Year 10

Conceptual narrative Science: The Earth's surface

In the Earth and space sciences sub-strand, there are two main conceptual threads being developed from Foundation through to Year 10, Earth in space and the Earth's surface.

Big ideas

Systems on the surface of the Earth, result from interactions in the atmosphere, hydrosphere, biosphere and lithosphere.

What concepts do I want my students to understand?

- Carbon and other materials cycle through the atmosphere, hydrosphere, biosphere and lithosphere in predictable ways on a range of time frames.

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 (Earth in space and the Earth's surface) together, because they complement each other.

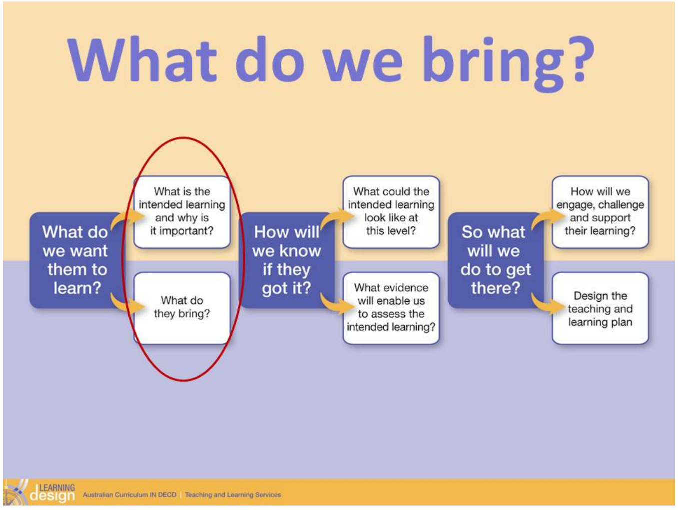
Note: Not all concepts are specifically addressed in each year level.

Introduction

What might my students already know about this concept?

Students are likely to be aware that:

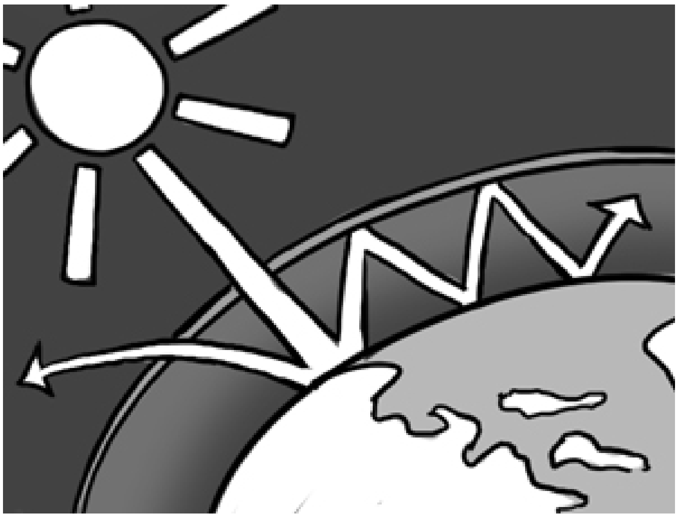
- Water cycles through the environment.
- The Earth's crust is continually changing.
- Rocks are part of a gradual cycle of formation, change and destruction.



What content could I use to explore this concept?

Students could learn this concept by focusing on one of the cycles such as nitrogen, phosphorus or carbon, by investigating a phenomena such as global warming or the hole in the ozone layer, or by focusing on an area such as the hydrosphere or atmosphere.

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 10, we want our students to take a global perspective on systems in the atmosphere, lithosphere and biosphere and be able to use this to explain phenomena at local and global levels.

Year 10 example

In this example, I want my students to investigate the thinning of the ozone layer.

What do you observe?

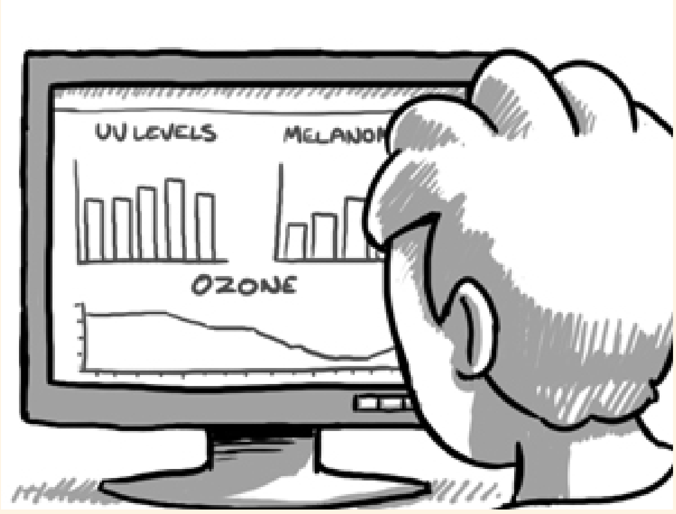
How can I help my students make observations?

