PrimaryConnections®
Linking science with literacy

Fully aligned with the Australian Curriculum

The PrimaryConnections program is supported by astronomer, Professor Brian Schmidt, Nobel Laureate

Friends or foes?

Year 4

Biological sciences

Primary**Connections project**

Professional learning program

Primary**Connections** comprises a professional learning program supported with exemplary curriculum resources to enhance teaching and learning in science and literacy. 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.primaryconnections.org.au

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Friends or foes?

Year 4

Biological sciences



Who would think that insects as small as the bee and ant would play such a pivotal role in the world's ecosystems and the survival of humankind? Bees are the major pollinators of our food crops. There are more than 1500 plant species in Australia that rely on ants for seed dispersal to continue their life cycle.

The *Friends or foes?* unit is an ideal way to link science with literacy in the classroom. It provides opportunities for students to explore the special relationship between plants and animals, such as bees and ants. Through investigations students investigate about the life cycles of these species as well as the mutually beneficial relationships these species have with one another.

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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 (www.primaryconnections.org.au).

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. 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 (2010–2013)
Australian Academy of Science

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.primaryconnections.org.au)

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 Primary**Connections** 5Es teaching and learning model can be found at: www.primaryconnections.org.au

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 [PISA & OECD], 2009).

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 and to 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.

Assessment

Assessment against the year level achievement standards of the Australian Curriculum: Science (ACARA, 2014) 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 in the *Evaluate* phase for the Science Understanding.

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, 2014).

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). (2014). *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 *Friends or foes?*

Phase	Lesson	At a glance
ENGAGE	**Lesson 1** Tomato troubles	To capture students' interest and find out what they think they know about how living things, including plants and animals, have life cycles and depend on each other and the environment to survive. To elicit students' questions about the reasons for fruit and flowers.
EXPLORE	**Lesson 2** Flower and bees ***Session 1*** Pollinating parts ***Session 2*** The bees' knees ***Session 3*** Flower power	To provide students with hands-on, shared experiences of the beneficial relationship between flowers and bees.
	Lesson 3 Ants and seeds ***Session 1*** Seed detectives ***Session 2*** Spreading seeds	To provide students with hands-on, shared experiences of the seeds of different types of fruit and how seeds are dispersed by ants.
EXPLAIN	**Lesson 4** Coming together	To support students to represent and explain their understanding of the life cycles of bees, ants and plants and the interactions between them, and to introduce current scientific views.
ELABORATE	**Lesson 5** Leaving home	To support students to plan and conduct an investigation of various seed dispersal methods.
EVALUATE	**Lesson 6** Giving advice	To provide opportunities for students to represent what they know about how living things, including plants and animals, have life cycles and depend on each other and the environment to survive, and to reflect on their learning during the unit.

A unit overview can be found in Appendix 7, page 74.

Alignment with the Australian Curriculum: Science

This *Friends or foes?* unit embeds all three strands of the Australian Curriculum: Science. The table below lists sub-strands and their content for Year 4. This unit is designed to be taught in conjunction with other Year 4 units to cover the full range of the Australian Curriculum: Science content for Year 4.

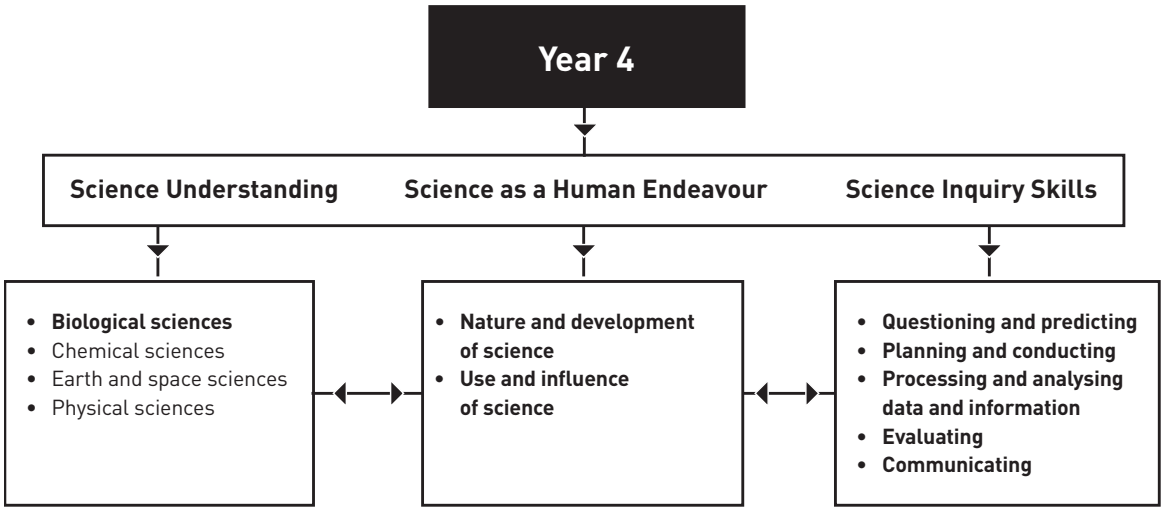
For ease of assessment the table below outlines the sub-strands and their aligned lessons.

Strand	Sub-strand	Code	Year 4 content descriptions	Lessons
Science Understanding	**Biological sciences**	ACSSU072	Living things have life cycles	1–6
		ACSSU073	Living things, including plants and animals, depend on each other and the environment to survive	1–6
Science as a Human Endeavour	**Nature and development of science**	ACSHE061	Science involves making predictions and describing patterns and relationships	2–6
	Use and influence of science	ACSHE062	Science knowledge helps people to understand the effect of their actions	4
Science Inquiry Skills	**Questioning and predicting**	ACSIS064	With guidance, identify questions in familiar contexts that can be investigated scientifically and predict what might happen based on prior knowledge	3, 6
	Planning and conducting	ACSIS065	Suggest ways to plan and conduct investigations to find answers to questions	3, 6
		ACSIS066	Safely use appropriate materials, tools or equipment to make and record observations, using formal measurements and digital technologies as appropriate	2, 3, 6
	Processing and analysing data and information	ACSIS068	Use a range of methods including tables and simple column graphs to represent data and to identify patterns and trends	3, 6
		ACSIS216	Compare results with predictions, suggesting possible reasons for findings	2, 3, 6
	Evaluating	ACSIS069	Reflect on the investigation, including whether a test was fair or not	3, 6
	Communicating	ACSIS071	Represent and communicate ideas and findings in a variety of ways such as diagrams, physical representations and simple reports	1–6

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 *Friends or foes?* these overarching ideas are represented by:

Overarching idea	Incorporation in *Friends or foes?*
Patterns, order and organisation	Students describe the life cycle of flowering plants and insects. They investigate the patterns and mutualistic relationships that exist between plants, bees and ants through the processes of pollination and seed dispersal.
Form and function	Students observe and investigate the parts of flowers and bees that play important roles in pollination as part of the plant life cycle.
Stability and change	Students observe the predictable stages of growth of living things as they change through their life cycle.
Scale and measurement	Students investigate the time scale involved in the growing and changing of living things.
Matter and energy	Students explore the different materials and methods involved in seed dispersal.
Systems	Students identify and describe the relationships that exist between the components of ecosystems, including the interdependency of plants and animals, and their environments'.

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 3–6	Incorporation in *Friends or foes?*
Recognising questions that can be investigated scientifically and investigating them	Students explore the life cycles and interactions between flowering plants, bees and ants. They investigate the process of pollination and seed dispersal, and how the plants and insects benefit mutually. Students conduct a fair test on the food preferences of ants, and observe how they disperse food.

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 from the ACARA website.

By the end of this unit, teachers will be able to make evidence-based judgments on whether the students are achieving below, at or above the Australian Curriculum: Science Year 4 achievement standard.

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 further information see: www.australiancurriculum.edu.au

For examples of our unit-specific general capabilities information see the next page.

Friends or foes?—Australian Curriculum general capabilities

General capabilities	Australian Curriculum description	*Friends or foes?* 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 *Friends or foes?* the literacy focuses are: • science journals • science chat-boards • word walls • cross sections • labelled diagrams • procedural texts • tables • factual texts • storyboards.
 **Numeracy**	Elements of numeracy are particularly evident in Science Inquiry Skills. These include practical measurement and the collection, representation and interpretation of data.	Students: • draw a scale for a cross section diagram • collect and represent data in tables • use time measurements in an investigation of ant behaviour.
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 digital cameras to record observations in investigations • integrate digital images into science journal entries • use interactive resource technology to view pollination and seed dispersal animation.
 **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 evidence to support and discuss claims • make predictions • summarise information from investigations • reflect on learning.
Ethical behaviour	Students develop ethical 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: • participate in discussions • work collaboratively in teams • listen to and follow instructions to safely complete investigations.
 **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.

For further information see: www.australiancurriculum.edu.au

Aboriginal and Torres Strait Islander histories and cultures

The PrimaryConnections Indigenous perspectives framework supports teachers' implementation of Aboriginal and Torres Strait Islander histories and cultures in science. The framework can be accessed at: www.primaryconnections.org.au

Friends or foes? focuses on the Western science way of making evidence-based claims on the life cycles and interactions between living things. Aboriginal and Torres Strait Islander Peoples might have other explanations for why living things interact.

PrimaryConnections recommends working with Aboriginal and Torres Strait Islander community members to access local and relevant cultural perspectives. Protocols for engaging with Aboriginal and Torres Strait Islander community members are provided in state and territory education guidelines. Links to these are provided on the PrimaryConnections website.

Sustainability

The *Friends or foes?* unit provides opportunities for students to develop an understanding of how the growth of some living things can be impacted by environmental conditions, including changes due to human impact. This can assist them 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 Mathematics

Strand	Sub-strand	Code	Year 4 content descriptions	Lessons
English–Language	**Language for interaction**	ACELA1488	Understand that social interactions influence the way people engage with ideas and respond to others for example when exploring and clarifying the ideas of others, summarising their own views and reporting them to a larger group	2–6
	Text structure and organisation	ACELA1490	Understand how texts vary in complexity and technicality depending on the approach to the topic, the purpose and the intended audience	2–6
	Expressing and developing ideas	ACELA1498	Incorporate new vocabulary from a range of sources into students' own texts including vocabulary encountered in research	2–6
English–Literacy	**Interacting with others**	ACELY1689	Plan, rehearse and deliver presentations incorporating learned content and taking into account the particular purposes and audiences	2–5
	Interpreting, analysing, evaluating	ACELY1692	Use comprehension strategies to build literal and inferred meaning to expand content knowledge, integrating and linking ideas and analysing and evaluating texts	3
	Creating texts	ACELY1694	Plan, draft and publish imaginative, informative and persuasive texts containing key information and supporting details for a widening range of audiences, demonstrating increasing control over text structures and language features	6
Mathematics–Measurement and Geometry	**Using units of measurement**	ACMMG084	Use scaled instruments to measure and compare lengths, masses, capacities and temperatures	2, 3
Mathematics–Statistics and Probability	**Data representation and interpretation**	ACMSP096	Construct suitable data displays, with and without the use of digital technologies, from given or collected data. Include tables, column graphs and picture graphs where one picture can represent many data values	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.primaryconnections.org.au).

Teacher background information

Introduction to life cycles and interactions between living things

The majority of plants on earth are flowering plants, including trees, grasses, cacti and other small plants, as well as the flowering plants we readily know.

Flowering plants all go through the same basic stages of a life cycle (birth, life, reproduction and death). Producing flowers and fruit are part of this life cycle. Flowers are the reproductive organs of a plant and usually contain both male and female parts. After fertilisation, the female parts of a flower develop into seed-containing fruits.

Pollination and the formation and dispersal mechanisms of seeds are important components of the flowering plant's life cycle. Plants have developed relationships with animals to attract pollinators to visit them and animals to help spread their seeds.

When living things have relationships with one another it is called symbiosis (meaning 'living together' in Greek). There are a number of symbiotic relationships between living things. This unit explores the relationships known as 'mutualism' and 'cooperation'.

Mutualism and cooperation are relationships where two organisms—plant and animal, plant and plant, plant and fungi or animal and animal—mutually gain benefit from their interactions, however in a cooperative relationship the organisms can survive in the absence of one of the organisms. Bees and flowering plants have a beneficial relationship due to the fertilisation of the plant when the bee is seeking nectar. Some orchids have a mutualistic relationship as they can only be pollinated by one species of bee. Many plant and bee relationships are cooperative as the flower can be pollinated by other pollinators and the bees can harvest pollen from different flower species. Ants may benefit some plants when they disperse their seeds, and the seed helps the ant by providing packets of food for the ant to consume.

