Year 9

Conceptual narrative Science: Interdependence and ecosystems

In the Biological Sciences strand, there are three main conceptual threads being developed from Foundation through to year 10. They are the concepts of diversity and evolution, form and function and interdependence and ecosystems.

Big ideas

How energy and matter flow through whole ecosystems which can be affected by both living or (biotic) and nonliving (a biotic) factors.

What concepts do I want my students to understand?

- There are interrelations between biotic (living) and abiotic (non-living) components of ecosystems. How can you explain and predict how biological systems respond to external changes with reference to interdependencies, energy transfers and flows of matter.
- Interactions between (biotic) organisms include predator / prey, parasites, competitors, pollinators, introduced species and disease.
- Abiotic factors that affect population sizes include seasonal changes, destruction of habitats (bushfires, droughts and flooding).

Scientific models can be used to predict changes in ecosystems now and in the future?

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 all concepts (diversity and evolution, form and function and interdependence and ecosystems) together, because they complement each other.

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

Introduction

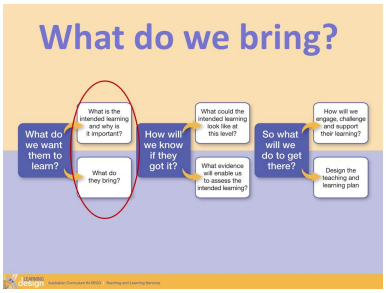
What might my students already know about this concept?

Living things need to survive, and living things live where their needs are met. Students may also understand how living things depend on each other and the environment to survive. They may understand that the growth and survival of living things are affected by the physical conditions of their environment, such as water, temperature, air quality, etc. The interactions between living things, such as food chains and food webs and the impact of humans on these interactions.

What content could I use to explore this concept?

We want students to understand what happens if the components (living and non-living things) of ecosystems change, such as introducing a predator and seasonal changes. There are many ways we can help students understand the parts of this complex concept. We could explore the impact of humans on ecosystems, such as deforestation and bushfires, or the interactions between organisms within ecosystems, including the flow of energy through an ecosystem, such as food webs.

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).



Year 9 example

In this example, my students will look at the regeneration of a local area after a bushfire.

What do you observe?

How can I help my students make observations?

Using the BitL questions, I could ask:

- *What do you observe?*

In Year 9, I want my students to make observations that change over time and geographically. I want them to select data that is reliable to make observations from. Questions I could ask my students are:

- *What do you observe in the ecosystem after a bushfire?*
- *What features of both living and non-living things change over time? How?*
- *What equipment might help you to make and record your observations, to extend your observations?*
- *What secondary sources might help to extend your understanding?*

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?*

At Year 9, I want my students to start using models to reveal patterns from their observations. I could ask my students:

- *What differences are there between the sites viewed?*
- *How have they changed over time?*
- *What are your questions about the regeneration process or the nature of the bushfire?*

What do you predict might 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 9, I want my students to predict what will happen over time. I could ask the students:

- *What do you predict will happen next?*
- *If we changed the species present before the bushfire, how might that affect the regeneration process and rate?*
- *What do you already know about local area regeneration after fires, which might lead you to a prediction?*
- *What changes can we predict with accuracy? Why? What other variables might have an effect?*
- *Can you formulate a scientifically testable hypothesis?*

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 investigation could you design?*

Questions I could ask my students are:

- *How might you test your hypothesis? What could you try?*
- *Do you think you could model your ideas?*
- *How should safety be considered in your planning?*
- *How will you measure and record data?*
- *How will you ensure the data is reliable and representative?*
- *Which is the independent and the dependent variable?*
- *How might you improve the investigation?*
- *How can you review and communicate?*

How can you review and communicate?

How can I help students share their observations and questions?

