PrimaryConnections®
Linking science with literacy

Fully aligned with the Australian Curriculum

Up, down and all around

Year 1

Earth and space sciences

Primary**Connections project**

Australian Government

Australian Academy of Science

Professional learning program

The Primary**Connections** program includes a sophisticated professional learning component and exemplary curriculum resources. Research shows that this combination is more effective than using each in isolation.

Professional Learning Facilitators are available throughout Australia to conduct workshops on the underpinning principles of the program: the Primary**Connections** 5Es teaching and learning model, linking science with literacy, investigating, embedded assessment and collaborative learning.

The Primary**Connections** website has contact details for state and territory Professional Learning Coordinators, as well as additional resources for this unit. Visit the website at:
www.science.org.au/primaryconnections

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Year 1

Earth and space sciences

Look out your window and you will see a constantly changing world. The Sun rises and sets and the sky reflects many different hues over a day. The landscape, everything we know about the environment began by observing it. Environmental modelling, space exploration and city planning all rely on careful observations of the land and sky.

The *Up, down and all around* unit is an ideal way to link science with literacy in the classroom. It provides opportunities for students to explore natural, made and managed features that undergo change. Through outdoor observations and photographic records, students investigate the daily, weekly and seasonal changes in their local environment.

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Contents

Foreword

The Australian Academy of Science is proud of its long tradition of supporting and informing science education in Australia. 'Primary**Connections**: linking science with literacy' is its flagship primary school science program, and it is making a real difference to the teaching and learning of science in Australian schools.

The Primary**Connections** approach has been embraced by schools since its inception in 2004, and there is substantial evidence of its effectiveness in helping teachers transform their practice. It builds teacher confidence and competence in this important area, and helps teachers use their professional skills to incorporate elements of the approach into other areas of the curriculum. Beginning and pre-service teachers find the approach do-able and sustainable. Primary**Connections** students enjoy science more than in comparison classes and Indigenous students, in particular, show significant increases in learning using the approach.

The project has several components: professional learning, curriculum resources, research and evaluation, and Indigenous perspectives. With the development of an Australian curriculum in the sciences by ACARA in December 2010, it is an exciting time for schools to engage with science and to raise the profile of primary science education.

Students are naturally curious. Primary**Connections** provides an inquiry-based approach that helps students develop deep learning, and guides them to find scientific ways to answer their questions. The lessons include key science background information, and further science information is included on the Primary**Connections** website.

Science education provides a foundation for a scientifically literate society, which is so important for engagement in key community debates such as climate change, carbon emissions and immunisation, as well as for personal decisions about health and well-being. The inquiry approach in Primary**Connections** prepares students well to participate in evidence-based discussions of these and other issues.

Primary**Connections** has been developed with the financial support of the Australian Government and has been endorsed by education authorities across the country. The Steering Committee, comprising the Department of Education, Employment and Workplace Relations and Academy representatives, and the Reference Group, which includes representatives from all stakeholder bodies including states and territories, have provided invaluable guidance and support over the last seven years. Before publication, the teacher background information on science is reviewed by a Fellow of the Academy. All these inputs have ensured an award-winning, quality program.

The Fellows of the Academy are committed to ongoing support for teachers of science at all levels. I commend Primary**Connections** to you and wish you well in your teaching.

Professor Suzanne Cory, AC PresAA FRS
President
Australian Academy of Science
2010–2013

The Primary**Connections program**

Primary**Connections** is an innovative program that links the teaching of science and literacy in the primary years of schooling. It is an exciting and rewarding approach for teachers and students with a professional learning program and supporting curriculum resources. Further information about professional learning and other curriculum support can be found on the Primary**Connections** website: www.science.org.au/primaryconnections

Developing students' scientific literacy

The learning outcomes in Primary**Connections** contribute to developing students' scientific literacy. Scientific literacy is considered the main purpose of school science education and has been described as an individual's:

- scientific knowledge and use of that knowledge to identify questions, acquire new knowledge, explain scientific phenomena and draw evidence-based conclusions about science-related issues
- understanding of the characteristic features of science as a form of human knowledge and enquiry
- awareness of how science and technology shape our material, intellectual and cultural environments
- willingness to engage in science-related issues, and with the ideas of science, as a reflective citizen (Programme for International Student Assessment & Organisation for Economic Co-operation and Development, 2009).

The Primary**Connections teaching and learning model**

This unit is one of a series designed to exemplify the Primary**Connections** teaching and learning approach, which embeds inquiry-based learning into a modified 5Es instructional model, with the five phases: *Engage, Explore, Explain, Elaborate* and *Evaluate* (Bybee, 1997). The relationship between the 5Es phases, investigations, literacy products and assessment is illustrated below:

Primary**Connections 5Es teaching and learning model**

Phase	Focus	Assessment focus
ENGAGE	Engage students and elicit prior knowledge	**Diagnostic assessment**
EXPLORE	Provide hands-on experience of the phenomenon	**Formative assessment**
EXPLAIN	Develop scientific explanations for observations and represent developing conceptual understanding Consider current scientific explanations	**Formative assessment**
ELABORATE	Extend understanding to a new context or make connections to additional concepts through a student-planned investigation	**Summative assessment** of the Science Inquiry Skills
EVALUATE	Students re-represent their understanding and reflect on their learning journey and teachers collect evidence about the achievement of outcomes	**Summative assessment** of the Science Understanding

More information on the Primary**Connections** 5Es teaching and learning model can be found at: www.science.org.au/primaryconnections/teaching-and-learning

Assessment

Assessment against the year level Achievement standards of the Australian Curriculum: Science (ACARA, 2010) is ongoing and embedded in PrimaryConnections units. Assessment is linked to the development of literacy practices and products. Relevant understandings and skills are highlighted at the beginning of each lesson. Different types of assessment are emphasised in different phases:

Diagnostic assessment occurs in the *Engage* phase. This assessment is to elicit students' prior knowledge so that the teacher can take account of this when planning how the *Explore* and *Explain* lessons will be implemented.

Formative assessment occurs in the *Explore* and *Explain* phases. This enables the teacher to monitor students' developing understanding and provide feedback that can extend and deepen students' learning.

Summative assessment of the students' achievement developed throughout the unit occurs in the *Elaborate* phase for the Science Inquiry Skills, and of the Science Understanding in the *Evaluate* phase.

Linking science with literacy

PrimaryConnections has an explicit focus on developing students' knowledge, skills, understanding and capacities in science and literacy. Units employ a range of strategies to encourage students to think about, reason and represent science.

PrimaryConnections develops the literacies of science that students need to learn and to represent their understanding of science concepts, processes and skills. Representations in PrimaryConnections are multi-modal and include text, tables, graphs, models, drawings and embodied forms such as gesture and role-play. Students use their everyday literacies to learn the new literacies of science. Science provides authentic contexts and meaningful purposes for literacy learning, and also provides opportunities to develop a wider range of literacies. Teaching science with literacy improves learning outcomes in both areas.

Alignment with the Australian Curriculum: Science

The Australian Curriculum: Science has three interrelated strands — Science Understanding, Science as a Human Endeavour and Science Inquiry Skills — that together 'provide students with understanding, knowledge and skills through which they can develop a scientific view of the world' (ACARA, 2010).

The content of these strands is described by the Australian Curriculum as:

Science Understanding	
Biological sciences	Understanding living things.
Chemical sciences	Understanding the composition and behaviour of substances.
Earth and space sciences	Understanding Earth's dynamic structure and its place in the cosmos.
Physical sciences	Understanding the nature of forces and motion, and matter and energy.
Science as a Human Endeavour	
Nature and development of science	An appreciation of the unique nature of science and scientific knowledge.
Use and influence of science	How science knowledge and applications affect people's lives and how science is influenced by society and can be used to inform decisions and actions.
Science Inquiry Skills	
Questioning and predicting	Identifying and constructing questions, proposing hypotheses and suggesting possible outcomes.
Planning and conducting	Making decisions regarding how to investigate or solve a problem and carrying out an investigation, including the collection of data.
Processing and analysing data and information	Representing data in meaningful and useful ways, identifying trends, patterns and relationships in data, and using evidence to justify conclusions.
Evaluating	Considering the quality of available evidence and the merit or significance of a claim, proposition or conclusion with reference to that evidence.
Communicating	Conveying information or ideas to others through appropriate representations, text types and modes.

AC All the material in this table is sourced from the Australian Curriculum.

There will be a minimum of four Primary**Connections** units for each year of primary school from Foundation to Year 6 at least one for each Science Understanding sub-strand of the Australian Curriculum. Each unit contains detailed information about its alignment with all aspects of the Australian Curriculum: Science and its links to the Australian Curriculum: English and Mathematics.

Safety

Learning to use materials and equipment safely is central to working scientifically. It is important, however, for teachers to review each lesson before teaching to identify and manage safety issues specific to a group of students. A safety icon 

is included in lessons where there is a need to pay particular attention to potential safety hazards. The following guidelines will help minimise risks:

- Be aware of the school's policy on safety in the classroom and for excursions.
- Check students' health records for allergies or other health issues.
- Be aware of potential dangers by trying out activities before students do them.
- Caution students about potential dangers before they begin an activity.
- Clean up spills immediately as slippery floors are dangerous.
- Instruct students never to taste, smell or eat anything unless they are given permission.
- Discuss and display a list of safe practices for science activities.

References

Australian Curriculum Assessment and Reporting Authority (ACARA). (2010). *Australian Curriculum: Science*. www.australiancurriculum.edu.au

Bybee, R.W. (1997). *Achieving scientific literacy: from purposes to practical action*. Portsmouth, NH: Heinemann.

Programme for International Student Assessment & Organisation for Economic Co-operation and Development. (2009). *PISA 2009 assessment framework: key competencies in reading, mathematics and science*. Paris: OECD Publishing.

Unit at a glance

Up, down and all around

Phase	Lesson	At a glance
ENGAGE	**Lesson 1** I spy	To capture students' interest and find out what they think they know about observable changes that occur in the sky and landscape. To elicit students' questions about what features of the sky and landscape change over time.
EXPLORE	**Lesson 2** Garden grooming	To provide hands-on shared experiences of changes that occur in the sky and landscape through investigating how human activity affects features of the landscape.
	Lesson 3 Daily changes ***Session 1*** Spying again ***Session 2*** Night visions	To provide shared experiences of changes that occur in the sky and landscape over short timescales.
	Lesson 4 Seasonal traits	To provide shared experiences of changes that occur in the sky and landscape over the course of a year.
EXPLAIN	**Lesson 5** Sort it out ***Session 1*** Interview planning ***Session 2*** Guest speaker	To support students to represent and explain their understanding of how different changes can occur in the sky and landscape over different timescales. To introduce current scientific views about changes that occur in the sky and landscape over longer timeframes.
ELABORATE	**Lesson 6** It's only natural	To support students to represent and discuss their investigation of how human activity affects features of the landscape.
EVALUATE	**Lesson 7** Time spy	To provide opportunities for students to represent what they know about observable features in the sky and landscape and how they change over time, and to reflect on their learning during the unit.

A unit overview can be found in Appendix 6, page 60.