Life cycle of a flowering plant

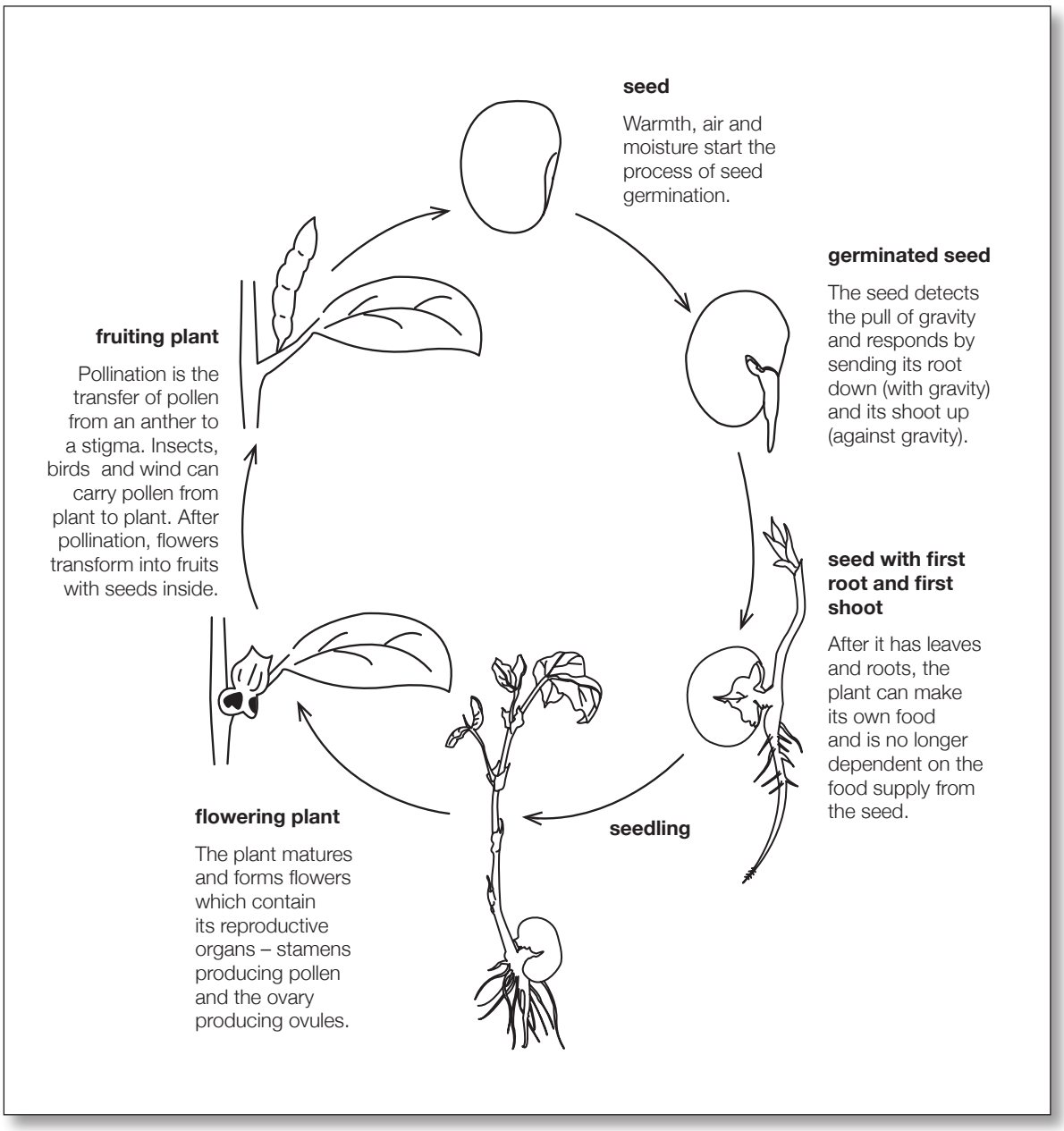
Every flowering plant starts life as a seed. With the right amount of warmth, air and moisture, a seed starts to germinate by sending roots down into the soil and a shoot up towards the sunlight. If the plant receives enough light it grows to become a seedling, and eventually an adult plant. When it is time for the plant to reproduce, it produces flowers. After pollination and fertilisation have occurred, the flower develops into a fruit containing seeds. If the seeds experience suitable conditions for germination, the life cycle starts over again.

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.

Some students might not understand the concept that fruit functions as a seed dispersal system.

Some students might think that plants grow flowers because bees need the pollen and nectar, to make it look nice, to grow seeds or to grow fruit. Flowering plants produce flowers and fruit as part of their reproductive cycle.



Life cycle of a flowering plant

References

Skamp, K. (Ed.) (2012). *Teaching primary science constructively* (4th Edn). 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 Resource which has now been loaded on the Primary**Connections** website: www.primaryconnections.org.au/science-background-resource/.

Note: This background information is intended for the teacher only.

Lesson 1 Tomato troubles

ENGAGE

AT A GLANCE

To capture students' interest and find out what they think they know about how living things, including plants and animals, have life cycles and depend on each other and the environment to survive.

To elicit students' questions about the reasons for fruit and flowers.

Students:

- read a letter and discuss the needs of a tomato plant to produce fruit
- create the life cycle of a tomato plant and include ideas about each stage
- contribute to a science chat-board about the growth of a tomato plant.

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 account of 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:

- how living things, including plants and animals, have life cycles and depend on each other and the environment to survive.

Key lesson outcomes

Science

Students will be able to represent their current understanding as they:

- describe the needs of a flowering plant
- describe the reason for flowers
- describe the reason for fruit
- construct and sequence the life cycle of a tomato plant.

Literacy

Students will be able to:

- contribute to discussions about fruit and the life cycle of a tomato plant
- represent the life cycle of a tomato plant
- contribute to the beginning of a science chat-board and word wall.

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

Teacher background information

Fruits are an adaptation of a plant, which have evolved either to attract animals to eat and later disperse their seeds, or to store seeds for later dispersal, thus contributing to the reproduction of the species.

Each flower must be pollinated in order to make fruit and seeds. Bees are major pollinators of flowers. Fruit is produced after a grain of pollen combines with the ovule inside a flower. Thus, a fruit is a ripened ovary of a flower.

Tomatoes are self-fertile but that does not mean they self-pollinate easily. The pollen needs to be shaken—some motion is required to release it—so it can reach the stigma. Bees buzz their wings at the frequency that dislodges the pollen but other actions, for example, shaking the flower will work also.

Some fruits are edible and fleshy, while some fruits are dry. Seed pods, kernels and nuts are also fruits. Fruits are important food sources for many living organisms. Vegetables are parts of plants that are edible, such as stalks, leaves or tubers. They have not come from the ovary of the flower like fruit.

Equipment

FOR THE CLASS

- class science journal
- word wall
- science chat-board
- tomatoes of different varieties
- 1 enlarged copy of 'Tomato troubles' (Resource sheet 1)
- 1 enlarged copy of 'How does it grow?' (Resource sheet 2)
- 1 set of enlarged images from 'How does it grow?' (Resource sheet 2)
- 3 large sheets of paper (see 'Preparation')

FOR EACH STUDENT

- science journal
- 1 copy of 'Tomato troubles' (Resource sheet 1)
- 1 copy of 'How does it grow?' (Resource sheet 2)

Preparation

- Read 'How to use a science journal' (Appendix 2).
- Read 'How to use a word wall' (Appendix 3).
- Prepare an enlarged copy of and cut out images from 'How does it grow?' (Resource sheet 2) to be used for class science chat-board. (see Lesson step 9)
- Create a science chat-board by joining three large sheets of paper.

ENGAGE

Lesson steps

1 Introduce the tomatoes. Discuss shapes, sizes, taste, how they are eaten and cooked, and favourite types. Ask if any students have grown tomatoes and what they know about growing them.

2 Introduce the enlarged copy of 'Tomato troubles' (Resource sheet 1). Read and discuss with students.

Ask questions, such as:

- Why does a plant produce fruit?
- Why does a plant produce flowers?
- Are people the only ones who eat fruit? What else eats fruit?

3 Distribute copies of 'Tomato troubles' (Resource sheet 1). Ask students to complete the sentences.

Note: In the *Engage* phase, do not provide any formal definitions or correct students' answers as the purpose is to elicit students' prior knowledge.

4 Ask students to share their responses with the class. Record students' answers in the class science journal. Discuss the purpose and features of a science journal.

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.

What does a science journal include?

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

5 Introduce the enlarged copy of 'How does it grow?' (Resource sheet 2). Discuss with students that these are images of different life stages of a tomato plant.

6 Explain that students will cut out each of the images and arrange and paste them into their science journals to show how they think a tomato plant grows. Ask students to add labels or any other information needed to explain their ideas.

7 Allow time for students to complete the activity.

8 Introduce the enlarged images of the life cycle of the tomato plant (see 'Preparation'). Place the images on the science chat-board (see 'Preparation'). Introduce the science chat-board and discuss its purpose and features.

Literacy focus

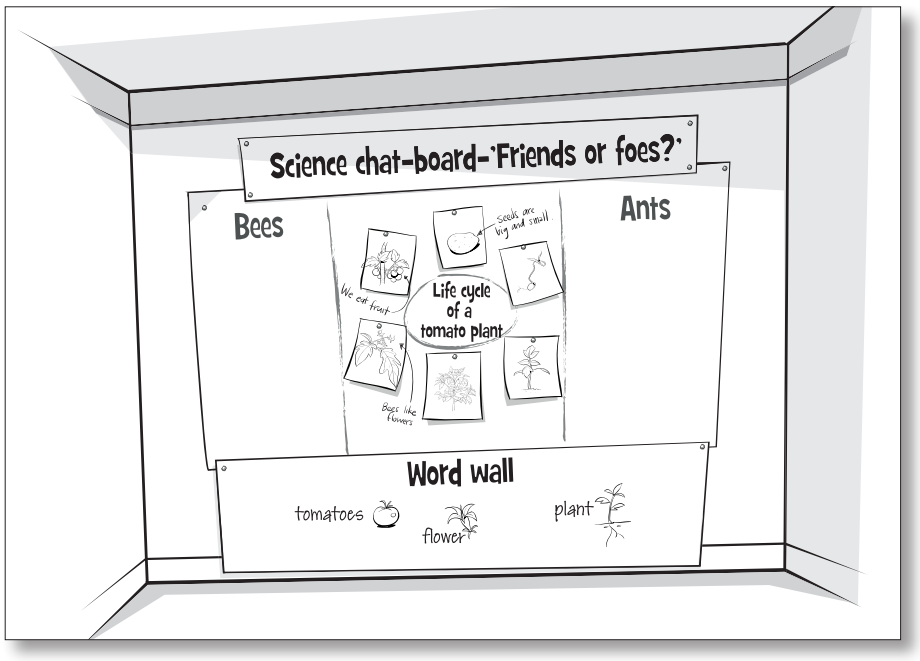
Why do we use a science chat-board?

A **science chat-board** is a display area where we share our changing questions, ideas, thoughts and findings about a science topic.

What does a science chat-board include?

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

9 Ask students to place the images in the order they think that the tomato plant grows. Ask students what ideas they have about the stages in the life of a flowering plant, for example, the tomato plant, and add those to the science chat-board.



***Friends or foes?* science chat-board**

Note: Students may place the images in a line rather than a cycle. This is acceptable at this phase. Ideas about a life cycle will be developed throughout the unit.

10 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 spelled.

What does a word wall include?

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

11 Ask students what new words they have learned in the lesson and add the words and images to the word wall.

Curriculum links

Indigenous perspectives

- Find out about local bush tucker—especially the bush tomato—from local members of the Aboriginal or Torres Strait Islander community. Start a bush tucker garden at school. Explore the different uses of local plants by the Aboriginal people.
  See: http://www.aboriginalculture.com.au/bushfoods.shtml

Tomato troubles

Name: _____ **Date:** _____

Dear Gardening Editor,

I need some help.

I love eating tomatoes, so I thought I would try to grow them myself.

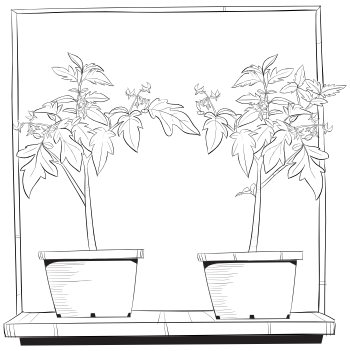
I live in an apartment and I don't have a garden. I am growing my tomato plants on the window sill in the kitchen where they get lots of sun.

I water and fertilise my tomato plants and they have grown well and even grew lots of little yellow flowers. But I haven't seen one tomato yet.

Why aren't there any tomatoes growing on my plants? Can you help me?

Kind regards,

Andy



1. I think that Andy's tomato plants aren't growing tomatoes because:

2. Tomato plants grow tomatoes because:

3. Plants grow flowers because:

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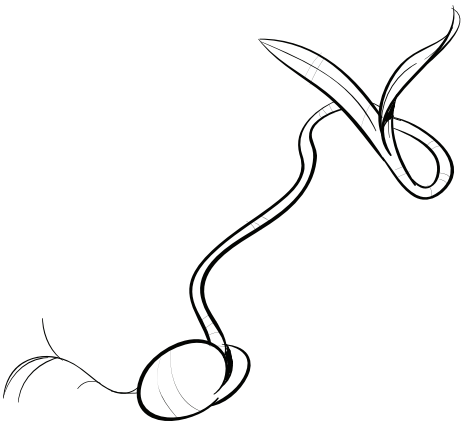
How does it grow?

Name: _____ **Date:** _____

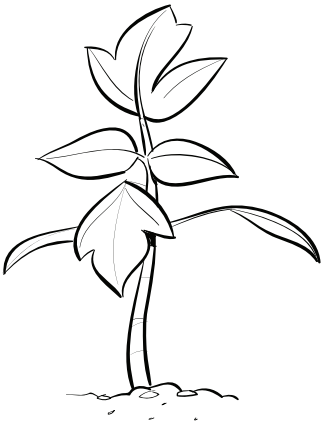
How does a tomato plant grow?
Cut out each picture and arrange to show the life cycle of a tomato plant.



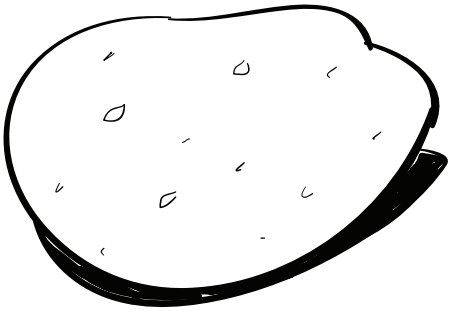
germinating seed

plant with tomatoes

mature plant



seedling



tomato seed

plant with flowers

 ISBN 978 0 85847 341 6

Lesson 2 Flowers and bees

EXPLORE

AT A GLANCE

To provide students with hands-on, shared experiences of the beneficial relationship between flowers and bees.

Session 1 Pollinating parts

Students:

- explore the internal parts of a flower used in pollination.

Session 2 The bees' knees

Students:

- explore the life cycle of a bee
- explore the parts of the bees involved in pollination
- explore why and how bees pollinate flowers.