Using the BitL questions, I could ask:

- *What do you observe?*

I want my students to make observations that change over time. I would ask them to look at data on UV levels, melanoma rates and ozone levels over time. Questions I might ask include:

- *What changes over time do you notice?*
- *Where did this data come from? How was it collected? Who published it? Why did they publish it?*
- *How reliable do you think it is?*
- *Where else could we get data related to this from?*



What patterns and relationships can you see?

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

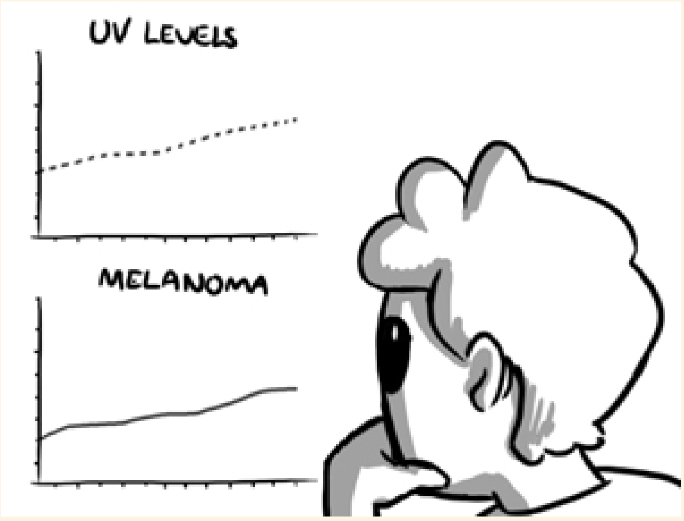
Student's curiosity leads them to ask questions. These questions help students to order their findings into a pattern to be able to make comparisons or find relationships. These questions support students to be more precise and foster analysis and classification of the observations.

Using the BitL questions, I could ask:

- *What patterns and relationships can you see?*

In Year 10, I want my students to identify patterns in data and start to form generalisations from their observations and data they have collected. I might ask:

- *What trends can you see?*
- *How do they relate to each other?*
- *What might cause this?*
- *What other factors might affect this?*
- *What other data might you need to look at?*
- *What interventions have addressed or might address this?*
- *What questions do you have?*



What do you predict will happen?

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

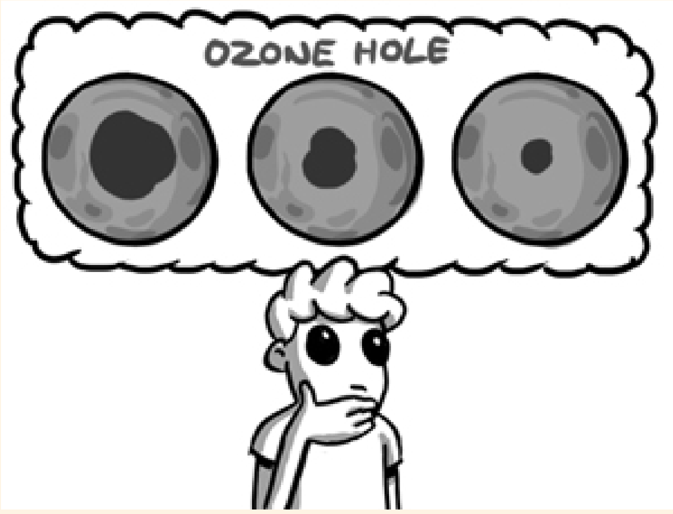
Students ask testable questions that help them to narrow the focus of the inquiry. These questions provide opportunities for students to make predictions.

Using the BitL questions, I could ask:

- *What do you predict will happen?*

In Year 10, I want my students to formulate a scientifically testable hypothesis. I may suggest:

- *How might this look different in the future?*
- *What might affect it?*
- *Where on the body, and in what parts of the world, would you expect most sun damaged skin to be? Why?*
- *How long after an intervention might it take the system to recover?*



What investigations could you design?