Alignment with the Australian Curriculum: Science

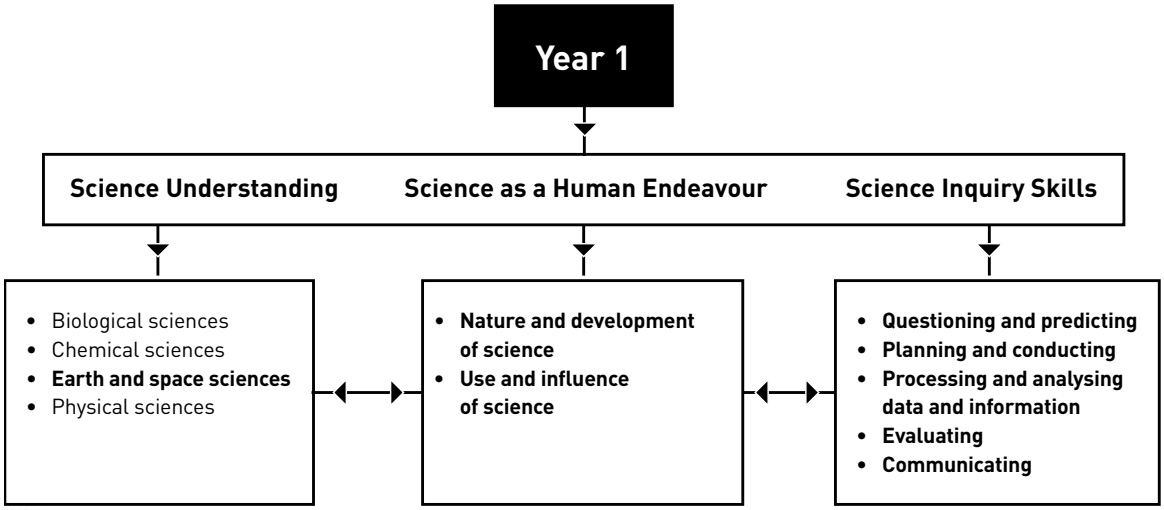
Up, down and all around embeds the three strands of the Australian Curriculum: Science. The particular sub-strands and their content for Year 1 that are relevant to this unit are shown below.

Strand	Sub-strand	Code	Year 1 content descriptions	Lessons
Science Understanding	**Chemical sciences**	ACSSU019	Observable changes occur in the sky and landscape	1, 2, 3, 4, 6, 7
Science as a Human Endeavour	**Nature and development of science**	ACSHE021	Science involves asking questions about, and describing changes in, objects and events	1–7
	Use and influence of science	ACSHE022	People use science in their daily lives, including when caring for their environment and living things	2, 3, 4, 5, 6
Science Inquiry Skills	**Questioning and predicting**	ACSIS024	Respond to and pose questions, and make predictions about familiar objects and events	1, 2, 3, 6
	Planning and conducting	ACSIS025	Participate in different types of guided investigations to explore and answer questions, such as manipulating materials, testing ideas and accessing information sources	3, 4, 6
		ACSIS026	Use informal measurements in the collection and recording of observations, with the assistance of digital technologies as appropriate	6
	Processing and analysing data and information	ACSIS027	Use a range of methods to sort information, including drawings and provided tables	1–6
		ACSIS212	Through discussion, compare observations with predictions	3, 5, 6
	Evaluating	ACSIS213	Compare observations with those of others	3, 4, 6
	Communicating	ACSIS029	Represent and communicate observations and ideas in a variety of ways such as oral and written language, drawing and role play	2–6

AC All the material in the first four columns of this table is sourced from the Australian Curriculum.

Interrelationship of the Science strands

The interrelationship between the three strands — Science Understanding, Science as a Human Endeavour and Science Inquiry Skills — and their sub-strands is shown below. Sub-strands covered in this unit are in bold.



AC All the terms in this diagram are sourced from the Australian Curriculum.

Relationship to Overarching ideas

In the Australian Curriculum: Science, six overarching ideas support the coherence and developmental sequence of science knowledge within and across year levels. In *Up, down and all around* these overarching ideas are represented as follows:

Overarching idea	Incorporation in *Up, down and all around*
Patterns, order and organisation	Students identify patterns of change in the sky and landscape, for example, seasons, and organise changes by informal timescales.
Form and function	Students identify different features of the landscape and sky based on their forms.
Stability and change	Students explore whether different features of the sky and landscape change, and relate stability to periods of time.
Scale and measurement	Students use informal measurements of time to discuss different timescales of change.
Matter and energy	Students are introduced to simple changes that occur in the sky and landscape, providing a foundation to explore why those changes occur in later years.
Systems	Students identify observable features of the ecosystem around them, both living and non-living components.

Curriculum focus

The Australian Curriculum: Science is described by year level, but provides advice across four year groupings on the nature of learners. Each year grouping has a relevant curriculum focus.

Curriculum focus Years F–2	Incorporation in *Up, down and all around*
Awareness of self and the local world	Students use direct observations and make comparisons to describe features of their local environment and to gather information about whether the features change.

Achievement standards

The achievement standards of the Australian Curriculum: Science indicate the quality of learning that students typically demonstrate by a particular point in their schooling, for example, at the end of a year level. These standards will be reviewed regularly by ACARA and are available on the ACARA website.

By the end of the unit, teachers will be able to make evidence-based judgements on whether the students are achieving below, at or above the Australian Curriculum: Science Year 1 achievement standard. Rubrics to help teachers make these judgements are available on the website: www.science.org.au/primaryconnections/curriculum-resources

General capabilities

The skills, behaviours and attributes that students need to succeed in life and work in the 21st century have been identified in the Australian Curriculum as general capabilities. There are seven general capabilities and they are embedded throughout the units. For unit-specific information see the next page. For further information see: www.australiancurriculum.edu.au/generalcapabilities

Up, down and all around – Australian Curriculum General capabilities

General capabilities	Australian Curriculum description	*Up, down and all around* examples
Literacy	Literacy knowledge specific to the study of science develops along with scientific understanding and skills. Primary**Connections** learning activities explicitly introduce literacy focuses and provide students with the opportunity to use them as they think about, reason and represent their understanding of science.	In *Up, down and all around* the literacy focuses are: • science journals • tables • word walls • Venn diagrams • posters • flow charts • interviews.
 **Numeracy**	Elements of numeracy are particularly evident in Science Inquiry Skills. These include practical measurement and the collection, representation and interpretation of data.	Students: • collect, interpret and represent data about observable changes to a garden.
Information and communication technology (ICT) competence	ICT competence is particularly evident in Science Inquiry Skills. Students use digital technologies to investigate, create, communicate and share ideas and results.	Students are given optional opportunities to: • use interactive resource technology to view, record and discuss information • use the internet to research further information about changes that have occurred to their local landscapes.
 **Critical and creative thinking**	Students develop critical and creative thinking as they speculate and solve problems through investigations, make evidence-based decisions, and analyse and evaluate information sources to draw conclusions. They develop creative questions and suggest novel solutions.	Students: • use reasoning to develop questions for inquiry • formulate, pose and respond to questions • develop evidence-based claims.
Ethical behaviour	Students develop behaviour as they explore principles and guidelines in gathering evidence, and consider the implications of their investigations on others and the environment.	Students: • ask questions of others, respecting each other's point of view.
 **Personal and social competence**	Students develop personal and social competence as they learn to work effectively in teams, develop collaborative methods of inquiry, work safely, and use their scientific knowledge to make informed choices.	Students: • work collaboratively in teams • listen to and abide by rules for a new game • participate in discussions.
 **Intercultural understanding**	Intercultural understanding is particularly evident in Science as a Human Endeavour. Students learn about the influence of people from a variety of cultures on the development of scientific understanding.	• 'Cultural perspectives' opportunities are highlighted where relevant. • Important contributions made to science by people from a range of cultures are highlighted where relevant.

AC All the material in the first two columns of this table is sourced from the Australian Curriculum.

Cross curriculum priorities

There are three cross curriculum priorities identified by the Australian Curriculum:

- Aboriginal and Torres Strait Islander histories and cultures
- Asia and Australia's engagement with Asia
- Sustainability.

Two of these are embedded within this unit as described below. For further information see: www.australiancurriculum.edu.au/CrossCurriculumPriorities

Aboriginal and Torres Strait Islander histories and cultures

Primary**Connections** has developed an Indigenous perspective framework that has informed practical reflections on intercultural understanding. It can be accessed at: www.science.org.au/primaryconnections/indigenous

Up, down and all around focuses on the Western science method of identifying particular components of the landscape and sky, and making evidence-based claims about whether they can change over set periods of time.

Indigenous cultures might have different explanations for changes to landscape and time. Dreamtime stories sometimes include explanations for the formation of landscapes, for example, many groups have legends about the Rainbow Serpent, an immense serpent that created mountains and gorges. Dreamtime stories can be specific to particular people or communities or can be shared across different groups.

Primary**Connections** recommends working with Indigenous community members to access contextualised, relevant Indigenous perspectives. Protocols on seeking out and engaging Indigenous community members are discussed in state and territory Indigenous education policy documents, and can be found on the Primary**Connections** website.

Sustainability

In *Up, down and all around*, students explore how the ongoing management of gardens and living spaces impacts on changes to the landscape. They also identify natural and constructed features of the landscape, and changes to the sky and landscape that have to do with human activity. This provides students with opportunities to develop an understanding of some of the relationships between human activity and surrounding ecosystems. This can assist students to develop knowledge, skills and values for making decisions about individual and community actions that contribute to sustainable patterns of use of the Earth's natural resources.

Alignment with the Australian Curriculum: English and Maths

Strand	Sub-strand	Code	Year 1 content descriptions	Lessons
English – Language	**Language variation and change**	ACELA1443	Understand that people use different systems of communication to cater to different needs and purposes, and that many people may use sign systems to communicate with others.	5
	Language for interaction	ACELA1444	Understand that language is used in combination with other means of communication, for example, facial expressions and gestures, to interact with others.	1, 2, 3, 4, 6, 7
		ACELA1446	Understand that there are different ways of asking for information, making offers and giving commands.	5, 6
	Text structure and organisation	ACELA1447	Understand that the purposes texts serve shape their structure in predictable ways.	1, 2, 4, 5
		ACELA1450	Understand concepts about print and screen, including how different types of texts are organised using page numbering, tables of contents, headings and titles, navigation buttons, bars and links.	1, 4
	Expressing and developing ideas	ACELA1451	Identify the parts of a simple sentence that represent 'What's happening?', 'Who or what is doing or receiving the action?' and the circumstances surrounding the action.	1, 2, 3, 6, 7
		ACELA1452	Explore difference in words that represent people, places and things (nouns and pronouns), actions (verbs), qualities (adjectives) and details like when, where and how (adverbs).	1, 6
English – Literacy	**Interaction with others**	ACELY1656	Engage in conversations and discussions, using active listening behaviours, showing interest, and contributing ideas, information and questions.	1, 2, 3, 4, 6, 7
		ACELY1788	Use interaction skills including turn-taking, recognising the contributions of others, speaking clearly and using appropriate volume and pace.	1, 2, 3, 4, 6, 7
		ACELY1667	Make short presentations using some introduced text structures and language, for example, opening statements.	3
	Creating texts	ACELY1661	Create short imaginative and informative texts that show emerging use of appropriate text structure, sentence-level grammar, word choice, spelling, punctuation and appropriate multi-modal elements, for example, illustrations and diagrams.	4
Maths	**Measurement and geometry**	ACMMG021	Describe duration using months, weeks, days and hours.	1
	Statistics and probability	ACMSP024	Identify outcomes of familiar events involving chance and describe them using everyday language such as 'will happen', 'won't happen' or 'might happen'.	1, 2, 5, 6, 7
		ACMSP262	Choose simple questions and gather responses.	2, 3, 6

AC All the material in the first four columns of this table is sourced from the Australian Curriculum.

Other links are highlighted at the end of lessons where possible. These links will be revised and updated on the website: www.science.org.au/primaryconnections/curriculum-resources

Introduction to changes in the land and sky

Teacher background information

Features in our environment, both land and sky, are constantly changing. These changes occur over varying periods of time from very quick to extremely long. Some changes are due to natural processes, such as the weather, and some are due to human activity, such as building and construction.