Session 3 Flower power

Students:

- explore features of flowers that attract pollinators
- create labelled diagrams of a flower highlighting those features.

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:

- the internal parts of flowers, their role in pollination and how bees assist in pollination while meeting their own needs.

You will also monitor their developing science inquiry skills (see page 2).

Key lesson outcomes

Science

Students will be able to:

- discuss the role of parts of the flower in pollination
- explore the role of bees in pollination
- label the parts of the bee involved in pollination
- sequence the life cycle of a bee
- explore the features of flowers used to attract pollinators.

Literacy

Students will be able to:

- accurately draw and label a diagram of a flower
- contribute to discussions about flowers, bees and pollination
- construct a cross section diagram of the internal parts of a flower
- represent the life cycle of a bee
- create a labelled diagram of the features of a flower used to attract pollinators.

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

Teacher background information

Pollination

Pollination is the process by which plants sexually reproduce. Pollination is the delivery of pollen to the female organ of a plant (the pistil in flowers, which is comprised of stigma, style and ovary). Pollen is made by the male organs of a plant (stamens in flowers) and contains genetic information needed for plant reproduction. Pollen may be transferred to female organ on the same plant (self-pollination) or another plant of the same species (cross-pollination). The term cross-pollination can also be used more specifically to mean pollen exchange beween different plant strains or species. As a result of pollination the plants produce seeds.

Tomatoes are self-fertile but that does not mean they self-pollinate easily. The pollen needs to be shaken or some motion is required to release the pollen so it can reach the stigma. Bees buzz their wings at the frequency that dislodges the pollen but other actions such as shaking the flower will work also.

Many plants depend on animals, particularly insects, to transfer pollen as they forage. Plants attract pollinators in various ways, by offering pollen or nectar meals and by guiding them to the flower using scent and visual cues. This has resulted in strong relationships between plants and the animals that pollinate them.

The most sophisticated relationships between plants and insects are generally those involving bees. Bees collect pollen and nectar not only for themselves but also to feed their young. For this reason bees have developed a number of adaptations that make them particularly good pollen carriers. Bees have special hairs that are arranged to form pollen 'baskets' on their hindlegs and the underside of their abdomen. These adaptations allow them to gather and carry large volumes of pollen. Bees are ideal pollinators because they visit many flowers while carrying lots of pollen, before returning to their nest. So the chance that a bee will transfer the pollen between flowers of the same species is very high.

Reference: australianmuseum.net.au/Pollination/

Session 1 Pollinating parts

Equipment

FOR THE CLASS

- class science journal
- science chat-board
- team roles chart
- team skills chart
- word wall
- samples of different flowers that clearly show the pistil and stamen (eg, daffodil, lillium, tulip)
- 1 enlarged copy of 'Cross section of a flower' (Resource sheet 3)

FOR EACH TEAM

- role wristbands or badges for Director, Manager and Speaker
- each team member's science journal
- flower samples (2 per team)
- 1 pair of tweezers
- 1 magnifying glass
- 1 small tray to hold flower samples
- 1 copy of 'Cross section of a flower' (Resource sheet 3) per team member

Preparation

- **Note:** If students have studied the *Plants in action* Year 4 Primary Connections unit, you might choose to review their understanding of the internal parts of a flower, and then move to Step 11.
- Prepare an enlarged copy of 'Cross section of a flower' (Resource sheet 3).
- Purchase flowers, find flowers in the school gardens or ask students to bring in samples of flowers that demonstrate differences in shape, size, colour and perfume.
- Organise two flower specimens for each team that are cut longways through the pistil. (Biologists call this a 'longitudinal section'.)
- Display enlarged copies of the team skills chart and team roles chart in the classroom.

Lesson steps

1. Revise the previous lesson by looking at the seed image and the new information that students learned. Ask questions, such as:
   - How do we know that a tomato is a fruit?
   - Do all fruit have their seeds on the outside?
2. Refer to the science chat-board and the flower image. Explain that students are going to take a closer look at the parts of a flower to help understand why Andy had flowers on his tomato plant but no fruit ('Tomato troubles' Resource sheet 1).
3. Ask students what they know about the parts of a flower. Record students' responses in the class science journal.
4. Explain that students' will be working in collaborative learning teams to explore the parts of a flower. Tell students that you have collected some flowers and cut through them longways so that they can observe a cross section of the flower.

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

Draw students' attention to the equipment table and discuss its use. Explain that this table is where Managers will collect and return equipment.

5 Ask students to observe the flower and draw a cross section of it. Discuss the purpose and features of a cross section.

Literacy focus

Why do we use a cross section?

We use a **cross section** to show the inside of an object.

What does a cross section include?

A **cross section** includes a title, a drawing and an indication of scale. The main features are labelled and lines or arrows connect the label to the feature.

6 Demonstrate how to use the magnifying glass and tweezers to assist students' observations.

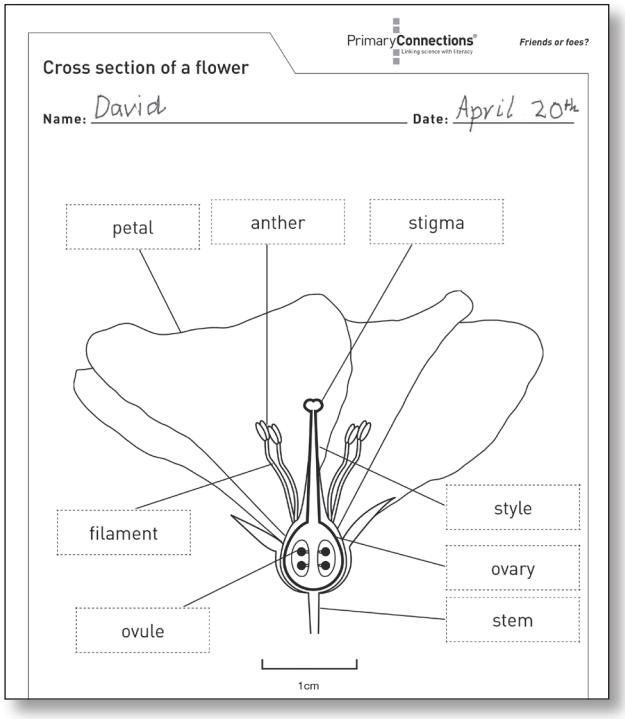
7 Form teams and allocate roles. Ask Managers to collect team equipment.

Allow time for teams to complete the activity.

8 Introduce the enlarged copy of 'Cross section of a flower' (Resource sheet 3). Read and discuss the names of the flower parts. Ask students if they recognise the parts of the flower from observing the cross section.

9 Provide each student with a copy of 'Cross section of a flower' (Resource sheet 3). Ask teams to review their cross sections and add the labels to the matching flower parts.

Re-form teams to complete the activity.



Work sample of a cross section of a flower with labels added

10 Ask some students to show their cross sections and point out the parts of the flower and their scientific names.

11 Revise the enlarged copy of 'Cross section of a flower' (Resource sheet 3). Ask students if they have heard of the word pollination and what they think it means. Record students' responses in the class science journal.

12 Discuss with students that pollination is when pollen is transferred from the male parts of the flower, the anther, to the female part of the flower, the stigma. Ask students to locate the anther and the stigma on the resource sheet. Discuss how once this happens fertilisation occurs and a seed will grow.

13 Ask students to suggest ways that the pollen grains might transfer from the anther to the stigma as the parts are unable to move themselves. Record students' responses in the class science journal. Discuss how at this stage the plant needs help with pollination.

14 Revise the science chat-board and the flower image of the plant stages. Discuss new ideas that might be added. Include lines and arrows to show connections.

15 Update the word wall with words and images.

Curriculum links

Science

- View *The private life of plants*, Episode 3: 'Flowering', David Attenborough (2003), BBC Worldwide Ltd. The first 20 to 25 minutes are particularly useful for this topic.
- Play the interactive game, 'Plant life cycles': http://www.bbc.co.uk/bitesize/ks2/science/living_things/plant_life_cycles/play/

Mathematics

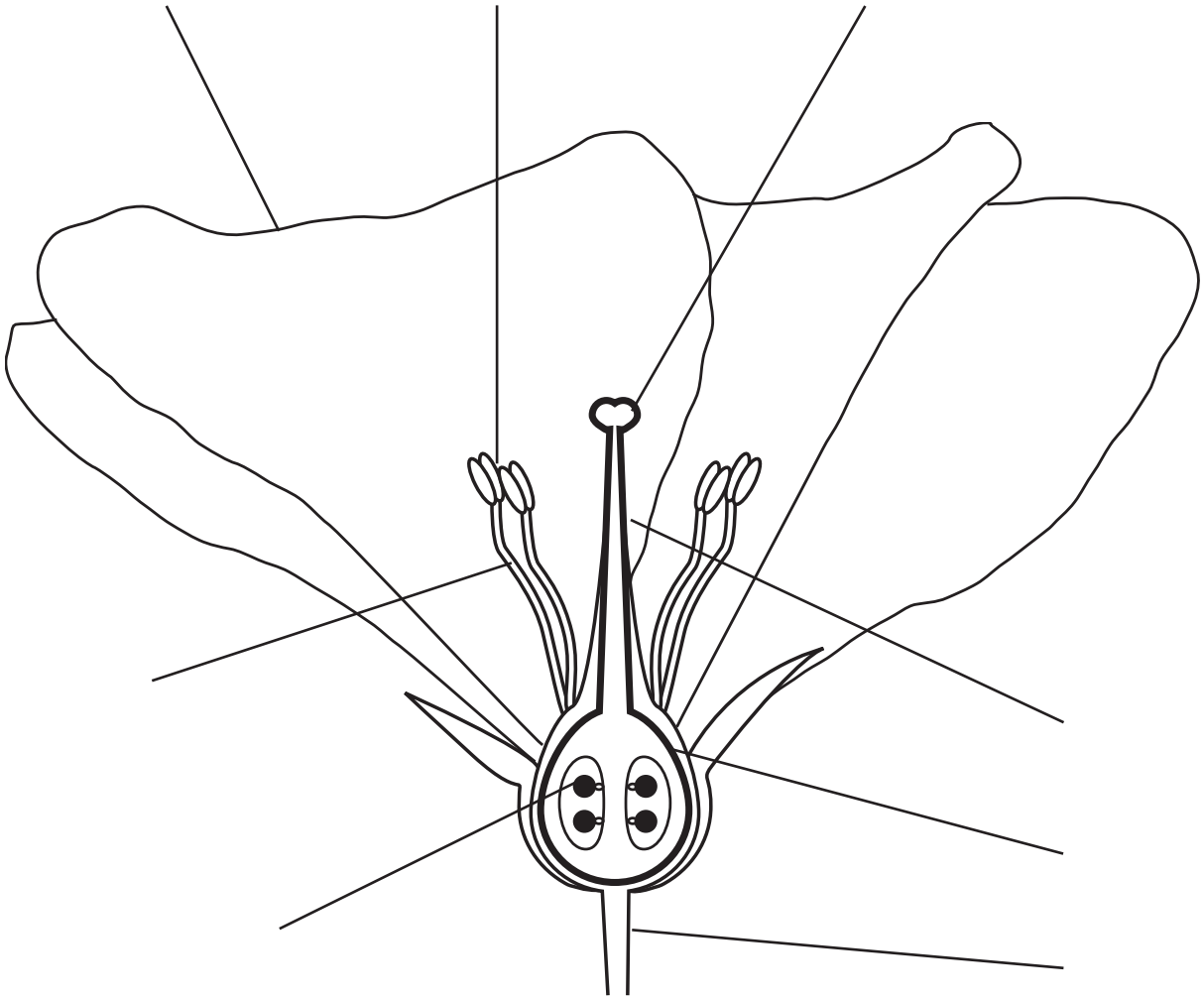
- Revise scale and its use.

Indigenous perspectives

- See www.anbg.gov.au/anbg/aborigibal-trail.html for Indigenous knowledge on Australian native flowering plants.

Cross section of a flower

Name: _____ **Date:** _____



1cm

stem	petal	anther	filament
stigma	style	ovary	ovule

Session 2 The bees' knees

Equipment

FOR THE CLASS

- class science journal
- science chat-board
- team roles chart
- team skills chart
- word wall
- 1 enlarged copy of 'Diagram of a bee' (Resource sheet 4)
- 1 enlarged copy of 'A bee pollinator' (Resource sheet 5)

FOR EACH TEAM

- role wristbands or badges for Director, Manager and Speaker
- each team member's science journal
- 1 copy of 'Diagram of a bee' (Resource sheet 4) per team member
- 1 copy of 'A bee pollinator' (Resource sheet 5) per team member
- 12 pipe cleaners
- 3 paper cups
- 1/2 tspn each of 3 different coloured powdered paints
- double sided self-adhesive tape

EXPLORE

Preparation

- Prepare an enlarged copy of 'Diagram of a bee' (Resource sheet 4).
- Prepare an enlarged copy of 'A bee pollinator' (Resource sheet 5).
- Prepare a video for students to watch showing bees pollinating flowers. For example: http://australianmuseum.net.au/Bee-Scene1 'Solitary bees—the efficient pollinators' and 'Buzz pollination'.

Lesson steps

1. Revise the previous lesson by looking at the flower image of the plant life cycle and the new information that students learned. Ask questions, such as:
   - What parts of the flower are involved in pollination?
   - Why do flowers need help with pollination?
2. Revise students' ideas on ways the pollen grains might get from the anthers to the stigma in a flower.
3. Show students a video of a bee pollinating a flower (see 'Preparation'). Ask students questions, such as:
   - What do you observe the bee doing?
   - What is happening to the legs of the bee as it looks for nectar in the flower?
   - What are you wondering about?
4. Introduce the enlarged copy of 'Diagram of a bee' (Resource sheet 4). Discuss the purpose and features of a labelled diagram.

Literacy focus

Why do we use a labelled diagram?

