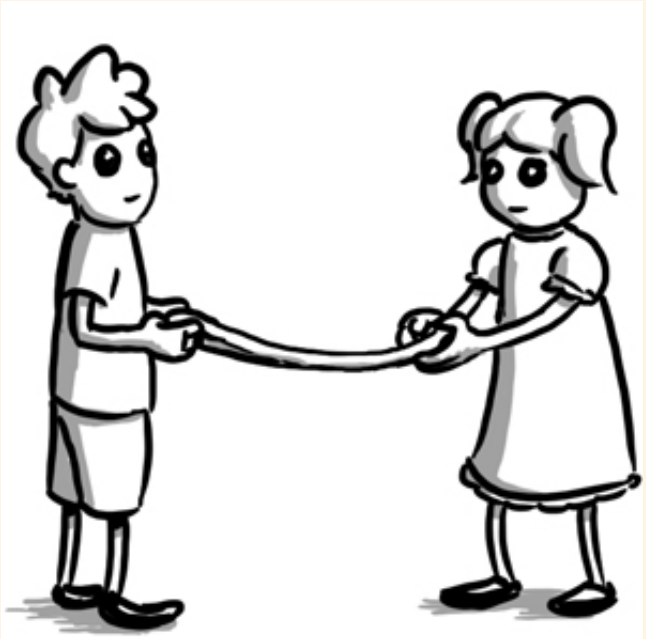
These questions support students to develop science inquiry skills and problem solve.

Using the BitL questions, I could ask:

- *How can you explore?*

At Year 2, I want my students to compare their observations to their predictions about pushing and pulling play dough. I could ask:

- *How can you find out how far play dough can be stretched before it breaks*
- *What ideas do you have?*
- *Which is your best idea?*
- *How could you test your idea?*



How can you share?

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 share?*

In Year 2, I want my students to represent and communicate observations and ideas about play dough changing shape. Questions I could ask:

- *How could you record your results?*
- *Could you draw or photograph the play dough?*
- *How could you share what the play dough looked like before and after the test?*
- *Was it the same or different to what you predicted?*

So what?

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?

I want my students to see this science in their everyday lives.

- *Where do you use pushes and pulls in your life?*
- *When do you need to change the shape of an object or move an object?*
- *When might you push or pull too hard?*
- *What happens when you pull too hard when opening a drawer?*
- *When does pushing or pulling too hard cause problems?*

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 be able to think, work and process scientifically. Students can connect science to their world and consider why they need to learn that a push or a pull affects how an object moves or changes shape.

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 forces and motion.

Foundation

In the Foundation year, students look at the way objects move, and how they move depends on their size and shape. For example, different balls like footballs, tennis balls and table tennis balls roll differently depending on their size and shape.

Year 2

In Year 2, students learn that movement is caused by either a push or a pull, and that it takes a bigger push to move a brick than a lunch box. They also learn that you can change the shape of some objects when a push or pull force is applied.

Year 4

In Year 4, students group forces as contact forces and non-contact forces. Examples of forces acting on contact are, a bat striking a ball or friction, where one object rubs against another object, like when you get a carpet burn. An example of a non-contact force is the pull of a magnet on paperclips.

Year 7

Year 7 is when students look at common situations where a balanced or unbalanced force cause changes to an object's motion. An example of a balanced force is a tug-of-war where the force exerted by the two teams is equal and it is clear that neither team will win. We say the forces on the rope are balanced, when the rope stays still. However, if the forces on the rope are unbalanced we can see a different effect. If in the tug-o-war and one side exerts greater force than the other, then the forces on the rope are unbalanced and the rope starts to move in the direction of the greatest force.

Year 10

At Year 10, students use Newton's laws to describe and predict motion and use mathematics to quantify this. Force is equal to, the mass times the acceleration, and speed is equal to distance divided by time. These are equations that students use to describe the effects of interactions between objects. They extend the application of force to other scales, including forces between atoms and between stars and planets.

So from Foundation to Year 10, students broaden and deepen their understanding by building on from their learning about forces and the motion of familiar objects, to consider a wider range of forces and then use laws and mathematical models to describe, predict and generalise.