Examples of changes and their approximate corresponding lengths of time are:

Changes due to natural and human activity	Approximate time periods
Felling of a tree by lightning or humans Changing cloud formations	Seconds to minutes
Grass growing and mowing Sun tracking in the sky Spider spinning a web	Hours, days
Trees and shrubs growing Establishing a garden Moon phases changing Building houses	Weeks, months, years
Eroding of river courses Weathering of rocks Star patterns changing in the night sky Building roads and cities	Years, decades, hundreds to thousands of years
Mountains forming and eroding Stars forming and dying	Millions of years

If you take a photograph from your window and another one minute later, the two images might seem to be the same but there will be subtle differences. The Sun, Moon or clouds will appear in a slightly different position in the sky. A flower on a tree might have begun to open, wind might have blown a pile of leaves around, or a bird might have added an extra twig to its developing nest.

Take another photograph in the early evening and the apparent movements of the Sun or Moon in relation to the Earth will be obvious. The flowers might begin to close for the night, the pile of leaves might have disappeared from view and the bird's nest might be completely finished.

If you study the environment over longer periods, patterns will begin to emerge, these might include trees blossoming at certain times or the presence of certain animals such as baby birds in Spring. These patterns are often tied to weather cycles or day lengths and are indicative of the changing seasons.

Students' conceptions

Taking account of students' existing ideas is important in planning effective teaching approaches that help students learn science. Students develop their own ideas during their experiences in everyday life and might hold more than one idea about an event or phenomenon.

Young students need to develop an understanding of time and appreciate observable daily, weekly and seasonal changes before being able to understand more complex changes, such as the causes of day and night or the way the Moon appears to change shape.

Understanding long-term changes, especially those over very long periods, might be difficult for some students who expect changes to always occur quickly. Some features in the environment change so gradually that students assume that they never change. Only through direct observation do students begin to appreciate the relationship between subtle change and time.

Students' conceptions of the outside world are often tied to imagery they have seen in books, movies or other media. For example, students might think that the Moon only appears in the sky at night because they have only seen it drawn that way. The Moon will rise and set at varying times during the day or night as a result of its relative position to the Sun and Earth, as the Earth and Moon both spin on their axes and the Moon revolves around the Earth.

Some students might also hold conceptions that seasons suddenly happen and that, like the backdrop of a play, all features in the environment will adopt the typical look for that season, such as all trees flowering in Spring or leaves falling from deciduous trees in Autumn.

Some students might hold concepts that mountains, valleys, rivers and other major landscape features have always existed and always will exist as they are today without appreciating that subtle changes, such as weathering, erosion and deposition, are constantly occurring. They might believe that phenomena, such as volcanic activity, tsunamis, storms or earthquakes, resulting in rapid changes are 'natural disasters' that are not related to slower and more subtle forms of change in the environment.

Reference

Skamp, K. (Edn). (2012). *Teaching primary science constructively* (4th Ed.). South Melbourne: Cengage Learning Australia.

To access more in-depth science information in the form of text, diagrams and animations, refer to the Primary**Connections** Science Background CD, which has now been loaded on the Primary**Connections** website: www.science.org.au/primaryconnections. Note that this background information is intended for the teacher only.

Lesson 1 I spy

AT A GLANCE

To capture students' interest and find out what they think they know about observable changes that occur in the sky and landscape.

To elicit students' questions about what features of the sky and landscape change over time.

Students:

- play a game of 'I spy' to identify landscape features and objects in the schoolyard
- predict what will look the same in several weeks
- discuss changes that might occur over different timescales.

Lesson focus

The focus of the *Engage* phase is to spark students' interest, stimulate their curiosity, raise questions for inquiry and elicit their existing beliefs about the topic. These existing ideas can then be taken into account in future lessons.

Assessment focus

Diagnostic assessment is an important aspect of the *Engage* phase. In this lesson you will elicit what students already know and understand about:

- observable changes that occur in the sky and landscape.

Key lesson outcomes

Students will be able to represent their current understanding as they:
• identify and describe features of the landscape and sky
• contribute to discussions about features of the landscape and sky that change over different timescales
• identify the purpose and features of a science journal and word wall
• record their predictions in a table.

This lesson also provides opportunities to monitor the development of students' general capabilities (highlighted through icons, see page 5).

Equipment

FOR THE CLASS

- class science journal
- word wall
- digital camera

FOR EACH STUDENT

- science journal

ENGAGE

Preparation

- Read 'How to use a science journal' (Appendix 2).
- Read 'How to use a word wall' (Appendix 3).
- Enlarge a copy of 'What changed at night?' (Resource sheet 2).
- Identify a place in the schoolyard where you can observe at least three features in the land or sky including:
  - something natural that changes position in a day (for example, Sun or Moon)
  - something natural or made that changes how it looks seasonally (for example, deciduous tree, flowering plant or vegetable patch)
  - something made that has not changed for some time (for example, a building or play equipment).

  Note: The Moon is not always visible in the sky. Check the time the Moon will rise and set from your location at: www.ga.gov.au/geodesy/astro/moonrise.jsp
- Take photos of the area that you will be observing and enlarge for discussion in the class. If possible, use the photos taken during the class observation, otherwise take photos at a time similar to the time when observations will occur.
- Draw a table in the class science journal with the following headings:

Looking for changes

What we saw	After 2 weeks will it look the same?	After 2 weeks will it have moved?

- *Optional:* Display the science journal, word wall and photos on an interactive whiteboard or a computer connected to a projector. Check the Primary**Connections** website to see if an accompanying interactive resource has been developed: www.science.org.au/primaryconnections
- Identify a plot of garden within the school grounds that can be fenced off for the investigation in Lesson 2. If there is not one available create your own garden in a large box, for example, Styrofoam with a few fast-growing seedlings such as spinach, alfalfa or rocket.
- Start collecting photos of the school and surrounding environment taken during different seasons of the year for Lesson 4.

Lesson steps

1 Ask students if they have played the game 'I spy'. Discuss and practise how it is played. Explain that the class is going outside to play 'I spy' to look at things on the land and in the sky, and then take photos of some of those things. Take students to the game location (see 'Preparation').

2 Play 'I spy' asking students to describe the location and characteristics of what they are guessing, for example, 'I spy something that is round and in the sky'. The student who guesses correctly is next to describe something. Encourage students to broaden the objects and landscape features that they are describing by asking them to identify:

- something that is in the sky
- something that grows
- something that was made by people
- something far away.

SAFETY

Remind students not to look directly at the Sun.

Optional: Incorporate other senses into the game, by beginning with 'I smell with my little nose…' or 'I hear with my little ear…' if there are obvious smells or sounds in the environment that will likely change over time.

3 Take photos of what can be seen, including each thing chosen.

4 Return to the classroom and introduce the science journal and discuss its purpose and features.

Literacy focus

Why do we use a science journal?

We use a **science journal** to record what we see, hear, feel and think so that we can look at it later to help us with our claims and evidence.

What does a science journal include?

A **science journal** might include dates and times, written text, drawings, measurements, labelled diagrams, photographs, tables and graphs.

Ask students to recall the things they spied in the game and record them in the class journal, using the photos taken as a reference.

5 Introduce the enlarged photos from the observation area (see 'Preparation'), and ask students to predict whether things in each photo will look the same in two weeks. Ask questions such as:

- What might still be in the photo?
- What might have moved?
- What might look different? Why? Why not?

6 Introduce the table in the class science journal (see 'Preparation'). Discuss the purpose and features of a table.

Literacy focus

Why do we use a table?

We use a **table** to organise information so that we can understand it more easily.

What does a table include?

A **table** includes a title, columns with headings and information organised under each heading.

7 Record students' predictions of things that will look the same in two weeks in the table. Ask questions such as:

- Why do you think it will/won't look the same?
- How will it look different?
- Why do you think it will/won't have moved?

8 Ask students what things they think will change if we wait for a longer period of time, for example, a month or a year. Ask students what things they think will look different if they come back to the school when they have grown up.

Record students' responses in the class science journal.

9 Introduce the word wall and discuss its purpose and features.

Literacy focus

Why do we use a word wall?

We use a **word wall** to record words we know or learn about a topic. We display the word wall in the classroom so that we can look up words we are learning about and see how they are spelt.

What does a word wall include?

A **word wall** might include a topic title or picture and words that we have seen or heard about the topic.

Invite students to contribute words from different languages to the word wall, including local Indigenous names of features in the environment if possible, and discuss.

Australian Curriculum links

Mathematics

- Review notions of time in familiar settings, including hours, days, weeks and months.

English

- Discuss how to pronounce the words on the word wall, and how deaf people communicate them using sign language.

Lesson 2 Garden grooming

AT A GLANCE

To provide hands-on shared experiences of changes that occur in the sky and landscape through investigating how human activity affects features of the landscape.

Students:

- identify and discuss items as being natural or made
- discuss how to conduct an investigation of what happens to a garden over time.

Lesson focus

The *Explore* phase is designed to provide students with hands-on experiences of the science phenomenon. Students explore ideas, collect evidence, discuss their observations and keep records, such as science journal entries. The *Explore* phase ensures all students have a shared experience that can be discussed and explained in the *Explain* phase.

Assessment focus

Formative assessment is an ongoing aspect of the *Explore* phase. It involves monitoring students' developing understanding and giving feedback that extends their learning. In this lesson you will monitor students' developing understanding of:

- how observable changes in the sky and landscape might occur.

Key lesson outcomes

Students will be able to:
• identify whether everyday items in the garden are natural or made
• work in collaborative learning teams to discuss and sort items into categories
• place items in a Venn diagram and review their categories
• record their predictions of what the garden will look like in a month as a drawing in their science journals.

This lesson also provides opportunities to monitor the development of students' general capabilities (highlighted through icons, see page 5).

Teacher background information

Our environments contain features that are natural and constructed. Natural features are those found 'in nature', such as plants, animals, water courses, soil and hills. Constructed features are those that humans have built from numerous materials, such as buildings, roads, tunnels, drains, lighting, fences and art features. Some constructions are made from all natural materials like wood while others are made from manufactured materials, such as plastic. Others are made from composites of natural and manufactured materials, such as a wooden garden seat with metal brackets. Some features are constructed by animals, such as birds' or ants' nests, wombat burrows or bee hives, mostly made from natural materials. Some animals have incorporated manufactured materials into their constructions, such as coloured pegs in bower bird displays.

Natural and constructed features in our environment are subjected to the weather elements of rain, wind, hail, sunshine, snow and temperature changes. These elements can be destructive to our environmental features, such as shifting and breaking up rocks, knocking down trees or buildings and water causing flood damage. More subtly they might cause colours to fade, paint to peel or materials to gradually break down.

Weather elements can also promote growth and development of some living natural features, such as plant growth, seed germination, flower and fruit production or build-up of moss, algal and fungal growth in soils or on constructed features such as paths, garden seats and ornaments.

Students' conceptions

Students might not understand the cause and effect relationship between weather elements and changes in environmental features. They might think that things just 'get old' over time regardless of the weather. They might not understand that some materials, such as certain plastics, remain intact and show little change over long periods of time while others break down readily when subject to weather elements.

Some students might not hold concepts about the critical need for water and sunshine for plant growth, thinking that they will simply grow if they are planted in soil.

Students might be confused about constructed objects made from natural materials, such as a wooden garden seat or a clay garden ornament. They might categorise them in the same way they would categorise a constructed plastic garden pot.