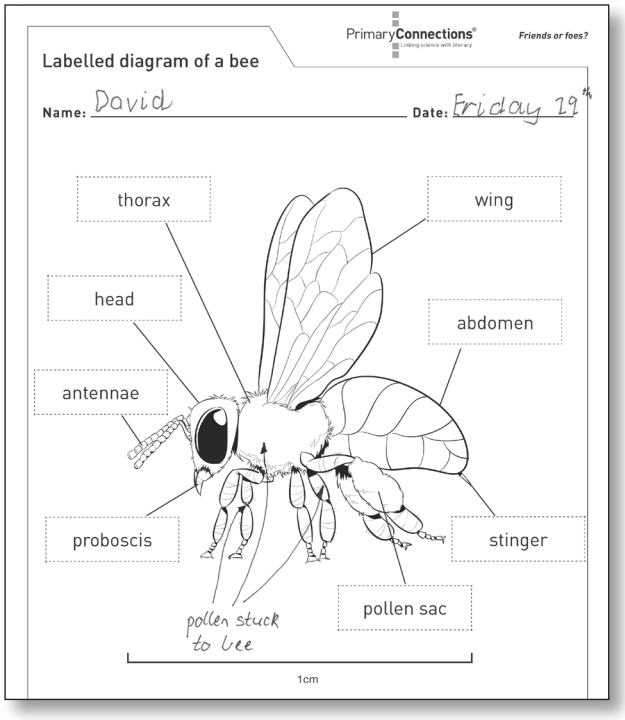
We use a **labelled diagram** to show the shape, size and features of an object.

What does a labelled diagram include?

A **labelled diagram** might include a title, an accurate drawing, a scale to show the object's size and labels showing the main features. A line or arrow connects the label to the feature.

Ask students to label the parts of the bee that collect pollen.

Optional: Show close-up images of bees collecting pollen



Work sample of 'Labelled diagram of a bee' (Resource sheet 4)

5 Explain to students that they are going to work in collaborative learning teams to make a model of a bee and a flower to explore how a bee pollinates flowers.

6 Introduce an enlarged copy of 'A bee pollinator' (Resource sheet 5). Read through and discuss. Discuss the purpose and features of a procedural text.

Literacy focus

Why do we use a procedural text?

We use a **procedural text** to describe how something is done. We can read a **procedural text** to find out how to do things.

What does a procedural text include?

A **procedural text** includes a list of materials needed to do the task and a description of the sequence of steps used. It might include annotated diagrams.

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

Allow time for teams to complete the activity.

8 Discuss the activity with students. Ask students for their responses to the questions on the resource sheet.

9 Discuss with students that some flowers need pollen from other plants of the same species to pollinate (cross-pollinate) while the flowers of other plants, such as tomato plants, use their own pollen (self-pollinate). Ask students questions such as:

- What happened when you put your bee inside other cups to collect nectar? (Pollen from the different cups sticks to the bee and is taken to other cups. This helps flowers that cross-pollinate.)
- What happens if you shake the cup? Does the pollen move around the cup? Do you think it would be easy for the pollen to reach the stigma if you shake the cup? (Self-pollinating flowers like those on a tomato plant can be pollinated by being shaken by the wind, the buzzing wings of a bee or even by people, which might help the pollen reach the stigma.)
- What do you think might happen if flowers were sprayed with a pesticide harmful to bees?

10 Ask students to complete the following sentences about their ideas on bees and pollination in their science journals:

- Bees pollinate flowers because…
- The parts of a bee's body that make it suited to pollination are…
- Bees and flowers have a special relationship because…
- Scientists use models to…

11 Add an enlarged image of an adult bee to the science chat-board. Discuss new ideas that might be added to the science chat-board. Include lines and arrows to show connections.

12 Update the word wall with words and images.

EXPLORE

Curriculum links

Science

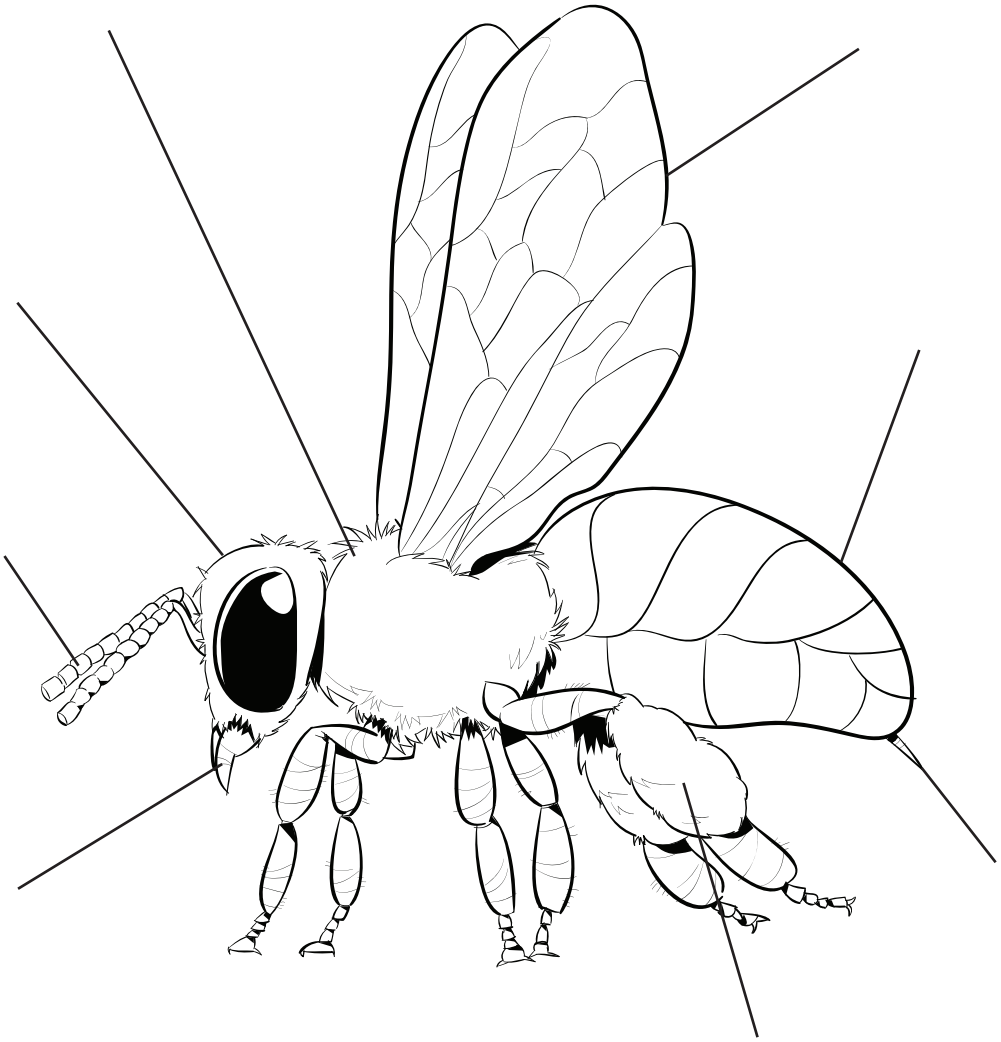
- Use interactive item: Pollination process on the PrimaryConnections Science Background Resource on the PrimaryConnections website (Life and Living; How Plants Function; Plants Systems C).

Indigenous perspectives

- Explore the role of native bees in the process of pollination of Australian native plants. See: www.aussibee.com.au/beesinyourarea.html
- Listen to an audio recording on 'sugarbag' (honey). See: http://www.abc.net.au/rural/reporter/stories/s2661932.htm

Labelled diagram of a bee

Name: _____ **Date:** _____



1cm

antennae	wing	pollen sac	proboscis
stinger	abdomen	head	thorax

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Bee pollinator

Name: _____ **Date:** _____

Aim:

To make a model of a flower and a bee to investigate how a bee pollinates a flower.

Equipment:

- 4 pipe cleaners
- 1 paper cup
- ½ tspn of coloured powdered paint
- double-sided self-adhesive tape

Activity steps:

1. **Nectar:** Colour in the bottom of the inside of the paper cup to represent the nectar at the base of a flower.
2. **Stigma:** Take one pipe cleaner and wrap some of the double-sided tape around one end. Poke the pipe cleaner through the bottom of the cup so that the sticky end is at the top of the pipe cleaner.
3. **Stamens:** Fold two pipe cleaners in half and poke each end through the bottom of the cup.
4. **Anthers:** Dip each end of the stamens into the coloured powder (pollen).
5. **Bee:** Take one of the pipe cleaners and bend it into a shape to represent a bee. Make sure it has a long tongue.

Use your bee to visit your cup and other team member's cup to collect nectar and pollen. Observe what happens.

Questions:

What happened to the bee?

What happened to the pollen?

(Adapted from Australian Museum – Making an insect pollinator. See: australianmuseum.net.au)

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Session 3 Flower power

Equipment

FOR THE CLASS

- class science journal
- science chat-board
- team roles chart
- team skills chart
- word wall
- 1 enlarged copy of 'Blooming flowers' (Resource sheet 6)

FOR EACH TEAM

- role wristbands or badges for Director, Manager and Speaker
- each team member's science journal
- 1 copy of 'Blooming flowers' (Resource sheet 6) per team member
- *optional:* digital camera

Preparation

- Prepare an enlarged copy of 'Blooming flowers' (Resource sheet 6).

Lesson steps

1 Revise the previous lesson by looking at the flower and bee images on the science chat-board and the new information that students learned. Ask questions, such as:

- Why do bees pollinate flowers?
- What parts of the bee are involved in pollination?
- How do flowers benefit from bees visiting them?

2 Discuss with students the importance of flowers to attract bees and other pollinators. Ask questions, such as:

- If flowers did not attract bees or other pollinators what might happen?
- How do you think flowers might attract bees?

3 Introduce an enlarged copy of 'Blooming flowers' (Resource sheet 6). Read through and discuss. Discuss the purpose and features of a table.

Literacy focus

Why do we use a table?

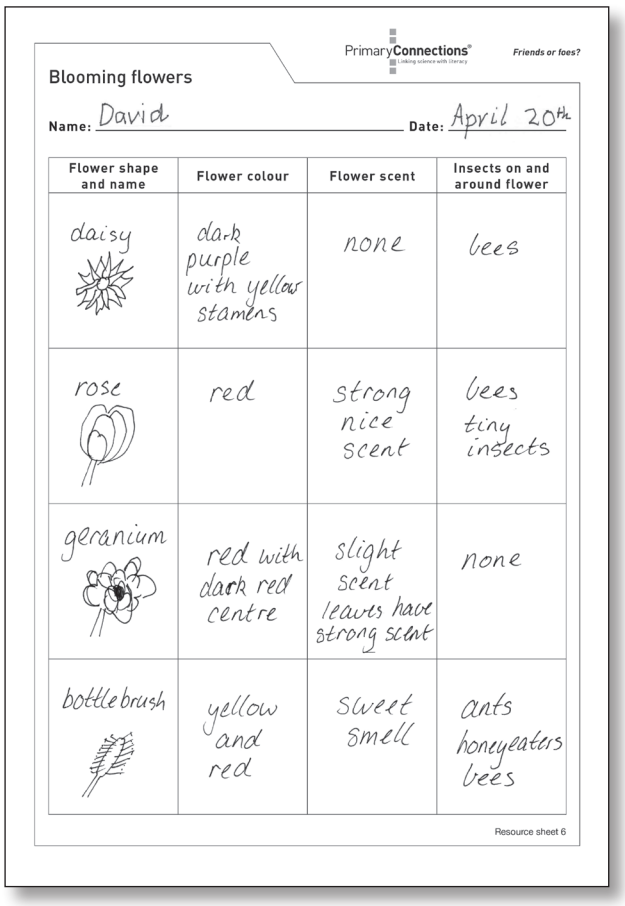
We use a **table** to organise information so that we can understand it more easily.

What does a table include?

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

4 Explain that students will be working in collaborative learning teams to explore the flowers in the school grounds and make observations of features of flowers to attract pollinators. Model an example of completing the table using a flower in the classroom.

Optional: Students use a digital camera to photograph flowers.



PrimaryConnections Linking science with literacy — Friends or foes?

Blooming flowers

Name: David Date: April 20th

Flower shape and name	Flower colour	Flower scent	Insects on and around flower
daisy	dark purple with yellow stamens	none	bees
rose	red	strong nice scent	bees tiny insects
geranium	red with dark red centre	slight scent leaves have strong scent	none
bottlebrush	yellow and red	sweet smell	ants honeyeaters bees

Resource sheet 6

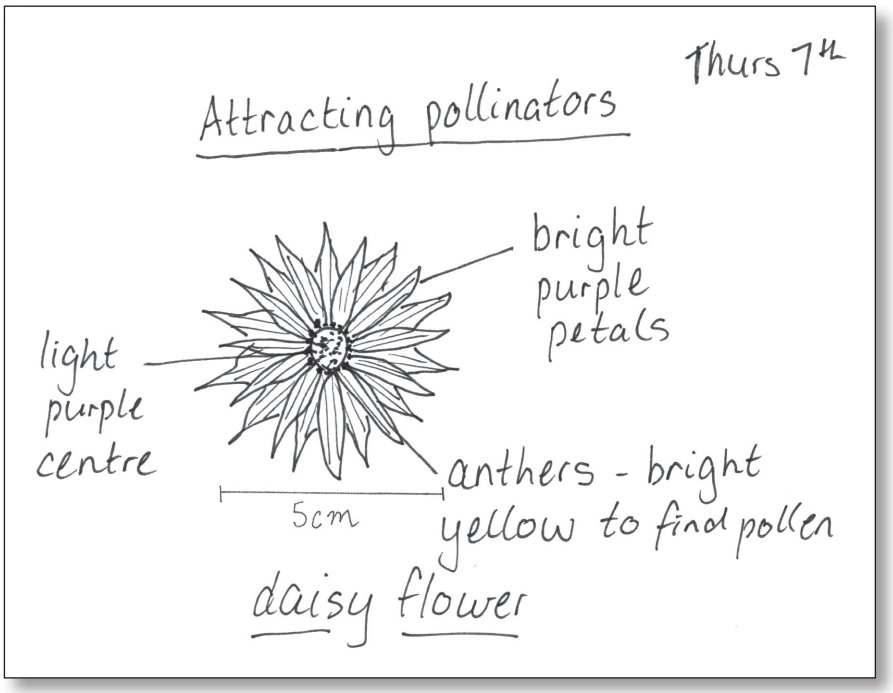
Work sample of 'Blooming flowers' (Resource sheet 6)

EXPLORE

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

Allow time for teams to complete the activity.

