Year 10

# Conceptual narrative Science: Earth in space

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

The origin of the universe using the Big Bang theory.

### What concepts do I want my students to understand?

- The universe contains features including galaxies, starts and solar systems.
- The Big Bang theory can be used to explain the origin of the universe.

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?

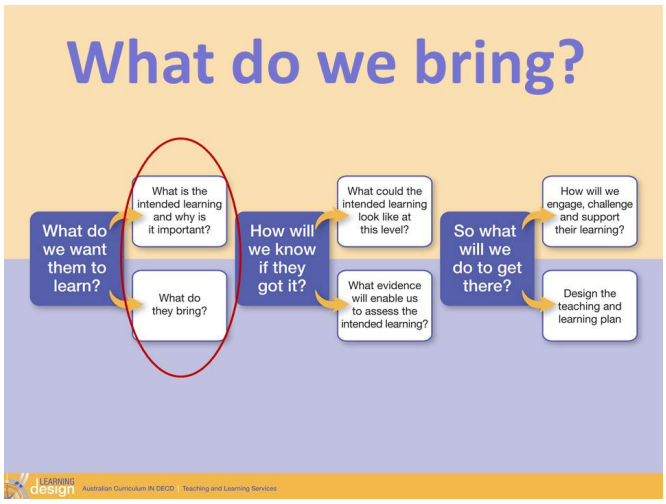
Students might know that the Earth revolves around the sun as part of a system of planets, the solar system. Students are likely to know the key features of our solar system and that Earth is a component within a solar system, the relative positions of the Earth, sun and moon and how they affect phenomena on Earth. They may know how to use models to investigate astronomical scales in the solar system.

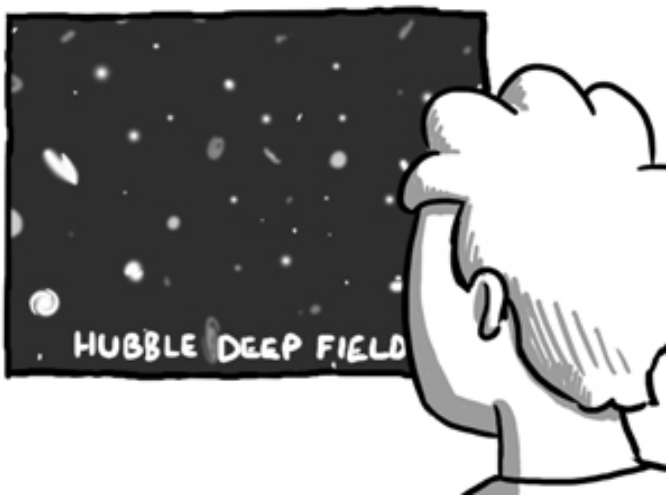
### What content could I use to explore this concept?

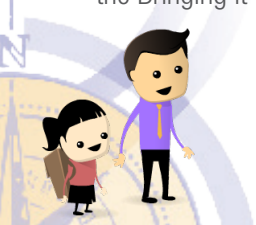
To understand the origin of the universe we could identify and evaluate the evidence for scientific theories that explain the origin of the universe.

Edwin Hubble's observations and the detection of microwave radiation, provide evidence to support the Big Bang theory and how evolution of the universe, including the formation of galaxies and stars, has continued since the Big Bang.

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).



The science understanding for Year 10 students extends their perspective of the universe to include other solar systems and galaxies, and how the Big Bang theory can explain the origins of the universe.

# Year 10 example

In this example, I will ask my students to consider the evolution of the universe through internet images from the Hubble and/or Webb space telescopes. I will ask my students to develop a timeline of the universe.

## 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 10, 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 students are:

- *What secondary sources might help to extend your understanding of the universe?*
- *What features of the universe are shown?*
- *How do they change over time?*
- *What do you observe about the technology used to make these observations?*


## What patterns and relationships can you see?

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

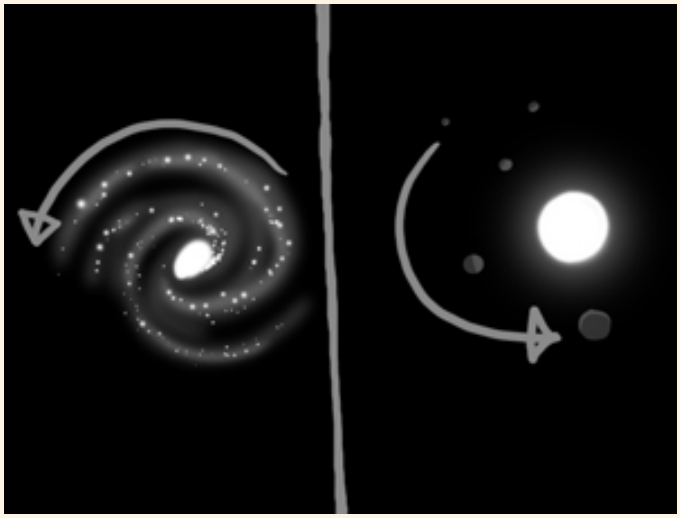
Student's curiosity leads them to ask questions. These questions help students to order their findings into a pattern to be able to make comparisons or find relationships. These questions support students to be more precise and foster analysis and classification of the observations.