Equipment

FOR THE CLASS

- class science journal
- word wall
- team skills chart
- team roles chart
- 1 garden plot (see 'Preparation')
- items to put in garden plot (see 'Preparation')
- 3 hoops
- 3 A4 pieces of paper
- digital camera

FOR EACH TEAM

- role wristbands or badges for Manager and Speaker
- each team member's science journal

Preparation

- Read 'How to organise collaborative learning teams' (Appendix 1). Display an enlarged copy of the team skills chart and the team roles chart in the classroom. Prepare role wristbands or badges and the equipment table.
- Organise for the identified garden plot (see Lesson 1) to be fenced off and not managed by the groundskeeper(s). Create a sign with a message such as 'Year 1 Investigation. Please do not touch.' Otherwise prepare a garden in a box and organise an area for the box to be left undisturbed, preferably outside if conditions permit.
- *Optional:* If you live in an area with low rainfall, organise a schedule for watering the garden to ensure plants survive.
- Collect items to put in the garden, such as parts of plants, gravel, soil, small toys, plastic bottles to shelter plants, sticks to make a fence and ornamental rocks.
- Prepare three signs: 'Natural', 'Made' and 'Not sure'.

Lesson steps

1 Review the previous lesson, focussing on students' ideas of what things in the sky and landscape might change over time.

2 Explain that the class is going to set up an investigation by observing changes to the garden over time. Introduce the garden (see 'Preparation'). Explain that the garden will be left to grow without being looked after. Ask students why they think we will be doing that. Discuss what 'not looking after' means (no weeding, pruning, fertilising).

3 Introduce the terms 'natural' and 'made'. Show some items in the classroom that are natural and made. Ask students what they think the terms mean and why they think that. Add students' ideas to the class science journal.

4 Introduce the items to put in the garden (see 'Preparation'). Explain that students will be working in collaborative learning teams to sort the items and photos according to whether they are natural or made. Teams will need to provide reasons why they think each item is made or natural.

If students are using collaborative learning teams for the first time, introduce and explain the team skills chart and team roles chart. Explain that students will wear team wristbands or badges to help them (and you) know which role each team member has.

5 Form teams and allocate roles. Ask Managers to choose an item from the collection. Explain that each team will discuss why they think that item is natural or made.

6 Place the three hoops on the floor with their labels (see 'Preparation'), and organise students to sit on the floor around them in their teams. Explain that students will be using the hoops to present their information. Discuss the purpose and features of a Venn diagram.

Literacy focus

Why do we use a Venn diagram?

We use a **Venn diagram** to show how the properties of different things are similar and different.

What does a Venn diagram include?

A **Venn diagram** includes overlapping circles. Things with a particular property are placed in a particular circle. Things with more than one of the properties are placed in the area where the circles overlap.

EXPLORE

7 Model how to place one of the items in the appropriate circle of the Venn diagram and provide a reason for your decision. Explain the use of the 'Not sure' hoop.

8 When teams have made their decisions, ask each Manager to place their item in the appropriate circle of the Venn diagram and say why they have put it there. If students want to identify something as 'Natural' and 'Made', overlap the hoops so that items can be placed in the overlapping area. Ask students if they think any of the items in the diagram should be moved and to give reasons.

9 Discuss with students what changes they think might happen to each of the items in the sorting diagram in the garden. Ask questions such as:

- Do you think it will change? How? Why?
- What things do you think will stay the same? How? Why?
- What things do you think might change? How? Why?

10 Ask students to draw in their science journals what they think their unmanaged garden will look like after a month.

11 Organise a schedule to create a class photo diary of the garden by taking a photo each day or week to see changes to the garden. Ensure there are at least four photos taken of the garden in various stages of development.

12 Update the word wall with words and images.

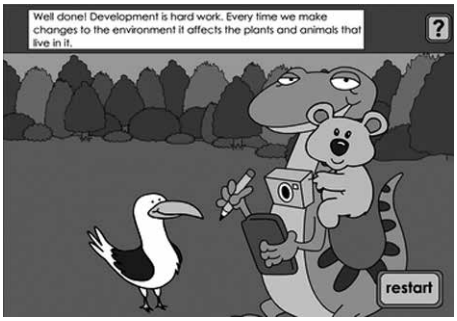
Australian Curriculum links

History

- Discuss the difference and similarities between students' lives and their great-grandparents' lives in obtaining food, for example, through managing gardens and farms to grow what was needed.
- Create a class calendar to record in a sequential way the observations of the class garden.

Studies of society and the environment

- Learning Federation Object L200: Manage and build in the environment and see the impacts it can have on wildlife.



The Learning Federation
(www.thelearningfederation.edu.au)

New developments, Curriculum Corporation, 2010. The Learning Federation learning object L200.

Students link urban development to effects on wildlife populations. Students explore interactions between wildlife populations and national parks, creeks, wetlands, bridges, towns and farms.

Lesson 3 Daily changes

EXPLORE

AT A GLANCE

To provide shared experiences of changes that occur in the sky and landscape over short timescales.

Session 1 Spying again

Students:

- identify things that have changed in the area where they played their 'I spy' game
- compare their observations to their predictions.

Session 2 Night visions

Students:

- present their home comparisons of night and day landscapes and the sky
- discuss why the sky looks different at night.

Lesson focus

The *Explore* phase is designed to provide students with hands-on experiences of the science phenomenon. Students explore ideas, collect evidence, discuss their observations and keep records, such as science journal entries. The *Explore* phase ensures all students have a shared experience that can be discussed and explained in the *Explain* phase.

Assessment focus

Formative assessment is an ongoing aspect of the *Explore* phase. It involves monitoring students' developing understanding and giving feedback that extends their learning. In this lesson you will monitor students' developing understanding of:

- observable changes in the sky and landscape that occur in a day or a couple of weeks.

Key lesson outcomes

Students will be able to:
• work in collaborative learning teams to identify changes that have occurred in a fortnight
• compare their observations with their predictions
• record their home observations in a table
• present and discuss their results with the class.

This lesson also provides opportunities to monitor the development of students' general capabilities (highlighted through icons, see page 5).

Teacher background information

The day and night pattern has been repeating on Earth for billions of years, all due to the Earth's rotation on its axis, currently every 24 hours. This recurring pattern has resulted, and continues to result in, many changes in the environment.

The Sun itself will change position in relation to its observers on Earth and appear to move in an arc across the sky from East to West. This arc will vary in height depending on the season, due to the tilt of the axis of rotation of the Earth relative to the plane of its orbit around the Sun and its position as it revolves around the Sun. In Summer the Sun's rays are more direct and the arc is higher in the sky. In Winter the rays are more angled and the arc is lower in the sky.

The Moon also rises in the East and sets in the West, but at different times to the Sun because the Moon revolves around the Earth once per month. Sometimes the Moon is on the same side of the Earth as the Sun and we will see it rise and set during the day. When it is on the opposite side of the Earth from the Sun, the Moon will rise at night and set in the morning. The moon also rotates on its axis once per month. The result is that we only see one side of the Moon from Earth. The Moon cannot produce its own light but is visible when it reflects light from the Sun to Earth. We see the Moon's phases because we only see the part of the Moon that is illuminated by the Sun. When the Moon is in a position in relation to the Earth and Sun where its whole face is illuminated, we see a full moon at night. When the Moon is on the same side of the Earth as the Sun, we will see a New or Crescent Moon, with very little of its face to Earth illuminated and this occurs during the day. During the rest of its revolution around the Earth we will see differing amounts of the Moon illuminated at differing times of the day and night. This pattern repeats itself approximately every 28 days.

With the Sun comes daylight and many features in the environment respond to this. Patterns of behaviour during the day, called diurnal patterns, emerge. For example, some animals are more active during the day. At dawn birds can be heard making their various calls, insects become active as the day warms and small reptiles, such as lizards, will warm themselves in the Sun to elevate their body temperatures. Plants also respond to daylight, such as leaves adjusting their orientation to directly catch the Sun's rays as it appears to track across the sky. Flowers open and wait for birds or insects to collect their nectar and transfer their pollen to other flowers. Human activity increases during the day as people go to school or work, and live their daily lives.

By contrast night or nocturnal patterns occur when the Sun goes down. Some animals are more active at night including native animals such as kangaroos, possums and wombats. Some insects, such as moths, are also active and can be attracted to bright lights from homes and other buildings. Some flowers close up during the night and open again at daylight. People are wired to sleep at night, recuperating for the next day's events.

At sunset, daylight gradually decreases until there is no light to illuminate objects for us to see. We say it is dark at night because there is an absence of light. If the Moon is in a position where it is fully or partially illuminated by the Sun, we will see it at some time during the night and will experience some objects illuminated by moonlight. We can see stars gradually seem to appear as darkness falls. They are always present in the sky but the Sun's brilliant light blocks the more distant starlight during the day, so they seem to disappear. The stars produce their own light and 'twinkle' because they are tiny points of lights that are affected by their passage through the Earth's atmosphere by turbulent winds. Some of our solar system's planets are also visible at night. Venus and Mars are easy to spot with the naked eye. They reflect light from the Sun and are big enough that the effects of the atmosphere cannot normally be seen and they do not 'twinkle'. The planets change their positions in relation to Earth as their own orbits progress around the Sun.

At night the objects we can see during the day seem to disappear because there is no sunlight to reflect from them into our eyes. We need to use artificial light (electrical lights or torches) to be able to see things. Houses are illuminated and street lights help us to see the roads and surrounding buildings at night.

Seasons are a way humans divide the year according to regular changes observed in the environment, particularly the weather and events that occur as a result of the weather.

Students' conceptions

Some students might believe the Sun goes up, stays in the same spot in the sky and then goes back down again, often giving the Sun human-like characteristics by saying it 'wakes up in the morning' and 'goes to sleep at night'. To the viewers on Earth, the Sun appears to rise from the horizon in the East and takes an arc-like path across the sky to the West where it sets. They might think that the Moon only appears at night and disappears during the day, replaced by the Sun. Likewise, they might think that stars appear at night and disappear during the day, like turning a light on or off.

Some students might think that 'dark' replaces 'light' at night. In fact 'darkness' is just an absence of light. They might believe that the objects and features they see during the day disappear at night along with the Sun and reappear the next morning. In fact, the objects are still present but have no sunlight available to reflect into our eyes for us to see them.

Students might not understand that some animals are more active at night than during the day because humans 'go to bed' at night. They might have little concept of the response of plants and flowers to daylight and darkness.

Session 1 Spying again

Equipment

FOR THE CLASS

- class science journal
- word wall
- team skills chart
- team roles chart
- 1 enlarged copy of 'Information note for families' (Resource sheet 1)
- 1 enlarged copy of 'What changed at night' (Resource sheet 2)
- *Optional:* digital camera

FOR EACH TEAM

- each team member's science journal
- role wristbands or badges for Manager and Speaker
- printed photo from Lesson 1 (see 'Preparation')
- coloured pens
- 1 copy of 'Information note for families' (Resource sheet 1) for each team member
- 1 copy of 'What changed at night' (Resource sheet 2) for each team member

Preparation

- Read 'How to facilitate evidence-based discussions' (Appendix 4).
- If possible, plan this lesson for a different time of day to Lesson 1 so that changes, such as the position of the Sun in the sky, are obvious.
- Prepare a printed photo taken at the 'I spy' game location in Lesson 1 for each team, for example, in black and white so that students can clearly mark what things have changed.
- Record the date of Session 2 in the 'Evening observations' section of 'Information note for families' (Resource sheet 1). Record the date of Lesson 4 in the 'Photo collection' section of the resource sheet.
- Enlarge a copy of 'Information note for families' (Resource sheet 1) and prepare a copy for each student.
- *Optional:* Display 'Information note for families' (Resource sheet 1) on an interactive whiteboard or a computer connected to a projector. Check the Primary**Connections** website to see if an accompanying interactive resource has been developed: www.science.org.au/primaryconnections/

Lesson steps

1 Review the previous lessons focusing on students' predictions made in Lesson 1. Ask students questions such as:

- What did you predict would happen to…?
- Do you still think that? Why/why not?

2 Introduce the photos from the 'I spy' game from Lesson 1. Explain that students will work in collaborative learning teams to identify whether things they observed during the 'I spy' game still look the same.