6 Ask teams to make a labelled diagram of one of the flowers that they observed and include information recorded about that flower. Revise the purpose and features of a labelled diagram.



Work sample of a flower observed in school grounds

7 Ask teams to present their labelled diagram of a flower that they observed in the school grounds. Ask students questions, such as:

- What have you noticed about the ways that flowers attract bees and other pollinators to visit them?
- Are there common features of the flowers? What are they?

8 Revise the science chat-board and the image of the flower part of the plant life cycle. Discuss new ideas that might be added. Include lines and arrows to show connections.

9 Update the word wall with words and images.

Curriculum links

Science

- Read about the 'Corpse flower' of Indonesia.

Blooming flowers

Name: _____ **Date:** _____

Flower shape and name	Flower colour	Flower scent	Insects on and around flower

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Lesson 3 Ants and seeds

AT A GLANCE

To provide students with hands-on, shared experiences of the beneficial relationship between flowers and bees.

Session 1 Seed detectives

Students:

- explore the internal parts of a flower used in pollination.

Session 2 Spreading seeds

Students:

- explore the life cycle of a bee
- explore the parts of the bees involved in pollination
- explore why and how bees pollinate flowers.

EXPLORE

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:

- the role of fruit and seeds in the life cycle of a plant and the interaction of ants in this process.

You will also monitor their developing science inquiry skills (see page 2).

Key lesson outcomes

Science

Students will be able to:

- explore the scientific definition of fruit
- investigate food preferences of ants
- observe the behaviour of ants and discuss how this behaviour is linked to seed dispersal.

Literacy

Students will be able to:

- use discussion to clarify ideas, make predictions and explain observations
- record observations and explanations about seed dispersal.

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

Teacher background information

From flower to fruit

Fertilisation occurs when the ovules (or small eggs) in the ovary are fertilised by the sperm in the pollen to form seeds. Once fertilisation occurs, the petals wither, eventually falling away. The ovary, containing the fertilised ova, begins to swell into an immature fruit.

Over the course of the growing season, the fruit swells, increasing in size and usually changing colour as well. When fruit is mature, some or all of it is eaten by birds and other animals. The fruit passes through their digestive tracts and the seeds are secreted through the droppings, thereby planting a new generation of seedlings, a process that eventually leads back to the flower-to-fruit cycle. Uneaten fruits drop to the ground, where the fleshy pulp degrades, allowing the seeds to come in contact with the soil and possibly germinate.

Is a tomato a fruit or a vegetable?

Scientifically speaking, a tomato is a fruit. True fruits are developed from the ovary in the base of the flower and contain the seeds of the plant (though cultivated forms may be seedless). Blueberries, raspberries and oranges are true fruits. Some plants have a soft part which supports the seeds and is also called a 'fruit', though it is not developed from the ovary: the strawberry is an example.

In the cooking process, some things which are strictly fruits, such as tomatoes or bean pods, may be called 'vegetables' because they are used in savoury rather than sweet cooking. The term 'vegetable' is more generally used of other edible parts of plants, such as cabbage leaves, celery stalks and potato tubers, which are not strictly the fruit of the plant from which they come. Occasionally the term 'fruit' may be used to refer to a part of a plant which is not a fruit, but which is used in sweet cooking: rhubarb, for example.

Reference: oxforddictionaries.com

Ants

Australia has a high diversity of seed-collecting ants that occur in most habitats across the continent. More than 1500 plant species in Australia rely on ants for seed dispersal.

Ants, like bees, have many close relationships with plants. Plants offer food, such as nectar, which attracts foraging ants which in turn helps control other insect predators on plants. Some plants encourage ants to disperse seed by having an ant food body attached to the seed which attracts the ants to move the seed to its nest, hence replanting the seed elsewhere. This is called myrmecochory (from the Greek 'myrmeco' meaning ants and 'chory' meaning dispersal).

Ants too are a very important indicator of the health of a habitat. They disperse seeds for native plants, and they act as decomposers dragging down rotting material into their nests which then add nutrients to the soil. They also act as pollinators and their underground activities also aerate the soil.

Five potential benefits of seed dispersal by ants to both plants and animals are that it:

1. Reduces competition between young plants and their parents. By distancing the seed from the parent plant and sibling seedlings it lowers the likelihood of competition for resources.

2. Reduces the amount of seeds lost to predation. By moving the seeds into ant nests, it is more difficult for other seed-eating animals to get to them.

3. Provides favourable conditions for seedling growth. Soil in ant nests is less compacted and richer in nutrients than surrounding soils. This is a great advantage to seedlings in arid environments like the Australian interior, which generally have hard, infertile soils.

4. Provides protection from harsh environmental conditions. By moving the seeds below ground they are protected from fire and high summer temperatures.

5. Provides protection for eggs of other insects. Some insects have exploited the seed dispersal behaviour of ants. Stick insects, for example, lay eggs that mimic seeds. These seed-like eggs are taken back to ant nests where they are guarded or discarded by the ants. When the young stick insect hatches, some species look and behave much like an ant. This method acts to disperse the stick insects as much as it does the seeds they mimic.

Reference: http://australianmuseum.net.au/Seed-dispersal/

When seeds are collected by ants, some seeds might be dropped during transportation. Some ants eat seeds and some eat the outer coating only. The seed might then be discarded in underground chambers, near the nest entrance or in the ants' refuse piles. Removal of the coating or the ant food body seems to improve the germination rate of some seeds.

Session 1 Seed detectives

Equipment

FOR THE CLASS

- class science journal
- science chat-board
- team roles chart
- team skills chart
- word wall
- 1 enlarged copy of 'From flower to fruit' (Resource sheet 7)
- 1 enlarged copy of 'Information note for families' (Resource sheet 8)

FOR EACH TEAM

- role wristbands or badges for Director, Manager and Speaker
- each team member's science journal
- 1 copy of 'Information note for families' (Resource sheet 8) per team member
- 1 tomato and 1 other piece of fruit

Preparation

- Prepare an enlarged copy of 'From flower to fruit' (Resource sheet 7).
- Prepare an enlarged copy of 'Information note for families' (Resource sheet 8).

Lesson steps

1 Revise the previous lesson by looking at the flower and bee images on the science chat-board and the new information that students learned. Ask questions, such as:

- Why do flowers attract pollinators to visit them?
- What are some ways that flowers attract pollinators to them?

2 Revise the images of the flower and fruit of the plant life cycle on the science chat-board. Ask students questions, such as:

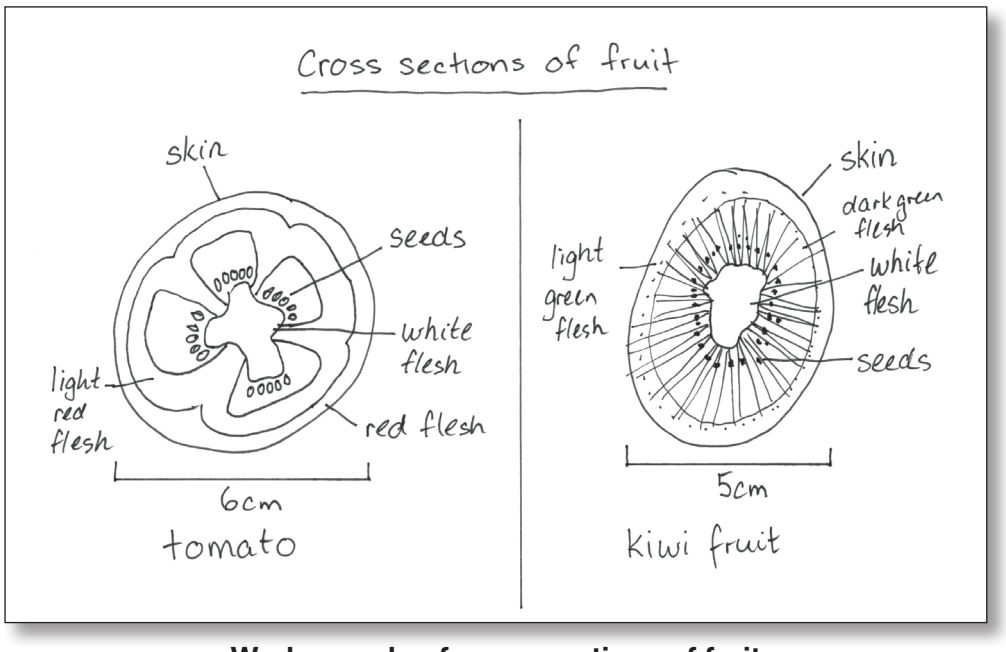
- Why do plants have fruit?
- How does a flower become a fruit?

Record students' responses in the class science journal.

3 Explain that students will be working in collaborative teams to examine the fruit of different plants. Each team will have a tomato and one other type of fruit. Teams will investigate the following questions:

- What do all of the fruit have in common?
- What are the differences between vegetables and fruit?

4 Ask students to also draw a cross section of a piece of fruit. Revise the purpose and features of a cross section.



Work sample of cross sections of fruit

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

Allow time for teams to complete the activity.

6 Ask students to share their cross sections with the class. This can be by using a 'Gallery wall', where all student work is displayed along a wall or corridor, and students peruse each other's work. Ask questions, such as:

- What is similar about all of the cross sections?
- What is different about all of the cross sections?
- Do all fruit have their seeds on the inside?
- Is a tomato a fruit or a vegetable? How do you know?
- How do you think scientists define a fruit?

Create a class definition of a fruit and add to the class science journal.

7 Discuss with students other types of plants that produce seeds. Discuss that seeds come in all shapes and sizes, and come from both flowering trees and shrubs, such as bottle brush and eucalyptus trees, as well as from plants considered to be weeds, such as dandelions and thistles.

Optional: Take students for a walk around the school grounds to look for plants producing seeds and compare their features.

8 Introduce the enlarged copy of 'From flower to fruit' (Resource sheet 7). Discuss the purpose and features of a factual text.

Literacy focus

Why do we use a factual text?

We use a **factual text** to inform, teach or persuade someone reading it. We can read a **factual text** to collect information.

What does a factual text include?

A **factual text** includes a title, text and pictures. It might include labels, diagrams, maps and photographs.

9 Read through and discuss the text and diagram with students. Discuss the questions on the resource sheet and complete as a class.

10 Introduce the enlarged copy of 'Information note for families' (Resource sheet 8). Read through and discuss the information note with students. Discuss with students that the seeds they collect will be used for an investigation later in the unit.

11 Revise the science chat-board and the seed image. Discuss new ideas that might be added. For example, 'Tomatoes are fruit because they contain seeds'. Include lines and arrows to show connections.

12 Update the word wall with words and images.

Curriculum links

Science

- Grow tomato plants inside and outside the classroom. Keep a record of the plants' growth. Compare the difference in growth between the plants.

Indigenous perspectives

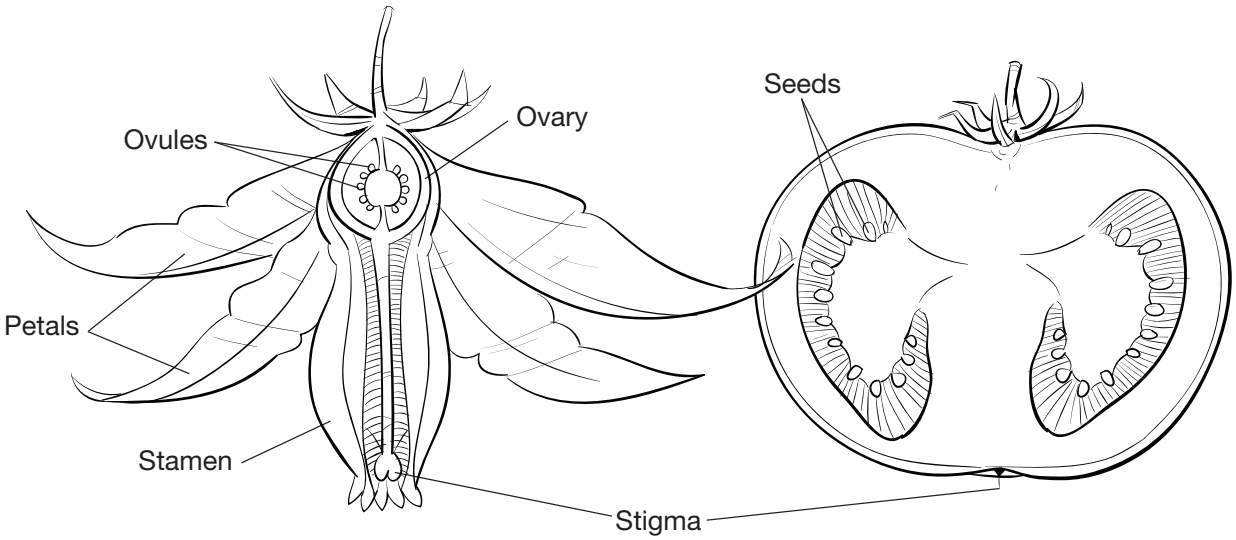
- Discuss Indigenous peoples' use of wattles and their seeds.
  See: www.anbg.gov.au/gardens/education/programs/pdfs/aboriginal-use-of-wattles.pdf

From flower to fruit

Name: _____ **Date:** _____

Once pollination happens, fertilisation occurs in the ovary. After this, the petals fall off, the ovary swells very large into a fruit and the seeds develop on the inside (such as in apples and tomatoes), or on the outside of the fruit (such as in strawberries).