Using the BitL questions, I could ask:

- *What patterns and relationships can you see?*

At Year 10, I want my students to start using models to reveal patterns from their observations. I could ask my students:

- *What patterns can you see between different structures/features?*
- *How have the models (ideas) about the structure of the universe changed over time?*
- *How did the originator of each model come up with the idea?*
- *What is a challenging question you might ask one of the historic scientists?*
- *How did the theories originate? Are there any anomalies?*



## 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?*

I want my students to predict what will happen over time. I could prompt my students by asking:

- *What does this imply about the universe? The end?*
- *What does it mean for our solar system?*
- *What changes can we predict with accuracy? Why?*
- *What other variables might have an effect?*
- *Can you formulate a scientifically testable hypothesis?*

Scientist currently think that the Big Bang theory explains the origin of our universe, how does this relate to your ideas?

- *How does this relate to your ideas?*
- *How might someone else explain or interpret these same phenomena?*
- *What is the same/different about their explanation?*


## What investigations could you design?

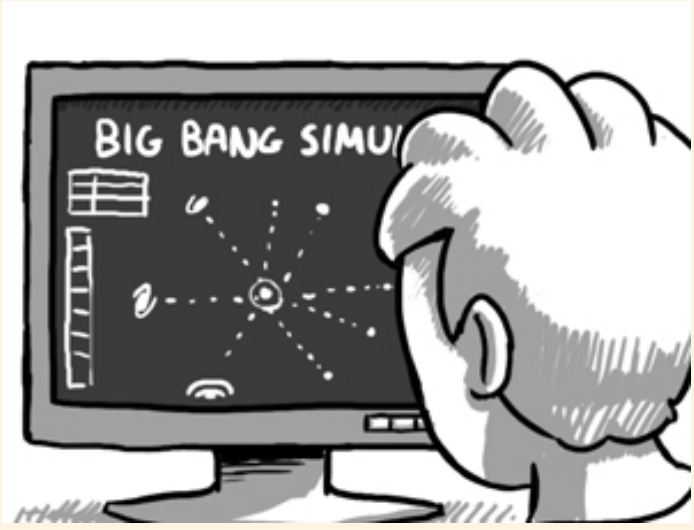
These questions support students to develop science inquiry skills and problem solve.

Using the BitL questions, I could ask:

- *What investigation could you design?*

I would provide students with secondary data, such as the Hubble website or a simulation or computer modelling program to investigate the Big Bang theory and the origin of the universe.

- *What evidence underlies the different views?*
- *What effect has technology had on the evidence available?*



## How can you review and communicate?

### How can I help students share their observations and questions?

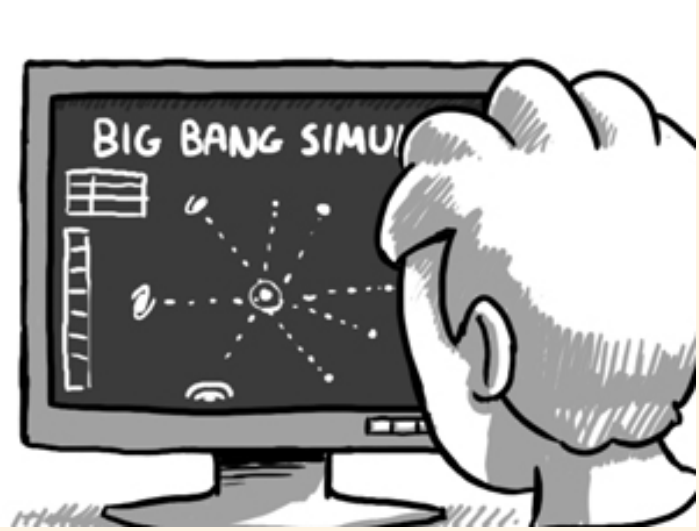
These questions stimulate student's reasoning and help them analyse, draw conclusions and make generalisations about the concepts.

Using the BitL questions, I could ask:

- *How can you review and communicate?*

In year 10, I want my students to analyse patterns in the data to generalise and justify their conclusion based on evidence and scientific theories.

- *How can you best represent your data and evidence?*
- *How could you explain what you found?*
- *What can you infer from the data?*
- *How can you justify your conclusion?*
- *Why might a scientist want to repeat and build on this investigation?*
- *What technology might be useful to improve your data collection or measurements?*
- *What are the advantages and disadvantages of the different technologies?*
- *How might you argue for or against space exploration?*



## 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?*
- *Who might be interested in this research?*
- *What else might people think about the origin of the universe?*
- *Does this fit with science or another discipline?*
- *What do we still need to know?*
- *Who decides what is valued to investigate?*
- *Would understanding the time line of the universe, influence your decisions or actions?*
- *Who might benefit?*
- *What is the 'cost' of space research?*
- *What would our lives be like if we didn't know this?*
- *How has this understanding (or technology associated with it) changed our lives?*

# 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 there are galaxies and solar systems in addition to our own, and that the Big Bang theory can explain the origin of the universe.

# 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 (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.

## 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 Earth in space.

## Let's look at the Earth in space concept

### Year 1

In Year 1, students notice observable changes in the sky. For example, students can see stars at night time.

### Year 3

Year 3, students are introduced to the concept of the Earth as a body in space, where Earth's rotation on its axis is used to explain day and night.

### Year 5

In Year 5, students build on their understanding of Earth as a body in space and see it is part of the solar system, which includes other planets also revolving around our star, the sun.

### Year 7

At Year 7, we want students to understand that phenomena such as seasons and eclipses can be explained by how the moon moves around the Earth, and the Earth, on a titled axis, moves around the sun.

### Year 10

In Year 10, students extend their perspective of the universe to include galaxies, stars and other solar systems, and can explain the origin of the universe using the Big Bang theory.

So, from Year 1 to Year 10, students develop their concept of Earth in space by using models and theories to explain their observations.