3 Discuss how students will use coloured pens to record their observations on their printed photo, for example, by crossing out things that have disappeared or moved and circling things that have changed appearance. Model completing an observation.

4 Form teams and allocate roles. Ask Managers to collect team equipment. Take teams to the site in Lesson 1.

5 Allow time for teams to complete the activity. Ask questions such as:

- Have you thought about…?
- That's interesting, can you tell me more about…?
- Others might think… What do you think now?

Optional: Take photos of the site to use for the class discussion, for example, by displaying them on an interactive whiteboard.

6 Return to the classroom and ask Speakers to share their teams' observations. Encourage students in the audience to use 'Science question starters' (see Appendix 4) to ask students about their results.

7 Discuss the results as a class and circle the agreed outcome for each feature on the 'Looking for changes' table in the class science journal.

8 Discuss the investigation, asking questions such as:

- Did we all observe the same things?
- Did our observations match our predictions? Why/why not?
- Do you have any questions about what we observed?

Record students' answers in the class science journal.

9 Ask students what they think would change if they looked at the sky and landscape at night compared with looking during the day. Record students' ideas in the class science journal.

10 Discuss how students might ask family members to help them observe what they can see near their house during the day and then at night. Introduce an enlarged copy of 'Information note for families' (Resource sheet 1), and read through with students. Discuss the tasks and draw students' attention to the due dates.

11 Model recording an observation on the enlarged 'What changed at night' table (Resource sheet 2). Review the purpose and features of a table.

12 Update the word wall with words and images.

EXPLORE

Session 2 Night visions

Equipment

FOR THE CLASS

- class science journal
- word wall

FOR EACH STUDENT

- science journal

Preparation

- *Optional:* If students have taken photos, prepare a printed or electronic display of them on an interactive whiteboard or a computer connected to a projector.

Lesson steps

1 Review the previous session focusing on what students thought might change if they observed things at night.

2 Invite students to discuss their observations from the homework night viewing task. Encourage students in the audience to use 'Science question starters' (see Appendix 4) to ask them about their results.

3 As a class discuss what a difference viewing at night makes, in particular to the sky. Discuss what things are only visible at night (stars) and what things are more easily visible at night (the Moon).

Optional: After the students complete their observations, introduce *Day sky, night sky* (see below). Discuss and complete the activity with the whole class.

The Learning Federation (www.thelearningfederation.edu.au)

Day sky, night sky, Curriculum Corporation, 2010. The Learning Federation learning object L204.

Students identify celestial objects visible during the day and night. Students explore apparent movement of celestial objects.

4 Update the word wall with words and images.

Information note for families

Introducing the Evening observation project

This term, our class is observing changes that occur in the sky and landscape as part of the science unit, *Up, down and all around*.

Evening observations

During the day students have observed changes that occur in the school environment. Students are asked to observe changes that occur in the landscape and sky at home before and after nightfall.

Some examples of things to observe might include: a flower that closes at night, the Moon 'rising' in the sky, stars 'appearing' or a spider's web being created.

Students are asked to draw 'before' and 'after' pictures, or takes photos of something that changed on the provided 'What changed at night?' sheet.

Students are asked to bring their completed 'What changed at night?' sheet to school by:

_____

Optional: Photo collection

Students will also study changes to the land and sky in different seasons. Students are asked to provide photos of the local outdoor environment that were taken during different seasons to share with the class. Some examples might include: a hot Summer day with people around a pool, or a Winter day with people dressed in warm clothes. Natural things might include trees in blossom, trees with no leaves, a bird's nest in a tree, water levels in creeks or leaf colour.

Students are asked to bring in photos by:

_____

Class teacher

What changed at night?

Name: _____ **Date:**_____

What it looked like in the day	What it looked like at night

Lesson 4 Seasonal traits

EXPLORE

AT A GLANCE

To provide shared experiences of changes that occur in the sky and landscape over the course of a year.

Students:

- work in teams to create posters that represent a season
- create a class flow chart of the characteristics of seasons
- discuss how the seasons change over the course of a year.

Lesson focus

The *Explore* phase is designed to provide students with hands-on experiences of the science phenomenon. Students explore ideas, collect evidence, discuss their observations and keep records, such as science journal entries. The *Explore* phase ensures all students have a shared experience that can be discussed and explained in the *Explain* phase.

Assessment focus

Formative assessment is an ongoing aspect of the *Explore* phase. It involves monitoring students' developing understanding and giving feedback that extends their learning. In this lesson you will monitor students' developing understanding of:

- observable changes in the sky and landscape.

Key lesson outcomes

Students will be able to:
• work in collaborative learning teams to create a poster to represent a season
• organise their posters into a flow chart
• discuss similarities and differences between seasons
• identify regular and predictable changes to the sky and landscape over the course of a year.

This lesson also provides opportunities to monitor the development of students' general capabilities (highlighted through icons, see page 5).

Teacher background information

Seasons are caused by three phenomena: the revolution of the Earth around the Sun once per year, the tilt of the Earth's axis of 23.5 degrees relative to the perpendicular to the plane of the orbit around the Sun, and the location on Earth. Countries on or close to the Equator experience very little seasonal temperature variation because the Sun's rays are very direct all year round, the tilt of the axis having little effect at the centre of the globe. The poles experience the most extreme seasons, with approximately six months of sunlight and six months of darkness and the greatest differences in angle of the Sun's rays.

In Australia, the tilt of the Earth's axis and our position on Earth have an effect on the angle of the Sun's rays as Earth revolves around it. Different places and cultures in Australia observe different seasons. Being such a large country, with locations close to the Equator in the North and closer to Antarctica in the South, many locations in Australia experience the seasons differently.

Many people in northern tropical areas of Australia identify two seasons, the wet and the dry season, others such as the Nunggubuyu people identify five seasons. In the South of Australia, the majority of people identify four seasons each lasting approximately three months: Spring, Summer, Autumn and Winter.

Official dates of starting seasons vary across the globe. For example, the start date is close to the 20th of the month for many European countries but always on the 1st of the month in Australia. Seasonal changes are variable and depend on many factors.

Some of the more common Australian seasons are described below:

Southern Australia

Season	Time of year	Weather	Observable features
Summer	Dec – Feb	Hot temperatures, sunny	Clear skies, dust, dry creeks
Autumn	March – May	Mild temperatures, some rain	Some leaves change colour
Winter	June – Aug	Cold temperatures, rainy weather	Clouds, no leaves on some trees, fewer animals
Spring	Sept – Nov	Mild temperatures, some rain	New plant growth, blossoms, presence of baby animals

Northern Australia

Season	Time of year	Weather	Observable features
Wet	Nov – March	Hot temperatures, heavy rains and high humidity	Clouds, flowing rivers and creeks, plant growth, more mosquitoes
Dry	May – Oct	Mild to hot temperatures, little to no rain and low humidity	Clear skies, dust, dry creeks

Students' conceptions

Through the course of a term, students will not be able to experience first-hand all the seasons of the year. They can focus on the current season as a starting point and use their knowledge of their previous years to explore the other seasons. Young students learn best about physical characteristics of place through narrative and personal accounts. Photos, particularly featuring people, will assist students to understand what the weather is like in the seasons through the clothes people wear and activities in which they take part.

Students might not have an understanding of the seasons as a phenomenon related to the Earth's revolution around the Sun nor the tilt of the Earth's axis. These are concepts for older students. However, they can through observation and evidence-based discussion appreciate that seasons are a recurring phenomenon characterised by changing environmental features and differing behaviours of plants and animals, including human beings.

Equipment

FOR THE CLASS

- class science journal
- word wall
- team skills chart
- team roles chart
- collection of photos (see 'Preparation')

FOR EACH TEAM

- each team member's science journal
- role wristbands or badges for Manager and Speaker
- sets of photos
- A3 piece of paper or card
- scissors
- glue

Preparation

- Print out or photocopy photos brought in by students and collected from the school to show the local environment throughout the seasons. Make up collections for each season.

Lesson steps

1. Review the previous lessons focusing on the changes that students have observed over the course of several weeks. Ask questions such as:
   - What will look different next term?
   - What will look different at the end of the year?
2. Explain that students will be working in collaborative learning teams to create a poster that shows what usually happens in their area during a particular season. Discuss the purpose and features of a poster.

> **Literacy focus**
>
> **Why do we use a poster?**
>
> We use a **poster** to display ideas and information. We can view a **poster** to collect information about a topic.
>
> **What does a poster include?**
>
> A **poster** includes a title, words and pictures. It might include graphs, photos and tables as well as borders, arrows and labels.

3. Introduce the sets of photos for each team. Discuss with students how they can examine their photos, for example, by looking at what is in the sky and what the landscape looks like to decide which season the photo was taken in.
4. Remind students to think about what the weather is generally like during that season and brainstorm words that students might like to include on their poster to describe the weather, for example, 'wet', 'dry', 'cold', 'hot', 'warm', 'cool', 'sunny' and 'rainy'.
5. Form teams and allocate roles. Allow time for students to complete the activity.
6. Work together as a class to place the posters for each season in order along a wall to form a flow chart of the seasons. If possible arrange the posters in a circle to reinforce the notion of a flow. Discuss the purpose and features of a flow chart.

> **Literacy focus**
>
> **Why do we use a flow chart?**
>
> We use a **flow chart** to show the order that things happen in.
>
> **What does a flow chart include?**
>
> A **flow chart** includes a title, pictures and/or words and arrows. The arrows show the order things happen and might go in a line or in a circle.

7 As a class review what normally happens during each season, inviting contributions from each team in chronological order. Ask questions such as:

- What are people wearing in your season? Why?
- What does the sky look like during each season?
- What happens to the trees during the year?
- What stays the same during the year? What changes?

Optional: Discuss other seasonal things that happen in different parts of Australia or the world. For example, snow in winter.

8 Update the word wall with words and images.

Australian Curriculum links

Science

- Discuss how living things find it more or less easy to meet their needs depending on the season due to availability of food and changing weather conditions.

Indigenous perspectives

- Invite a local Indigenous community member to see the timeline and discuss with students how they identify the seasons and what important features change to characterise the new season. Protocols are available on the website: www.science.org.au/primaryconnections/indigenous

Studies of society and the environment

- Discuss the different seasons experienced and recognised by people of different cultures and countries, for example, by viewing:
  - Burrarra Gathering: www.burarra.questacon.edu.au. Visit Dunaja and his grandfather in the wet and dry season, and discuss the differences in both the seasons.
  - National Film and Sound Archive clips from the movie 5 Seasons, which demonstrates the annual five-season cycle identified by the Nunggubuyu people who live on the South-west coast of the Gulf of Carpentaria in the Northern Territory: www.aso.gov.au/titles/documentaries/5-seasons/clip1

Lesson 5 Ask an expert

AT A GLANCE

To support students to represent and explain their understanding of how different changes occur in the sky and landscape over different timescales, and to introduce current scientific views about changes that happen over longer timeframes.

Session 1 Interview planning

Students:

- identify quick and slow changes to the landscape and sky
- prepare interview questions to gather information about longer-term changes.

Session 2 Guest speaker

Students:

- interview a guest speaker about changes to the landscape and sky.

Lesson focus

In the *Explain* phase students develop a literacy product to represent their developing understanding. They discuss and identify patterns and relationships within their observations. Students consider the current views of scientists and deepen their own understanding.

Assessment focus

Formative assessment is an important aspect of the *Explain* phase. It involves monitoring students' developing understanding and giving feedback that extends their learning. In this lesson you are looking for evidence that students are developing an understanding about:

- how different changes can occur in the sky and landscape over different timescales.

You are also able to look for evidence in students' drawings and oral language to represent what they know about changes to the landscape and sky, and to give students feedback about how they can improve their representations.