Animals that eat this fruit will spread the seeds around when they drop the seeds or when the seeds pass through the digestive system. This allows the seed to reach soil and germinate, starting the plant life cycle all over again.



Flower (enlarged) **Fruit**

Questions:

Which parts of the flower can still be seen in the fruit?

The ovules in a flower grow and are called what in a fruit?

Information note for families

Name: _____ **Date:** _____

Introducing the 'Seed collecting' task

This term, our class is exploring life cycles and interactions of living things as part of the *Friends or foes?* unit. As part of this unit we would like to learn about seeds that are in our environment and use them in an investigation of seed dispersal.

Tasks to do

Students are asked to:

1. Look for seeds in and around the home. These may be in fruits or vegetables that are eaten or seeds found in the garden.
2. Collect a number of each seed if possible and place in a small plastic bag.
3. Write the name of the flower or fruit on the bag.
4. Take a photo of or draw the fruit or flower that the seed came from and attach to the plastic bag with the date of collection.

Students will be asked to share their collected seeds with the class on _____.

Class teacher

Session 2 Spreading seeds

Equipment

FOR THE CLASS

- class science journal
- science chat-board
- team roles chart
- team skills chart
- word wall
- 1 enlarged copy of 'Ant dispersal investigation planner' (Resource sheet 9)

FOR EACH TEAM

- role wristbands or badges for Director, Manager and Speaker
- each team member's science journal
- 1 copy of 'Ant dispersal investigation planner' (Resource sheet 9) per team member
- card, A4
- 3 different types of food for ants—seeds, sweet, protein (eg, birdseed, brown sugar, crushed dog biscuits)
- timing device
- *optional:* digital camera

Preparation

- Read 'How to conduct a fair test' (Appendix 4).
- Each team will need access to an ant trail or ant nest.

Lesson steps

1 Revise the previous lesson by looking at the flower and fruit images on the science chat-board and the new information that students learned. Ask questions, such as:

- What needs to happen for flowers to become fruit?
- Why do scientists consider tomatoes to be fruit?

2 Watch the video 'Fruit: why plants make them'.
See: splash.abc.net.au/media/-/m/86130/fruit-why-plants-makethem?source=early-primary-science

After viewing the video ask students questions, such as:

- What might be the problem if fruit containing seeds falls close to the parent plant?
- Why would it be better for the plant if its seeds are spread (dispersed) further away?
- How do birds and other animals help spread seeds?

Record students' responses in the class science journal.

3 Ask students if they know which insect is the most commonly involved and effective at seed dispersal (the ant). Discuss that Australia has a high number of seed-collecting ants that collect seeds as food and in doing so disperse the seeds.

Optional: Show students a video on ants taking a seed below ground to eat the part that they like and leaving the seed itself.

See: http://www.bbc.co.uk/nature/adaptations/Seed_dispersal#p00lxvrk

4 Explain to students that different species of ants differ in the types of food they prefer to take back to their nest to eat. Discuss that students will be working in collaborative learning teams to investigate the types of food that ants in their school grounds prefer.

5 Introduce the enlarged copy of the 'Ant dispersal investigation planner' (Resource sheet 9). Discuss the question for investigation, 'What happens to the dispersal of food by ants if we change the type of food available?'.

6 Discuss that students will be placing a small amount of each type of food that they choose on a piece of card a small distance from an ant nest or trail. They will measure

Ant investigation after 30 mins

Ant investigation after 1 hour

the number of ants on the card every minute for fifteen minutes. They will also draw or photograph the card with the food before and after the investigation.

7 For this fair test investigation, discuss with students what things (variables) they will:

- **Change:** type of food
- **Measure/Observe:** the number of ants and the dispersal of food
- **Keep the same:** the distance of the food from the nest or trail, the mass of food, the type of card, the size of the card.

8 Model how to complete the planning section of the investigation planner.

9 Ask each student to complete the planning section of the investigation planner.

10 Explain that students will record their observations of the ants' behaviour as a storyboard. Discuss the purpose and features of a storyboard.

Literacy focus

Why do we use a storyboard?

We use a **storyboard** to show the important steps of a process in the order that they happen.

What does a storyboard include?

A **storyboard** includes a title and a series of drawings. Each step in the **storyboard** is numbered and includes a caption describing the step.

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

Allow time for teams to complete their investigations.

12 Ask teams to share their findings with the class. Encourage students to ask teams questions from the science questions starters (see Appendix 5).

Ask teams questions, such as:

- What food type did your ants prefer? How do you know that?
- What did you notice about the way the ants dispersed the food?
- Were the different food types dispersed in different ways? Why do you think that happened?
- What was similar about all the teams' results? What was different?
- Different species of ants prefer different types of food. For example, some prefer seeds, some like sweet food, others prefer protein such as meat. Do you think that our school grounds might have more than one species? Why do you think that?
- How could we find out more information about the species of ants in our school grounds?
- Scientists think that ants are the most efficient insect dispersers of seed. What thoughts do you have after completing your investigation?

Optional: Make observations of the food cards over the course of a day.

13 Revise the science chat-board with students' new observations and ideas about ants and the role they play in helping disperse seeds as part of plants' life cycles. Include lines and arrows to show connections.

14 Update the word wall with word and images.

Curriculum links

Science

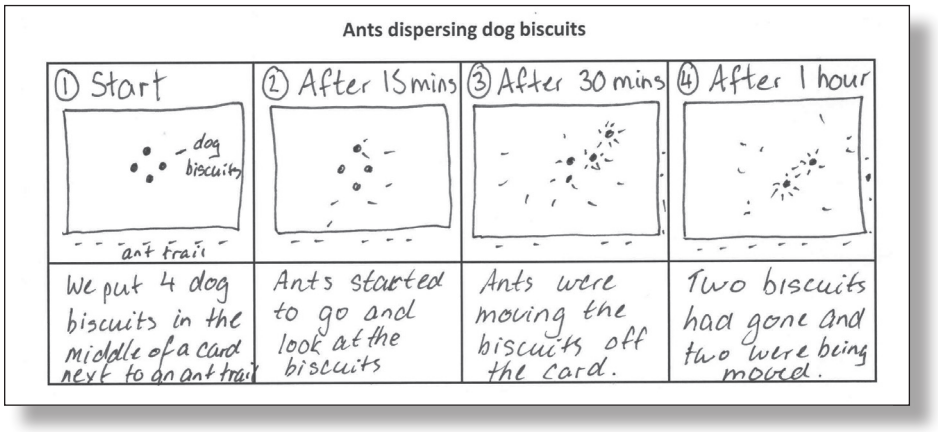
- Play an interactive resource on seed dispersal methods. See: http://www2.bgfl.org/bgfl2/custom/resources_ftp/client_ftp/ks2/science/plants_pt2/dispersal.htm

Mathematics

- Use digital resources to graph results of the investigation.

Indigenous perspectives

- Watch the video 'Honey ant', where Indigenous women discuss bush foods. See: http://aso.gov.au/titles/documentaries/living-country/clip3/



Work sample of storyboard of ant investigation

Ant dispersal investigation planner

Name: _____ **Date:** _____

Other members of your team: _____

What is your question for investigation?	**What do you predict will happen? Explain why.**
What happens to _____ when we change _____?	

To make this a fair test what things (variables) are you going to:

Change?	**Measure/Observe?**	**Keep the same?**
Change only one thing	What would the change affect?	Which variables will you control?

Describe how you will set up your investigation.	**What equipment will you need?**
Use drawings if necessary	Use dot points

Write and draw your observations in your science journal

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Recording results

Number of ants on food cards			
Minutes	**Food 1**	**Food 2**	**Food 3**
1 min			
2 mins			
3 mins			
4 mins			
5 mins			
6 mins			
7 mins			
8 mins			
9 mins			
10 mins			
11 mins			
12 mins			
13 mins			
14 mins			
15 mins			

Observations of ant dispersal

Draw or take photos of the food cards before and after the investigation to show the dispersal of the food by the ants. Add the images as a storyboard to your science journal.

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Explaining results

What happened to the dispersal of the food by ants when you changed the type of food?

Why did this happen?

Did your results match your prediction?

Evaluating the investigation

What challenges do you experience doing this investigation?

How could you improve the investigation?

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Lesson 4 Coming together

AT A GLANCE

To support students to represent and explain their understanding of the life cycles of bees, ants and plants and the interactions between them, and to introduce current scientific views.

Students:

- make word chains to explain interactions between flowering plants, bees and ants
- use cards to match scientific terminology to describe important parts and processes of these interactions.

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 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 living things, including plants and animals, have life cycles and depend on each other and the environment to survive.

Key lesson outcomes

Science

Students will be able to:

- explain interactions between flowering plants, ants and bees
- sequence the stages of the life cycle of flowering plants and insects.

Literacy

Students will be able to:

- use scientific terminology to explain parts and processes of these interactions.
- contribute to discussions explaining the interactions between flowering plants, ants and bees.

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
- science chat-board
- team roles chart
- team skills chart
- word wall
- 1 enlarged copy of 'Life cycles jumble 1' (Resource sheet 10)
- 1 enlarged copy of 'Life cycles jumble 2' (Resource sheet 10)

FOR EACH TEAM

- role wristbands or badges for Director, Manager and Speaker
- each team member's science journal
- 1 copy of 'Life cycles jumble 1' (Resource sheet 10) per team member
- 1 copy of 'Life cycles jumble 1' (Resource sheet 10) and 'Life cycles jumble 2' (Resource sheet 10) printed on card

Preparation

- Prepare an enlarged copy of 'Life cycles jumble 1' (Resource sheet 10).
- Prepare an enlarged copy of Life cycles jumble 2' (Resource sheet 10).
- Print a copy of 'Life cycles jumble 1' (Resource sheet 10) and 'Life cycles jumble 2' (Resource sheet 10) on card for each team.

Lesson steps

1 Revise the previous lesson by looking at the seed and ant images on the science chat-board and the new information that students learned about seed dispersal. Ask questions, such as:
   - Why do ants disperse seeds?
   - Why do plants disperse their seeds?

2 Introduce an enlarged copy of 'Life cycle jumble 1' (Resource sheet 10). Read through and discuss with students that these are all words taken from the unit so far about life cycles and how plants, bees and ants might interact.

3 Explain that students will work in their collaborative learning teams to cut out, make word chains using the different words and paste the chains into their science journals.

4 Discuss and model some examples:
   - bee – pollinate – flower
   - flower – anthers – stigma – bee – pollinate – ovary – fruit
   - fruit – seed – ant – seedling – mature plant
   - egg – larva – pupa – bee

   Discuss that teams will be asked to explain their word chains.

5 Form teams and allocate roles. Ask Managers to collect team equipment.
   Allow time for teams to complete the activity.

6 Ask teams to present their word chains to the class and explain why they made those connections.

7 Discuss with students what things could affect the connections. Ask questions, such as:

- What might the use of pesticides that are toxic to bees have on these interactions?
- What might the introduction of another species of bees or ants from another country have on these interactions?
- What other activities of humans might have an effect on these interactions?

8 Introduce enlarged copies of 'Life cycles jumble 1' and 'Life cycles jumble 2' (Resource sheet 10). Read through the enlarged copy of 'Life cycles jump 1' and discuss with students that these are descriptions, labels and images that are used during the unit.

9 Explain that students will cut the cards (see 'Preparation') to play a matching game. Students will:

- Shuffle all the cards and place face up on the desk.
- Arrange the images in sequence to show the life cycle of a bee and of a tomato plant.
- Match a label to each of the images.
- Match the remaining cards in pairs. (A pair consisting of a label and its description).

10 Re-form teams. Allow time for teams to play the game.

11 Discuss the game and any word matches that students had difficulty with. Discuss how both plants and animals have life cycles, and how scientists describe these as circular, rather than linear. Discuss the interdependency of plants and animals and the environment for survival.

12 Revise the science chat-board. Discuss new ideas that might be added. Include lines and arrows to show connections.

13 Update the word wall with words and images.

EXPLAIN

Life cycles jumble 1

pollination	anthers	ants	pollen
plant with fruit	seed dispersal	seed	fruit
bees	larva	flower	adult
pupa	seedling	pollinators	egg
plant with flowers	ovary	mature plant	stigma

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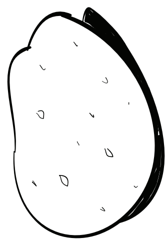
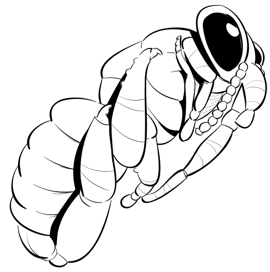
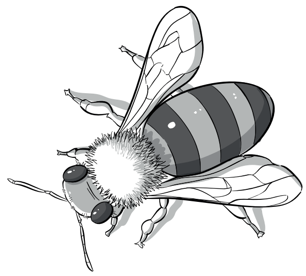
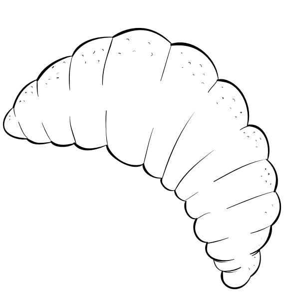
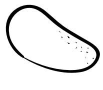
Life cycles jumble 2

Moving pollen from the anthers to the stigma	The part of the flower that contains the pollen	They are good at dispersing seeds	Carried by bees to pollinate flowers
	Moving seeds away from the parent plant		The part of the plant that contains its seeds
The main pollinators of flowers		The part of a plant that attracts bees to it	
		Some examples are bees, birds, beetles, ants	
	Swells after fertilisation to become fruit		The part of the flower that receives the pollen grains

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Lesson 5 Leaving home

AT A GLANCE

To support students to plan and conduct an investigation of various seed dispersal methods.

Students:

- observe seed dispersal methods and discuss observations
- investigate seed dispersal tests to decide on the dispersal method of a range of seeds.