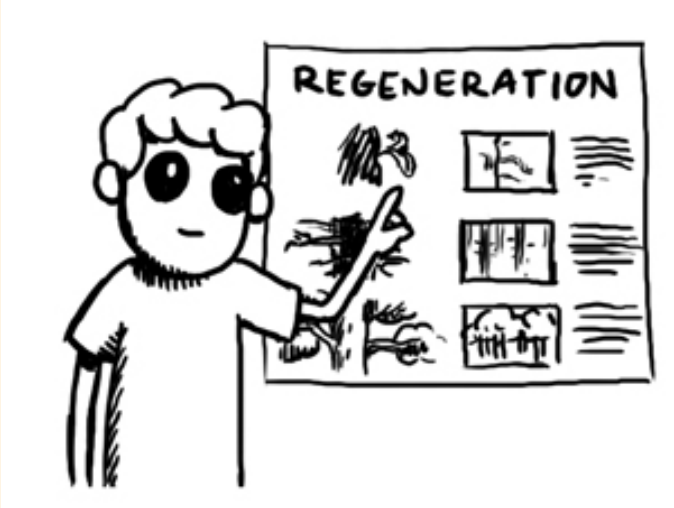
These questions stimulate student's reasoning and help them analyse, draw conclusions and make generalisations about the concepts.

Using the BitL questions, I could ask:

- *How can you review and communicate?*

Questions I might ask my students are;

- *How can you best represent and identify trends in the data you collected about the bushfires and regeneration?*
- *How will you evaluate the fairness of, and improve your investigation?*
- *Were your results consistent with your hypothesis?*
- *What technology could you use to communicate your findings to others?*
- *What can you infer or generalise from your data and findings?*
- *What evidence led to your explanations?*
- *How can you justify your conclusions?*
- *How do your findings align with the findings of others?*



So what? What next?

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:

- *So what? What next?*
- *Who might need to know this and why?*
- *Do you think botanists and the local community would be interested in hearing about regeneration after bushfires?*
- *Can you make recommendations for change as a result of your study?*
- *Who decides what is valued to investigate?*
- *If this leads to further study or action for example "Controlled burn offs", whose point of view might also need to be considered?*

- *How can scientific models be used to predict these effects of bushfire and regeneration on an ecosystem?*

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 entire ecosystems are made up of interdependent communities and that matter and energy flow through them.

Appendix 1

Appendix 1 shows how the Science as a Human Endeavour strand develops in sophistication and complexity across 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 all concepts (diversity and evolution, form and function and interdependence and ecosystems) together, because they complement each other.
Note: Not all concepts are specifically addressed in each year level.

Biological sciences

In the biological sciences sub-strand, there are three main conceptual threads being developed from Foundation to Year 10. They are the concepts of diversity and evolution, form and function and interdependence and ecosystems.

Let's look at the interdependence and ecosystems concept

Foundation

This starts in the Foundation year where students look at what people and other living things need to survive. For example, the class guinea pig needs food, water and shelter to survive.

Year 1

Year 1 goes a bit wider and students' focus on the idea that plants and animals live where their needs are met. This may vary for different plants and animals. For example, some spiders live under the bark of trees, whereas others like the trap door spider, live under the ground.

Year 4

In Year 4, students understand how living things depend on each other and the environment to survive. Insects and a spider living on a tree demonstrate this. The spider gets shelter and protection from the tree, and the tree gets protection from the spider because the spider eats the insects that could damage the tree.

Year 6

At Year 6, the growth and survival of living things are affected by the physical conditions of their environment. For example, a tree could be affected by extended lengths of darkness. If there is a thick smoke in the atmosphere and the sunlight isn't able to get through, a tree is unable to make its food because it needs sunlight, and so without the sun's light, it will slowly die.

Year 7

In Year 7, students study the interactions between living things which we call organisms and the impact of humans on these interactions. For example, humans introduced the cane toad in Queensland as an attempt to control the native cane beetle, however this impacted on other food chains and food webs.

Year 9

By Year 9, the focus broadens to include how energy and matter flow through whole ecosystems and the effect of both living (biotic) and non-living (abiotic) factors on them. An example of this is the regeneration of a local area that occurs after a bushfire or drought.

So, from Foundation to Year 10, students develop their understanding of interdependence in ecosystems from basic needs of familiar living things to abstract ideas about how energy and matter flows in ecosystems.