Key lesson outcomes

Students will be able to:
• identify changes in the features of the landscape and the sky, and compare basic timescales of change
• identify questions for an interviewee about long-term changes to the landscape and sky
• use appropriate oral communication to discuss their questions with their interviewee
• represent what they think the school environment used to look like by drawing.

This lesson also provides opportunities to monitor the development of students' general capabilities (highlighted through icons, see page 5).

Teacher background information

Changes in the environment are constantly occurring and can take different periods of time from short periods, such as seconds, minutes, hours and days, to much longer periods, such as weeks, months, years, decades and centuries.

Humans play a large role in shaping our current environment. Even natural environments, such as national parks, require management to ensure invasive species of both animals and plants do not take over and access is maintained for fire trucks and tourists. There are very few true wilderness areas on Earth that have not been impacted on by humans.

Urban environments change as governments plan and develop urban spaces depending on their purpose. Buildings are demolished and constructed. Roads, bridges, tunnels and houses create a vast constructed landscape as urban areas are developed and re-developed. Sometimes natural phenomena, such as fires or storms, can change these landscapes quickly and dramatically with great impact on all living things.

Students' conceptions

Some students might not hold concepts of change in their local environments, particularly subtle changes that take longer periods of time to observe. They might think that the natural and constructed features of their environment have always been there and always will be there. Detailed observations and records of change help them to understand that change is constantly occurring even when we don't notice it.

Session 1 Interview planning

Equipment

FOR THE CLASS

- class science journal
- word wall
- 3 A4 sheets of paper

FOR EACH STUDENT

- science journal

Preparation

- Prepare three A4 signs with the headings ‘Changes in a day’, ‘Changes over a year’ and ‘No change’.
- Organise for a guest speaker, such as a grandparent or local historian, to be interviewed by the class about how the local environment has changed over their lifetime.

Lesson steps

1 Review the previous lessons, focusing on things in the sky and landscape that students have observed. Discuss how some changes happen quickly, for example, the Sun moves in the sky over the course of the day, and some changes happen more slowly, for example, some trees lose their leaves in Autumn.

2 Place the three signs (see ‘Preparation’) in separate parts of the room. Explain that you will mention something in the landscape or sky and students will stand in front of the sign that shows their response.

3 Call out several things, for example, the position of the Sun, the presence of leaves on the trees or the school building. When students move into their position, ask questions such as:

- Why do you think…?
- When have you observed…?
- What about…?

Record students’ thoughts in the class science journal.

4 As a class, discuss whether changes might occur over a longer term, for example, over many years. Discuss how students could find evidence of change, for example, by interviewing an expert. Brainstorm questions that students might like to ask the expert. Record students’ questions in the class journal.

Note: Encourage students to consider open questions rather than simple yes/no questions, for example:

- When did you live/work here?
- How long have you lived/worked here?
- What natural things have changed since you were young?

EXPLAIN

- What made things have changed since you were young?
- When did [a particular feature] change?
- Why was [a particular feature] built? Who built it?

5 Discuss different forms of communication to collect information, such as writing a letter, sending an email, using a telephone or conducting a personal interview. Explain that the class will be conducting an interview and discuss the purpose and features of an interview.

Literacy focus

Why do we use an interview?

We use an **interview** to collect information and opinions from someone.

What does an interview include?

An **interview** includes one or more people asking questions and one or more people answering them. It might take place face-to-face or over distance, such as by telephone or video link.

6 Organise for students to record a question that they would like to ask the guest speaker. They can use this as a prompt during the interview. Provide students with time to practise asking their question, for example, with a partner.

7 Before the interview, model and practise appropriate oral communication skills, such as looking at the person you are speaking to and using appropriate voice volume and pace.

8 Update the word wall with pictures and images.

Session 2 Guest speaker

Equipment

FOR THE CLASS

- class science journal
- word wall
- *Optional:* digital camera

FOR EACH STUDENT

- science journal

Lesson steps

1. Introduce the guest speaker and support the students to conduct the interview as planned in the previous session. Look for opportunities to model asking the guest follow-up and clarifying questions, for example, about technical language.

   Optional: Take photographs of the guest speaker's visit to assist students to recount the interview.
2. Ask the students to thank the community member for their time.
3. Discuss the interview as a class, asking questions such as:
   - What did we want to find out about?
   - What have we learned about…? (For example, some changes occur fast and some changes occur more slowly, the trees at our school and homes looked different many years ago)
   - What did you find was most interesting?
   - What are you still wondering about?
4. Record students' responses in the class science journal.
5. Ask students to draw a picture in their science journal of what the school ground looked like a long time ago according to the descriptions from the guest speaker.

   Optional: Ask students to create a flow chart of what the school used to look like and what it looks like now.
6. Update the word wall with pictures and images.

Australian Curriculum links

History

- Discuss with the interviewee what life was like in the past.

EXPLAIN

Lesson 6 It's only natural

AT A GLANCE

To support students to represent and discuss their investigation of how human activity affects features of the landscape.

Students:

- discuss their observations of the changes in the class garden
- create a class flow chart to present what happened to the garden over time
- identify that natural and made things in a garden have different changes over time.

Lesson focus

In the *Elaborate* phase students plan and conduct an open investigation to apply and extend their new conceptual understanding in a new context. It is designed to challenge and extend students' Science Understanding and Science Inquiry Skills.

Assessment focus

Summative assessment of the Science Inquiry Skills is an important focus of the *Elaborate* phase. Rubrics are available on the website to help you monitor students' inquiry skills.

Key lesson outcomes

Students will be able to:
• compare their observations of the garden with their initial predictions
• work in teams to represent their understanding by ordering a set of photos into a flow chart
• identify natural and made features of the garden and how they have changed
• respond to and pose questions about what happens when humans stop making changes to the land.

This lesson also provides opportunities to monitor the development of students' general capabilities (highlighted through icons, see page 5).

Teacher background information

School grounds require a lot of maintenance. If left unmanaged the ovals would become overgrown, the buildings would suffer wear and tear, and the paths would become blocked by debris or plants. Some consequences for the school grounds would be that they become very unsafe, difficult to work in and unsightly. The size of a school and number of people that frequent the school can influence the amount of wear and tear on the school and its grounds. The weather and the climate also affect what needs to be managed and how often, for example, the weeding and mowing might need to take place more often after rainy weather.

Students' conceptions

Students might not have experienced an investigative exercise requiring detailed observations of change in a before/after scenario, such as this investigation, and might require guidance to 'look closely' at features that have changed beyond the obvious ones.

It might be helpful to provide students with guidelines for their observations, such as:

- place (Is the object in the same place?)
- colour (Has the object changed colour?)
- size (Has the object changed its size?)
- shape (Has the object changed its shape?)
- position (Has the object changed its position?)
- growth (Has the object grown or have things grown on it?)

Students might have completed 'spot the difference' puzzles before and will need to use their powers of observation to look for subtle changes like they do when completing such puzzles. They might require encouragement to go beyond their 'first look' and have a really 'close look'.

Equipment

FOR THE CLASS

- class science journal
- word wall
- team skills chart
- team roles chart
- enlarged photo of the garden as it was in Lesson 2
- enlarged set of 4 photos of the garden from Lesson 2 (See 'Preparation')

FOR EACH TEAM

- role wristbands or badges for Manager and Speaker
- each team member's science journal
- set of photos of the garden from Lesson 2 (see 'Preparation') for each student
- scissors
- glue

Preparation

- Choose four photos for teams to sort that represent the garden in various stages of development. Print out a copy for each student, for example, by creating an A4 printout with all four photos arranged on it ready to be cut out. Enlarge a set of photos for the class and cut the photos out.
- Enlarge a photo of the garden as it was, for example, by displaying it on an interactive whiteboard or a computer connected to a projector.
- Draw a table in the class science journal with the following headings:

Results of the garden investigation

Item	Natural or made?	How did it change?

- *Optional:* Ask the grounds keeper to plan a journey around the school to point out particular features and how they are maintained by his or her work.

Lesson steps

1 Review the previous lessons, focusing on the different scales of change that students have discussed.

2 Discuss the garden that was left untouched for a month, asking students what kinds of changes that they might expect to have happened in the month, for example, could they expect to see changes due to the seasons?

3 Introduce the garden that was not looked after and ask students to compare it with the predictions they made in their science journals. Ask questions such as:

- What is similar about your prediction and the garden?
- What is different? Why do you think that is?
- What else do you notice?

4 Introduce the enlarged photo of what the garden used to look like. Ask students to compare it with the final garden and identify what has changed and what has not.

5 Introduce the enlarged set of photos (see 'Preparation'), and explain that students are going to work in collaborative learning teams to arrange the photos in order from oldest to newest and glue them into their science journals. Review the purpose and features of a flow chart.

6 Form teams and allocate roles. Ask Managers to collect their team equipment.

7 Allow time for teams to complete the activity.

8 As a class agree on the order of the enlarged set of photos and glue them in the class science journal. Ask questions such as:

- What clues do we have about which photos are first and which are last (for example, the size of the plants, the tidiness of the garden)?
- What things have changed in the garden? How have they changed?
- What things have stayed the same?

9 Introduce the table in the class science journal (see 'Preparation'), and remind students of how they classified the different things in the garden as 'Natural' or 'Made' in Lesson 2. As a class, complete the table of observations.

Item	Natural or made?	How did it change?
grass	natural	It grew longer.
large stone	natural	It stayed the same.
plastic frog	made	It moved a bit. We think the rain moved it.
weeds	natural	They grew bigger.
can	made	It got a bit rusty.
popsticks	made	Some fell over.
plant	natural	It has flowers now.
green leaves	natural	They have turned brown.

Work sample of table of observations

10 Discuss the table with the class, asking questions such as:

- What kinds of changes happened to the 'Natural' things (for example, they grew, they died, they changed colour, they washed away)?
- What kinds of changes happened to the 'Made' things? (for example, they fell down, they rusted, their paint leeched, they stayed the same)?
- What do you think would happen if each thing was left outside for another month/ a whole year?
- Could we make the garden look like it used to? How? What kinds of changes would we need to make?
- What do you think the school would start to look like if we stopped making changes to it?
- What are you wondering about now?

Record students' thoughts in the class science journal.

Optional: As a class, explore images of previously managed areas that have been left unattended or foreshore restoration projects etc.

11 Update the word wall with words and images.

Lesson 7 Time spy

AT A GLANCE

To support students to represent what they have learned about features of the landscape and sky, and how the features may change over various periods of time.

Students:

- play an 'I spy' game about how features have changed
- use what they have discovered throughout the unit to create clues for the game
- reflect on their learning.

Lesson focus

In the *Evaluate* phase, students reflect on their learning journey and create a literacy product to re-represent their conceptual understanding.

Assessment focus

Summative assessment of the Science Understanding description is an important aspect of the *Evaluate* phase. In this lesson you will be looking for evidence of the extent to which students understand that:

- observable changes occur in the sky and landscape.

Key lesson outcomes

Students will be able to:
• identify and describe features of the landscape and sky
• contribute to discussions about features of the landscape and sky that change over different timescales.

This lesson also provides opportunities to monitor the development of students' general capabilities (highlighted through icons, see page 5).

Equipment

FOR THE CLASS

- 1 enlarged copy of 'Change spies' (Resource sheet 3)
- class science journal
- word wall

FOR EACH STUDENT

- 1 copy of 'Change spies' (Resource sheet 3)
- science journal

Preparation

- Prepare an enlarged copy of 'Change spies' (Resource sheet 3).