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 (see page 3).

ELABORATE

Key lesson outcomes

Science

Students will be able to:

- explore a range of seed dispersal methods
- investigate and make claims with evidence about a seed's method of dispersal.

Literacy

Students will be able to:

- discuss the relationship between seed dispersal and the environment
- use a table to record observations
- use group discussion to clarify ideas, make predictions and discuss claims about seed dispersal.

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

Teacher background information

Often fertilisation and pollination are the most emphasised aspects of the plant's reproductive cycle this but this isn't the end of the process. After seeds form, it is important that these seeds are dispersed away from the parent plant and from other seeds to ensure species survival. This is to prevent overcrowding and competition for light, water and nutrients needed for the seed to grow into a strong plant. It also enables the plant to take advantage of new optimal growing environments. Therefore, seeds have a better chance of survival if they are blown, carried, rolled, pushed or washed away from the parent plant.

Different plants have evolved seeds of different shape, size and texture which will suit one method of dispersal over another.

Wind – Some seeds are transported by wind and are designed to float, glide or spin through the air.

Water – Some seeds float on nearby flowing water to travel to a new site.

Animals – Many plants use animals, including humans, to move seeds around. Some seeds might have hooks that attach to animal fur and eventually drop off elsewhere. Other seeds are eaten or have parts that are edible, allowing the seed to relocate as it gets carried away by the consumer and passes through the digestive system or is buried.

Bursting – Some seeds are propelled away from the plant itself by a mechanism in which the seed pod twists apart and expels the seed in an explosive manner.

Equipment

FOR THE CLASS

- class science journal
- science chat-board
- team roles chart
- team skills chart
- word wall
- 1 enlarged copy of 'Travelling seeds procedure' (Resource sheet 11)
- 6 numbered containers (for seeds)
- seed samples (see 'Preparation)
- electric fan

FOR EACH TEAM

- role wristbands or badges for Director, Manager and Speaker
- each team member's science journal
- 1 copy of 'Travelling seeds procedure' (Resource sheet 11) per team member
- magnifying glass
- container for water
- woollen sock
- self-adhesive tape

Preparation

- Read 'How to facilitate evidence-based discussions' (Appendix 5).
- Prepare an enlarged copy of 'Travelling seeds procedure' (Resource sheet 11).
- Check seeds that students have brought from home for the 'Seed collecting' task. Ensure that there are enough seeds for the whole class to illustrate seed dispersal methods. Examples include:

Wind	sheoak, hakea, pines, lettuce, dandelions, daisies, thistles
Water	water chestnuts, coconut, tea tree, red gum, apple, passionfruit, any fruit or seed that floats on water
Animals	**Digestion:** tomato, kiwi fruit, cucumber, zucchini, squash, strawberries **Hooks:** grass including both native and introduced grasses, burrs, forget-me-nots
Bursting	pea, broccoli, bean, wattle, pomegranate

Place a quantity of each seed in numbered containers.

Lesson steps

1 Review the ant seed dispersal investigation. Discuss the importance of plants using ants to help disperse seeds and the benefit of this to ants.

2 Explain that using ants and other animals is one way that plants might disperse their seeds. Ask students if they know of other ways that plants disperse their seeds. Record students' responses in the class science journal.

3 View videos on seed dispersal methods. For example, see:

- *Seed dispersal* with David Attenborough (produced by BBC) available through YouTube
- Interactive resource on seed dispersal: www2.bgfl.org/bgfl2/custom/resources_ftp/client_ftp/ks2/science/plants_pt2/dispersal.htm

4 Explain to students that all plants have a unique method of dispersing seeds which has evolved over thousands of years. Discuss the four main methods of seed dispersal (wind, water, animals and bursting). Ask students which methods they observed in the video/s. Record these in the class science journal. Discuss with students if they have observed any of these methods of seed dispersal in life.

5 Discuss the different types of seeds that students have brought to school for the 'Seed collecting' task. Discuss the fruit that each seed type has come from and the similarities and differences between the features of the seed types.

ELABORATE

6 Introduce an enlarged copy of 'Travelling seeds procedure' (Resource sheet 11). Read through and discuss. Show students the numbered containers with a quantity of seeds in each. Explain that students will be working in collaborative learning teams to investigate which dispersal method each seed might use to travel.

7 Explain that students will firstly use a magnifying glass to make observations of the seed, and record key features under the 'Observations' column of 'Travelling seeds procedure' (Resource sheet 11). Students will then test the seed using three tests:

The wind test: hold the seed 10 cm in front of a blowing fan. Let it go. Record how far it travelled.

The water test: drop the seed into a container of water and stir. Record your observations.

The hitchhiker test: press the seed onto a woollen sock. Record your observations.

8 Discuss that after the tests you will advise if the seed came from a pod or a fruit. Students will then be able to record if it is likely that the seed uses bursting (comes from a pod) or digestion (comes from a fruit) as a method of seed dispersal.

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

Allow time for teams to complete the activity.

Advise students if each seed came from a pod or a fruit, so that teams can complete their investigation.

10 Ask teams to present their findings on each seed using the sentences:

We claim that seed number 1 uses _____ to travel because_____.

Encourage students to ask teams questions using the science questions starters (see Appendix 5).

Record teams' claims for each seed in the class science journal.

11 Discuss the relationship between seed dispersal and the environment, and the interdependence of plants and animals for survival.

12 Revise the science chat-board. Discuss new ideas that might be added. Include lines and arrows to show connections.

13 Update the word wall with words and images.

ELABORATE

Curriculum links

Science

- Design and make a seed that travels using each of the four dispersal methods: wind, water, animals and bursting.

Travelling seeds procedure

Name: _____ **Date:** _____

Other members of your team: _____

Question: What type of seed dispersal does each seed use?

Equipment:

- 1 fan
- 1 container of water
- 1 woollen sock
- 1 copy of 'Travelling seeds procedure' (Resource sheet 11)
- 1 seed from each seed container
- 1 magnifying glass
- self-adhesive tape

Activity steps:

1. Take one seed from each seed container and tape on the sheet next to the matching number.
2. Carry out the wind, water and hook seed dispersal tests using each seed and record your observations.
3. Find out from the teacher if the seed came from a pod or a fruit. Complete the last two sections on your sheet for 'Digestion' and 'Bursting'.
4. Make a claim about each of the seeds and what seed dispersal method you think it uses.

Explaining results:

Seed 1: We claim that it travels by _____

because _____

Seed 2: We claim that it travels by _____

because _____

Seed 3: We claim that it travels by _____

because _____

Seed 4: We claim that it travels by _____

because _____

Seed 5: We claim that it travels by _____

because _____

Seed 6: We claim that it travels by _____

because _____

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Recording results

Name: _____ **Date:** _____

Seed	Wind test (How far did it go?)	Water test (Did it float or sink?)	Hook test (Did it stick or fall off?)	Digestion (From a fruit?)	Bursting (From a pod?)
1					
2					
3					
4					
5					
6					

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Lesson 6 Giving advice

AT A GLANCE

To provide opportunities for students to represent what they know about how living things, including plants and animals, have life cycles and depend on each other and the environment to survive, and to reflect on their learning during the unit.

Students:

- explain why a tomato plant isn't producing tomatoes
- arrange and annotate pictures to represent the life cycle of a flowering plant
- reflect on their learning during the unit.

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 descriptions is an important aspect of the *Evaluate* phase. In this lesson you will be looking for evidence of the extent to which students understand:

- how living things have life cycles, and how living things, including plants and animals, depend on each other and the environment to survive.

Key lesson outcomes

Science

Students will be able to:

- explain the interactions between flowering plants, bees and ants
- describe the process of pollination and seed dispersal
- explain the stages in the life cycle of a flowering plant.

Literacy

Students will be able to:

- contribute to discussions about plant life cycles and interactions between living things
- reflect on their learning through science journal entries.

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
- science chat-board
- 1 enlarged copy of 'Tomato troubles' (Resource sheet 1)
- 1 enlarged copy of 'How does it grow?' (Resource sheet 2)

FOR EACH STUDENT

- science journal
- 1 copy of 'Tomato troubles' (Resource sheet 1)
- 1 copy of 'How does it grow?' (Resource sheet 2)

Preparation

- Prepare an enlarged copy of 'Tomato troubles' (Resource sheet 1).
- Prepare an enlarged copy of 'How does it grow?' (Resource Sheet 2).

Lesson steps

1 Review the enlarged copy of 'Tomato troubles' (Resource sheet 1) where students read a letter from Andy whose tomato plant wasn't producing tomatoes. Read the letter and the sentence starters at the bottom of the resource sheet.

2 Explain that students are going to complete the sentences again now that they have learned more about flowering plants, bees, ants and how they interact. Provide time for students to complete the sentences.

3 Ask students to share their new sentences with a partner. Ask students to read what they wrote at the beginning of the unit, and tell their partner about how their ideas have changed and why they have changed (the evidence they have used).

4 Provide each student with a new copy of 'How does it grow?' (Resource sheet 2). Ask students to cut out the pictures and glue them into their science journals in the order that they think best represents the flowering plant's life.

5 Ask students to include labels and information about each stage. Ask them to include arrows that link the pictures. Provide time for students to complete the activity.

6 Review the class science chat-board and discuss what the students have learned and how they learned those things.

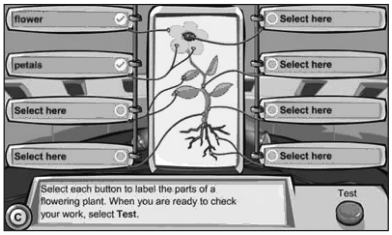
7 Ask students to reflect on their learning during the unit. Ask questions, such as:

- What did you think about _____ at the start of the unit. What do you think now?
- What have you learned about…?
- What activity did you enjoy the most? Why?
- What activity did you find the most challenging why?
- What are you still wondering about?

Curriculum links

Information and Communication Technology (ICT)

- Use the interactive crossword puzzle *The life cycle of flowering plants* on the PrimaryConnections website (See Curriculum Resources: Plants in Action: Other).



Plant scan, L31 (www.scootle.edu.au)

Students undertake a quiz on plant parts and functions. They label features of plants and match the correct function with plant parts.

EVALUATE

Appendix 1
How to organise collaborative learning teams (Year 3–Year 6)

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.

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

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.
- If you cannot divide the students in your class into teams of three, form two teams of two students rather than one team of four. It is difficult for students to work together effectively in larger groups.
- 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 Year 3–Year 6, the teams consist of three students—Director, Manager and Speaker. (For Foundation–Year 2, teams consist of two students—Manager and Speaker.)

Each member of the team should wear something that identifies them as belonging to that role, such as a wristband, badge, or colour-coded 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 (Year 3–Year 6)

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
- Take turns
- Perform your role.

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.

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 ROLES

Manager

Collects and returns all materials the team needs

Speaker

Asks the teacher and other team speakers for help

Director

Make sure that the team understands the team investigation and completes each step

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

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.

Keeping a science journal aligns to descriptions in the Australian Curriculum: Science and English. See pages 2 and 7.

Using a science journal

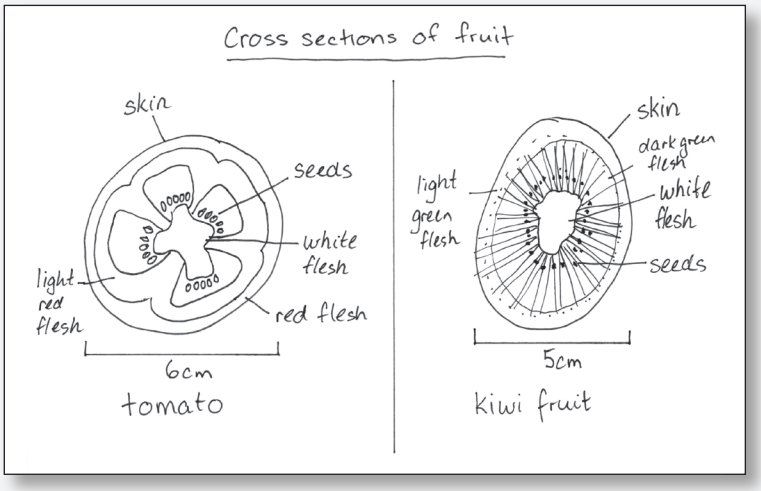
1. At the start of the year, or before starting a science unit, provide each student with a notebook or exercise book for their science journal or use an electronic format. Tailor the type of journal to fit the needs of your classroom. Explain to students that they will use their journals to keep a record 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 year levels 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, such as 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.

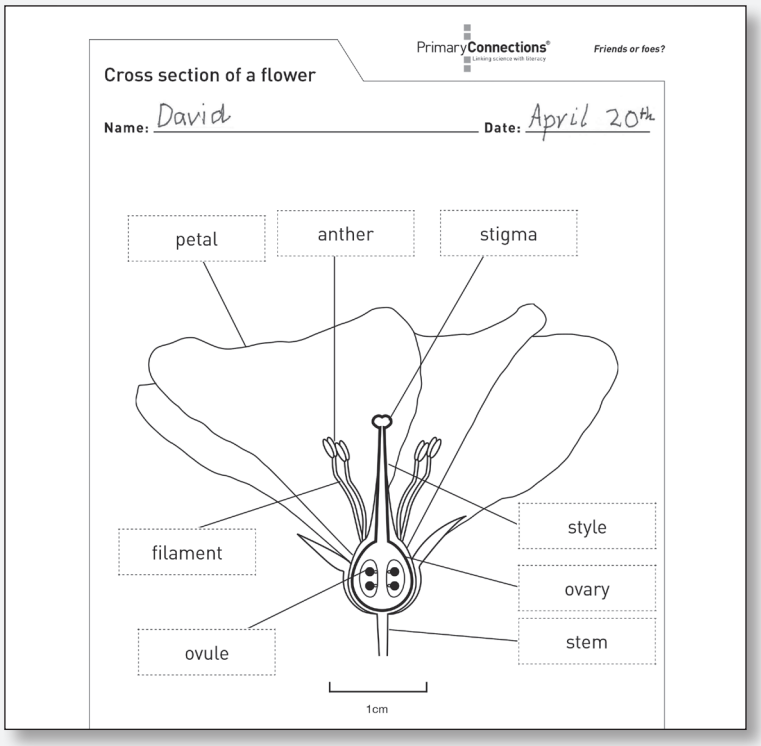
7 Combine the use of resource sheets with journal entries. After students have pasted their completed resource sheets in their journal, they might like to add their own drawings and reflections.