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

Using the BitL questions, I could ask:

- *What investigations could you design?*

At Year 10, I want my students to not only know how to use an inquiry approach to answer scientific questions, but to design their own investigations. I would ask the students:

- *How will you test your predictions?*
- *What could you change?*
- *What could you measure?*
- *What equipment could you use that will improve the accuracy of your data?*
- *How will you keep yourself and others safe in this investigation?*
- *How will you consider fairness?*
- *What is difficult about this investigation?*
- *How could the difficulties be resolved?*

How can you review and communicate?

How can I help students share their observations and questions?

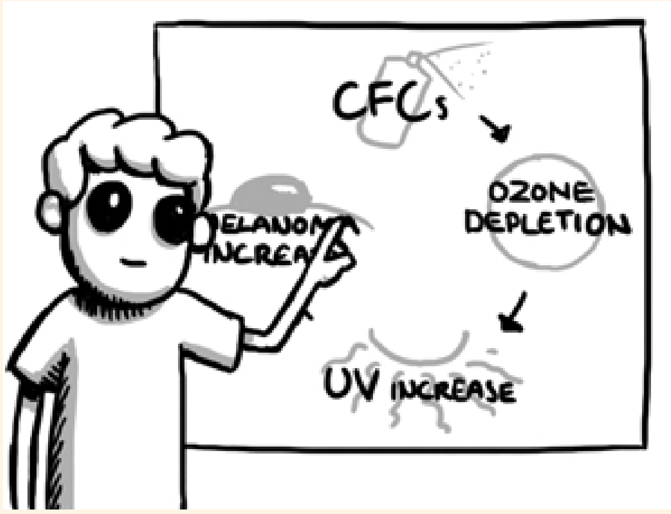
These questions stimulate student's reasoning and help them analyse, draw conclusions and make generalisations about the concepts.

Using the BitL questions, I could ask:

- *How can you review and communicate?*

Questions I could ask my students are:

- *How can you best represent and identify relationships in the data you collected?*
- *What is the difference between cause and correlation?*
- *How could you show correlation? Cause?*
- *Which data is consistent with your hypothesis?*



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?*
- *Can you write a general statement describing the effect of ozone on UV levels?*
- *Who might need to know this and why?*
- *How can scientific models be used to predict the levels of UV?*
- *Why might different people be concerned about ozone levels?*

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 students understand the connections between the different systems that make up the surface of the Earth.

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 (properties of matter and changes of matter) together, because they complement each other.

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

Earth and space sciences

In the Earth and space sciences sub-strand, there are two main conceptual threads being developed from Foundation through to Year 10. They are the concepts Earth in space and the Earth's surface. Let's look at the concept the Earth's surface.

Foundation

This begins in the Foundation year with students linking the weather to the effects it has on their daily life, for example how the weather can determine what clothing they wear.

Year 1

In Year 1, students observe changes in the landscape, such as water evaporating from a puddle or a sand castle washing away after the tide comes in.

Year 2

In Year 2, students focus on how we use resources from the Earth, including water. We want students to understand how they use water so they can identify ways to conserve water.

Year 4

At Year 4, students look at a range of changes to the surface of the Earth over time. Students group these changes as those caused by natural agents such as erosion or by human activity such as deforestation.

Year 6

In Year 6, students learn that sudden geological changes like earthquakes and volcanoes, and extreme weather conditions like hurricanes can affect the Earth's surface.

Year 7

In Year 7, students group the Earth's resources as renewable or non-renewable. For example, students can compare fossil fuels which take millions of years to form with wood that grows in decades and biofuel that grows in months. They also learn about the water cycle and that water is as an important resource.

Year 8

In Year 8, students develop an understanding of the rock cycle. They consider the timescale of the processes and formation of igneous, sedimentary and metamorphic rocks. Students also learn that rocks are made up of minerals.

Year 9

When students are in Year 9, they use the theory of plate tectonics to explain how major continental plate movement predicts areas prone to earthquakes and volcanic activity. Students identify global patterns of geological activity, such as considering the role of heat energy and convection currents in the movement of tectonic plates, and relating the extreme age and stability of a large part of the Australian continent to its plate tectonic history.

Year 10

In Year 10, students understand the connections between the different systems that make up the surface of the Earth. They appreciate how cycles of carbon and other materials involve interactions in the hydrosphere, lithosphere, atmosphere and biosphere. Students learn the role of carbon in the greenhouse effect and its effects on biodiversity.

So from Foundation to Year 10, students broaden and deepen their understanding by building on from their thinking about changes in their immediate surroundings, to consider those in the wider world, and then use models and theories to describe, explain, predict and generalise.