Lesson steps

1. Review the previous lessons, word wall and class science journal focusing on the many different things that students have observed change or have seen in photos.
2. Explain that at the end of the lesson the class will play 'I spy' and each student will have a turn to choose something for the game. Explain that this time the clues will be about when the feature has changed, for example, 'I spy with my little eye something that has changed since…'
3. Ask students to name some ways that things might change over time. Ask questions such as:
   - What things outside might change their position later today?
   - What things will change how they look next season?
   - What things have not changed for a very long time?
4. Introduce 'Change spies' (Resource sheet 3), and discuss how the sheet will help students find a clue for the 'I spy' game. Allow students time to complete the clues, providing them with the opportunity to look in their journals, the word wall and outside for ideas.

   Note: Remind students to keep their clues a secret.
5. Play the 'I spy' game as a class or in smaller groups, encouraging students to read the line from their sheet if they need assistance. Explain that many students might have the same clue, so they might need to guess the same things for different people.

   If students take a long time to guess a clue, ask the Speaker for extra clues such as:
   - Is it made or natural?
   - Has it changed where it is since this morning?
   - Has it changed what it looks like?
   - Was it there before?
   - Is it in the sky/on the land?

6 Review the *Up, down and all around* unit with the class, asking questions such as:

- Which activity helped you to learn something new?
- Which activity did you enjoy? Why?
- What did you learn about working with a partner?

Record students' responses in the class science journal.

Change spies

Name: _____ **Date:**_____

Draw a picture of something that has changed since...

yesterday It is natural / made	last season It is natural / made
last year It is natural / made	a very, very long time ago It is natural / made

Choose a clue from above and complete the sentence:

I spy with my little eye something that changed _____

_____

Appendix 1
How to organise collaborative learning teams (F–Year 2)

Introduction

Students working in collaborative teams is a key feature of the Primary**Connections** inquiry-based program. By working in collaborative teams students are able to:

- communicate and compare their ideas with one another
- build on one another's ideas
- discuss and debate these ideas
- revise and rethink their reasoning
- present their final team understanding through multi-modal representations.

Opportunities for working in collaborative learning teams are highlighted throughout the unit. Students need to be taught how to work collaboratively. They need to work together regularly to develop effective group learning skills.

Team structure

The first step towards teaching students to work collaboratively is to organise the team composition, roles and skills. Use the following ideas when planning collaborative learning with your class:

- Assign students to teams rather than allowing them to choose partners.
- Vary the composition of each team. Give students opportunities to work with others who might be of a different ability level, gender or cultural background.
- Keep teams together for two or more lessons so that students have enough time to learn to work together successfully.
- Keep a record of the students who have worked together as a team so that by the end of the year each student has worked with as many others as possible.

Team roles

Students are assigned roles within their team (see below). Each team member has a specific role but all members share leadership responsibilities. Each member is accountable for the performance of the team and should be able to explain how the team obtained its results. Students must therefore be concerned with the performance of all team members. It is important to rotate team jobs each time a team works together so that all students have an opportunity to perform different roles.

For F–Year 2, teams consist of two students—Manager and Speaker. (For Year 3 – Year 6, the teams consist of three students—Director, Manager and Speaker.) Each member of the team should wear something that identifies them as belonging to that role, for example, a wristband, badge or coloured clothes peg. This makes it easier for you to identify which role each student is doing, and it is easier for the students to remember what they and their team mates should be doing.

Manager

The Manager is responsible for collecting and returning the team's equipment. The Manager also tells the teacher if any equipment is damaged or broken. All team members are responsible for clearing up after an activity and getting the equipment ready to return to the equipment table.

Speaker

The Speaker is responsible for asking the teacher or another team's Speaker for help. If the team cannot resolve a question or decide how to follow a procedure, the speaker is the only person who may leave the team and seek help. The Speaker shares any information they obtain with team members. The teacher may speak to all team members, not just to the Speaker. The Speaker is not the only person who reports to the class; each team member should be able to report on the team's results.

Director

The Director is responsible for making sure that the team understands the team investigation and helps team members focus on each step. The Director is also responsible for offering encouragement and support. When the team has finished, the Director helps team members check that they have accomplished the investigation successfully. The Director provides guidance but is not the team leader.

Team skills

Primary**Connections** focuses on social skills that will help students work in collaborative teams and communicate more effectively.

Students will practise the following team skills throughout the year:

- move into your teams quickly and quietly
- speak softly
- stay with your team.

To help reinforce these skills, display enlarged copies of the team skills chart (see the end of this Appendix) in a prominent place in the classroom.

The development of these team skills aligns to descriptions in the Australian Curriculum: English. See page 7.

Supporting equity

In science lessons, there can be a tendency for boys to manipulate materials and girls to record results. Primary**Connections** tries to avoid traditional social stereotyping by encouraging all students, irrespective of their gender, to maximise their learning potential. Collaborative learning encourages each student to participate in all aspects of team activities, including handling the equipment and taking intellectual risks.

Observe students when they are working in their collaborative teams and ensure that both girls and boys are participating in the hands-on activities.

TEAM SKILLS

1 Move into your teams quickly and quietly

2 Speak softly

3 Stay with your team

4 Take turns

5 Perform your role

TEAM ROLES

Manager

Collects and returns all materials the team needs

Speaker

Asks the teacher and other team speakers for help

Appendix 2
How to use a science journal

Introduction

A science journal is a record of observations, experiences and reflections. It contains a series of dated, chronological entries. It can include written text, drawings, labelled diagrams, photographs, tables and graphs.

Using a science journal provides an opportunity for students to be engaged in a real science situation as they keep a record of their observations, ideas and thoughts about science activities. Students can use their science journals as a useful self-assessment tool as they reflect on their learning and how their ideas have changed and developed during a unit.

Monitoring students' journals allows you to identify students' alternative conceptions, find evidence of students' learning and plan future learning activities in science and literacy.

Using a science journal

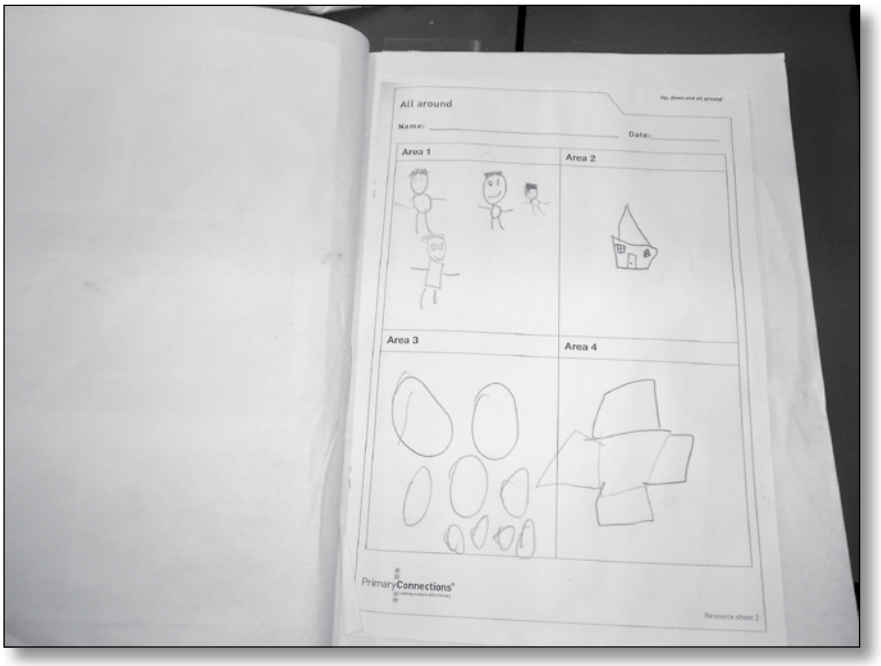
1. At the start of the year, or before starting a science unit, provide each student with a notebook or exercise book for their science journal or use an electronic format. Tailor the type of journal to fit the needs of your classroom. Explain to students that they will use their journals to keep a record of their observations, ideas and thoughts about science activities. Emphasise the importance of including pictorial representations as well as written entries.
2. Use a large project book or A3 paper to make a class science journal. This can be used at all stages to model journal entries. With younger students, the class science journal can be used more frequently than individual journals and can take the place of individual journals.
3. Make time to use the science journal. Provide opportunities for students to plan procedures and record predictions, and their reasons for predictions, before an activity. Use the journal to record observations during an activity and reflect afterwards, including comparing ideas and findings with initial predictions and reasons. It is important to encourage students to provide evidence that supports their ideas, reasons and reflections.
4. Provide guidelines in the form of questions and headings, and facilitate discussion about recording strategies, for example, note-making, lists, tables and concept maps. Use the class science journal to show students how they can modify and improve their recording strategies.
5. Science journal entries can include narrative, poetry and prose as students represent their ideas in a range of styles and forms.
6. In science journal work, you can refer students to display charts, pictures, diagrams, word walls and phrases about the topic displayed around the classroom. Revisit and revise this material during the unit. Explore the vocabulary, visual texts and ideas that have developed from the science unit, and encourage students to use them in their science journals.
7. Combine the use of resource sheets with journal entries. After students have pasted

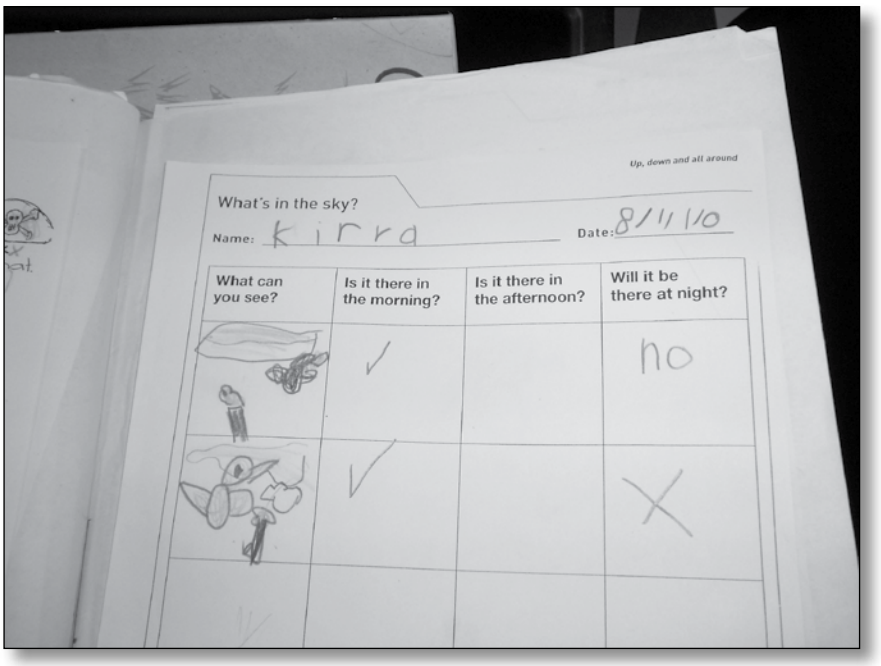
their completed resource sheets in their journal, they might like to add their own drawings and reflections.

8 Use the science journal to assess student learning in both science and literacy. For example, during the *Engage* phase, use journal entries for diagnostic assessment as you determine students' prior knowledge.

9 Discuss the importance of entries in the science journal during the *Explain* and *Evaluate* phases. Demonstrate how the information in the journal will help students develop literacy products, such as posters, brochures, letters and oral or written presentations.

Up, down and all around science journal entry





Appendix 3
How to use a word wall

Introduction

A word wall is an organised collection of words and images displayed in the classroom. It supports the development of vocabulary related to a particular topic and provides a reference for students. The content of the word wall can be words that students see, hear and use in their reading, writing, speaking, listening and viewing.

Goals in using a word wall

A word wall can be used to:

- support science and literacy experiences of reading, viewing, writing and speaking
- provide support for students during literacy activities across all key learning areas
- promote independence in students as they develop their literacy skills
- provide a visual representation to help students see patterns in words and decode them
- develop a growing bank of words that students can spell, read and/or use in writing tasks
- provide ongoing support for the various levels of academic ability in the class
- teach the strategy of using word sources as a real-life strategy.

Organisation

Position the word wall so that students have easy access to the words. They need to be able to see, remove and return word cards to the wall. A classroom could have one main word wall and two or three smaller ones, each with a different focus, for example, high-frequency words.

Choose robust material for the word cards. Write or type words on cardboard and perhaps laminate them. Consider covering the wall with felt-type material and backing each word card with a self-fastening dot to make it easy for students to remove and replace word cards.

Word walls do not need to be confined to a wall. Use a portable wall, display screen, shower curtain or window curtain. Consider a cardboard shape that fits with the unit, for example, an apple for a needs unit.

The purpose is for students to be exposed to a print-rich environment that supports their science and literacy experiences.

Organise the words on the wall in a variety of ways. Place them alphabetically, or put them in word groups or groups suggested by the unit topic, for example, words for an *Up, down and all around* unit might be organised using headings, such as ‘Natural’ and ‘Made’.

Up, down and all around word wall

Using a word wall

1. Limit the number of words to those needed to support the science and literacy experiences in the classroom.
2. Add words gradually and include images where possible, such as drawings, diagrams or photographs. Build up the number of words on the word wall as students are introduced to the scientific vocabulary of the unit.
3. Encourage students to interact with the word wall. Practise using the words with students by reading them and playing word games. Refer to the words during science and literacy experiences, and direct students to the wall when they need a word for writing. Encourage students to use the word wall to spell words correctly.
4. Use the word wall with the whole class, small groups and individually during literacy experiences. Organise multi-level activities to cater for the individual needs of students.

Appendix 4
How to facilitate evidence-based discussions

Introduction

Argumentation is at the heart of what scientists do—they pose questions, make claims, collect evidence, debate with other scientists and compare their ideas with others in the field.

In the primary science classroom, argumentation is about students:

- articulating and communicating their thinking and understanding to others
- sharing information and insights
- presenting their ideas and evidence
- receiving feedback (and giving feedback to others)
- finding flaws in their own and others' reasoning
- reflecting on how their ideas have changed.

It is through articulating, communicating and debating their ideas and arguments that students are able to develop a deep understanding of science content.

Establish norms

Introduce norms before starting a science discussion activity. For example:

- Listen when others speak.
- Ask questions of each other.
- Criticise ideas not people.
- Listen to and discuss all ideas before selecting one.

Question, claim, evidence and reasoning

In science, arguments that make claims are supported by evidence. Sophisticated arguments follow the **QCER** process:

Q What **question** are you trying to answer? For example 'What happens to the melting time when we change the size of the pieces of the chocolate?'

C The **claim**, for example, 'When we break a piece of chocolate into smaller pieces the melting time decreases' or 'Chocolate in smaller pieces melts more quickly'.

E The **evidence**, for example, 'We took chocolate in different sized pieces and measured how long it took them to melt using a fair test. The smaller pieces melted more quickly'.

R The **reasoning**—saying how the evidence supports the claim. For example, 'Since the only thing that changed in the test was the size of the pieces of chocolate, the decrease in melting time is due to the different sized pieces of chocolate. This evidence is also consistent with other scientific evidence and claims, for example, the claim that increasing available surface area increases the heat that enters the object.'
Note: Students are not expected to demonstrate this level of reasoning in Year 1.

Students need to be encouraged to move from making claims only, to citing evidence to support their claims. Older students develop full conclusions that include a claim, evidence and reasoning. This is an important characteristic of the nature of science and an aspect of scientific literacy. Using science question starters (see below) helps to promote evidence-based discussion in the classroom.

Science question starters

Science question starters can be used to model how to discuss a claim and evidence for students. Teachers encourage team members to ask these questions of each other when preparing their claim and evidence. They might also be used by audience members when a team is presenting its results (see The Primary**Connections** 5Es DVD, Chapter 5).

Science question starters

Question type	Question starter
Asking for evidence	I have a question about... What is your evidence to support your claim? Do you have any other evidence to support your claim?
Agreeing	I agree with _____ because _____.
Disagreeing	I disagree with _____ because _____. One difference between my idea and yours is _____.
Questioning more	I wonder what would happen if _____? I have a question about _____ . I wonder why _____? What caused _____? How would it be different if_____? What do you think will happen if _____?
Clarifying	I'm not sure what you meant there. Could you explain your thinking to me again?

DISCUSSION SKILLS

1 Listen when others speak

2 Ask questions of each other

3 Criticise ideas not people

4 Discuss all ideas before selecting one

Appendix 5
Up, down and all around equipment list

EQUIPMENT ITEM	QUANTITIES	LESSON	1	2	3	3	4	5	5	6	7
		SESSION			1	2		1	2		
Equipment and materials											
A4 paper	3 per class			●				●			
A4 paper	3 per class							●			
A3 card or paper	1 per team						●				
garden plot	1 per class			●							
glue	1 per team						●			●	
hoops	3 per class			●							
items to put in garden (see 'Preparation')	1 set per class			●							
pens (coloured)	2 per team				●						
photo (from Lesson 1)	1 per team				●						
photo sets	1 per class, 1 per team						●				
photo of garden (from Lesson 2) enlarged	1 per class									●	
photo set of garden (from Lesson 2) enlarged	1 per class									●	
photo set of garden (from Lesson 2)	1 per student									●	
scissors	1 per team						●			●	
Resource sheets											
'Information note for families' (RS1) enlarged	1 per class				●						
'Information note for families' (RS1)	1 per student				●						
'What changed at night?' (RS2) enlarged	1 per class				●						
'What changed at night?' (RS2)	1 per student				●						
'Change spies' (RS3) enlarged	1 per class										●
'Change spies' (RS3)	1 per student										●

EQUIPMENT ITEM	QUANTITIES	LESSON	1	2	3	3	4	5	5	6	7
		SESSION			1	2		1	2		
Teaching tools											
class science journal	1 per class		●	●	●	●	●	●	●	●	●
word wall	1 per class		●	●	●	●	●	●	●	●	●
student science journal	1 per student			●	●	●	●	●	●	●	●
team roles chart	1 per class			●	●		●			●	
team skills chart	1 per class			●	●		●			●	
role wristbands or badges	1 set per team			●	●		●			●	
Multi-media											
digital camera	1 per class		●	●	●				●		

Appendix 6
Up, down and all around unit overview

		LESSON SUMMARY	LESSON OUTCOMES*	ASSESSMENT OPPORTUNITIES
		Students	Students will be able to	
ENGAGE	**Lesson 1** I spy	• play a game of 'I spy' to identify landscape features and objects in the schoolyard • predict what will look the same in several weeks • discuss changes that might occur over different timescales.	represent their current understandings as they: • identify and describe features of the landscape and sky • contribute to discussions about features of the landscape and sky that change over different timescales • identify the purpose and features of a science journal and word wall • record their predictions in a table.	**Diagnostic assessment** • Science journal entries • Class discussions • Word wall contributions • Tables
EXPLORE	**Lesson 2** Garden grooming	• identify and discuss items as being natural or constructed • discuss how to conduct an investigation of what happens to a garden over time.	• identify whether everyday items in the garden are natural or constructed • work in collaborative learning teams to discuss and sort items into categories • place items in a Venn diagram and review their categories • record their predictions of what the garden will look like in a month, as a drawing in their science journals.	**Formative assessment** • Science journal entries • Class discussions • Word wall contributions • Venn diagrams • Drawings

* These outcomes are aligned to relevant descriptions of the Australian Curriculum: Science and are provided at the beginning of each lesson.

		LESSON SUMMARY	LESSON OUTCOMES*	ASSESSMENT OPPORTUNITIES
		Students	Students will be able to	
EXPLORE	**Lesson 3** Daily changes	• identify things that have changed in the area where they played their 'I spy' game • compare their observations to their predictions • present their home comparisons of night and day landscapes and the sky • discuss why the sky looks different at night.	• work in collaborative learning teams to identify changes that have occurred in a fortnight • compare their observations with their predictions • record their home observations in a table • present and discuss their results with the class.	**Formative assessment** • Science journal entries • Class discussions • Word wall contributions • 'What changed at night?' (Resource sheet 2) • Tables
EXPLORE	**Lesson 4** Seasonal traits	• work in teams to create posters that represent a season • create a class flow chart of the characteristics of seasons • discuss how the seasons flow over the course of a year.	• work in collaborative learning teams to create a poster to represent a season • organise their posters into a flow chart • discuss similarities and differences between seasons • identify regular and predictable changes to the sky and landscape over the course of a year.	**Formative assessment** • Science journal entries • Class discussions • Word wall contributions • Posters • Flow charts

* These outcomes are **aligned** to relevant **descriptions** of the Australian Curriculum: Science and are provided at the beginning of each lesson.

		LESSON SUMMARY	LESSON OUTCOMES*	ASSESSMENT OPPORTUNITIES
		Students	Students will be able to	
EXPLAIN	**Lesson 5** Ask an expert	• identify quick and slow changes to the landscape and sky • prepare questions to gather information about longer-term changes • interview a guest speaker about changes to the landscape and sky.	• identify changes in the features of the landscape and the sky and compare basic timescales of change • identify questions for an interviewee about long-term changes to the landscape and sky • use appropriate oral communication to discuss their questions with their interviewee • represent what they think the school environment used to look like, by drawing.	**Formative assessment** • Science journal entries • Class discussions • Word wall contributions • Interviews • Drawings
ELABORATE	**Lesson 6** It's only natural	• discuss their observations of the changes in the class garden • create a class flow chart to present what happened to the garden over time • identify that natural and constructed things in a garden have different changes over time.	• compare their observations of the garden with their initial predictions • work in teams to represent their understanding by ordering a set of photos into a flow chart • identify natural and constructed features of the garden and how they have changed • respond to and pose questions about what happens when humans stop making changes to the land.	**Summative assessment** of Science Inquiry Skills • Science journal entries • Class discussions • Word wall contributions • Drawings • Tables • Flow charts

* These outcomes are **aligned** to relevant **descriptions** of the Australian Curriculum: Science and are provided at the beginning of each lesson.

		LESSON SUMMARY	LESSON OUTCOMES*	ASSESSMENT OPPORTUNITIES
		Students	Students will be able to	
EVALUATE	**Lesson 7** Time spy	• play an 'I spy' game about how features have changed • students use what they have discovered throughout the unit to create clues for the game • reflect on their learning.	• identify and describe features of the landscape and sky and how the features have changed • contribute to discussions about features of the landscape that change over different timescales.	**Summative assessment** of Science Understanding • Science journal entries • Class discussions • Word wall contributions • 'Change spies' (Resource sheet 3)

* These outcomes are **aligned** to relevant **descriptions** of the Australian Curriculum: Science and are provided at the beginning of each lesson.

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Held annually, this two-day workshop develops a comprehensive understanding of the Primary**Connections** program. Participants receive professional learning resources that can be used to train others in Primary**Connections**.

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Year	Biological sciences	Chemical sciences	Earth and space sciences	Physical sciences
F	*Staying alive*	*What's it made of?*	*Weather in my world*	*On the move*
1	*Schoolyard safari*	*Spot the difference*	*Up, down and all around*	*Look! Listen!*
2	*Watch it grow!*	*All mixed up*	*Water works*	*Push pull*
3	*Feathers, fur or leaves?*	*Melting moments*	*Night and day*	*Heating up*
4	*Plants in action*	*Material world*	*Beneath our feet*	*Smooth moves*
	Friends and foes	*Package it better*		
5	*Desert survivors*	*What's the matter?*	*Earth's place in space*	*Light shows*
6	*Marvellous micro-organisms*	*Change detectives*	*Earthquake explorers*	*It's electrifying*
				Essential energy

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