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.

Friends or foes? science journal





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.

Creating a class word wall, including words from regional dialects and languages, aligns to descriptions in the Australian Curriculum: English. See page 7.

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.

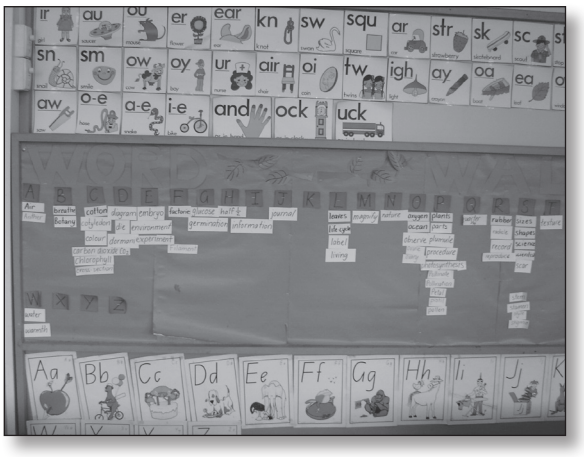
Choose robust material for the word cards. Write or type words on cardboard and perhaps laminate them. Consider covering the wall with felt-type material and backing each word card with a self-adhesive dot to make it easy for students to remove and replace word cards.

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.

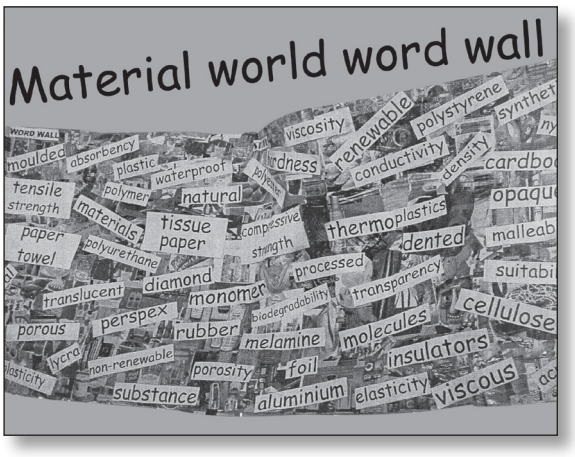
The purpose is for students to be exposed to a print-rich environment that supports their science and literacy experiences.

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 a *Friends or foes?* unit might be organised under headings, such as ‘flowering plants’ and ‘bees’ and ‘ants’.

Invite students to contribute different words from different languages to the word wall. Group words about the same thing, for example, flowering plants, bees and ants on the word wall so that the students can make the connections. Identify the different languages used, for example, by using different-coloured cards or pens to record the words.



***Plants in action* word wall**



***Material world* word wall**

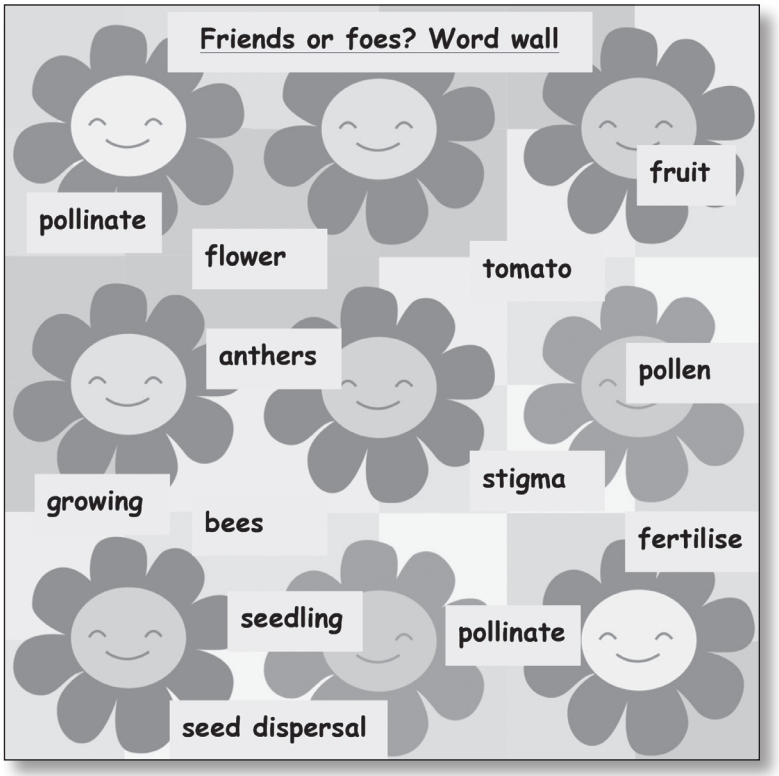
Using a word wall

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.



***Friends or foes?* word wall**

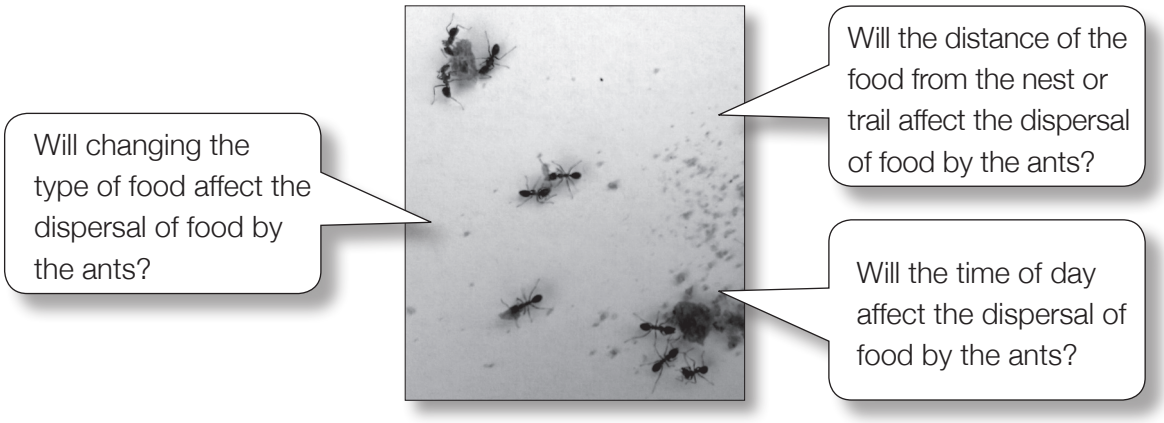
Appendix 4
How to conduct a fair test

Introduction

Scientific investigations involve posing questions, testing predictions, collecting and interpreting evidence and drawing conclusions and communicating findings.

Planning a fair test

In *Friends or foes?*, students investigate things that affect the dispersal of food by ants.



All scientific investigations involve *variables*. Variables are things that can be changed (independent), measured/observed (dependent) or kept the same (controlled) in an investigation. When planning an investigation, to make it a fair test, we need to identify the variables.

It is only by conducting a fair test that students can be sure that what they have changed in their investigation has affected what is being measured/observed.

'**C**ows **M**oo **S**oftly' is a useful scaffold to remind students how to plan a fair test:

Cows: **Change** one thing (independent variable)

Moo: **Measure/Observe** another thing (dependent variable) and

Softly: keep the other things (controlled variables) the **Same.**

To investigate whether the time of day affects shadow length, students could:

CHANGE	the type of food	Independent variable
MEASURE	the number of ants on the card	Dependent variable
KEEP THE **SAME**	the distance from the nest or trail, the type of card, the size of the card, the mass of food	Controlled variables

Appendix 5
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 dispersal of food by ants if we change the type of food available?'

C—The **claim**. For example, 'Our ants like dog biscuits.'

E—The **evidence**. For example, 'When we put out some different food, most ants were on the dog biscuits card and a team of ants carried most of the biscuits away in an hour.'

R—The **reasoning**. Saying how the evidence supports the claim. For example, 'Our ants liked the dog biscuits the best because most ants went to that card of food and they carried it away back to their nest. We don't think they are seed dispersers as there weren't many ants on the seed card.'

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 next section) helps to promote evidence-based discussion in the classroom.

Science question starters

Science question starters can be used to model the way 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 Primary**Connections** 5Es DVD, Chapter 5).

Science question starters

Question type	Question starter
Asking for evidence	I have a question about _____ . How does your evidence support your claim_____ ? What other evidence do you have to support your claim _____ ?
Agreeing	I agree with _____ because _____.
Disagreeing	I disagree with _____ because _____. One difference between my idea and yours is _____.
Questioning further	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

- Listen when others speak
- Ask questions of each other
- Criticise ideas not people
- Discuss all ideas before selecting one

Appendix 6
Friends or foes? equipment list

EQUIPMENT ITEM	QUANTITIES	LESSON	1	2	2	2	3	3	4	5	6
		SESSION		1	2	3	1	2			
Equipment and materials											
card, A4	1 per team							●			
container for water	1 per team									●	
containers, numbered (for seeds)	6 per class									●	
fan, electric	1 per class									●	
flowers, different samples that clearly show the pistil and stamen (eg, daffodil, lillium, tulip)	per class			●							
flower samples	2 per team			●							
food, 3 different types—seeds, sweet, protein (eg, birdseed, seed, brown sugar, crushed dog biscuits)	1 tbsp of each per team							●			
magnifying glass	1 per team			●						●	
paper, 3 large sheets	1 per class		●								
paper cups	3 per team				●						
pipe cleaners	12 per team				●						
powdered paint, 3 different colours	½ tspn of each colour				●						
seed samples	per class									●	
self-adhesive tape	per team									●	
self-adhesive tape, double-sided	per team				●						
sock, woollen	1 per team									●	
timing device	1 per team							●			
tomato and 1 other piece of fruit	1 per team						●				
tomatoes of different varieties	per class		●								
tray, small to hold flower samples	1 per team			●							
tweezers	1 pair per team			●							

EQUIPMENT ITEM	QUANTITIES	LESSON	1	2	2	2	3	3	4	5	6
		SESSION		1	2	3	1	2			
Resource sheets											
'Tomato troubles' (RS1)	1 per student		●								●
'Tomato troubles' (RS1), enlarged	1 per class		●								●
'How does it grow?' (RS2)	1 per student		●								●
'How does it grow?' (RS2), enlarged	1 per class		●								●
'Cross section of a flower' (RS3)	1 per team member			●							
'Cross section of a flower' (RS3), enlarged	1 per class			●							
'Diagram of a bee' (RS4)	1 per team member				●						
'Diagram of a bee' (RS4), enlarged	1 per class				●						
'A bee pollinator' (RS5)	1 per team member				●						
'A bee pollinator' (RS5), enlarged	1 per class				●						
'Blooming flowers' (RS6)	1 per team member					●					
'Blooming flowers' (RS6), enlarged	1 per class					●					
'From flower to fruit' (RS7)	1 per team member						●				
'From flower to fruit' (RS7), enlarged	1 per class						●				
'Information note for families' (RS8)	1 per team member						●				
'Information note for families' (RS8), enlarged	1 per class						●				
'Ant dispersal investigation planner' (RS9)	1 per team member							●			
'Ant dispersal investigation planner' (RS9), enlarged	1 per class							●			
'Life cycles jumble 1' (RS10)	1 per team member								●		
'Life cycles jumble 1' (RS10), enlarged	1 per class								●		
'Life cycles jumble 2' (RS10)	1 per team								●		
'Life cycles jumble 2' (RS10), enlarged	1 per class								●		
'Travelling seeds procedure' (RS11)	1 per team member									●	
'Travelling seeds procedure' (RS11), enlarged	1 per class									●	

EQUIPMENT ITEM	QUANTITIES	LESSON	1	2	2	2	3	3	4	5	6
		SESSION		1	2	3	1	2			
Teaching tools											
class science journal	1 per class		●	●	●	●	●	●	●	●	●
role wristbands or badges for Director, Manager and Speaker	1 set per team			●	●	●	●	●	●	●	
science chat-board	1 per class		●	●	●	●	●	●	●	●	●
student science journal	1 per student		●	●	●	●	●	●	●	●	●
team roles chart	1 per class			●	●	●	●	●	●	●	
team skills chart	1 per class			●	●	●	●	●	●	●	
word wall	1 per class		●	●	●	●	●	●	●	●	●
Multimedia											
digital camera *(optional)*						●		●			

Appendix 7
Friends or foes? unit overview

		SCIENCE OUTCOMES*	LITERACY OUTCOMES*	LESSON SUMMARY	ASSESSMENT OPPORTUNITIES
		Students will be able to represent their current understanding as they:	Students will be able to:	Students:	
ENGAGE	**Lesson 1** Tomato troubles	• describe the needs of a flowering plant • describe the reason for flowers • describe the reason for fruit • construct and sequence the life cycle of a tomato plant.	• contribute to discussions about fruit and the life cycle of a tomato plant • represent the life cycle of a tomato plant • contribute to the beginning of a science chat-board and word wall.	• read a letter and discuss the needs of a tomato plant to produce fruit • create the life cycle of a tomato plant and include ideas about each stage • contribute to a science chat-board about the growth of a tomato plant.	**Diagnostic assessment** • Science journal entries • Class discussions • Science chat-board and word wall contributions • 'Tomato troubles' (Resource sheet 1) • 'How does it grow?' (Resource sheet 2)
EXPLORE	**Lesson 2** Flowers and bees ***Session 1*** Pollinating parts ***Session 2*** The bees' knees ***Session 3*** Flower power	• accurately draw and label a diagram of a flower • discuss the role of parts of the flower in pollination • explore the role of bees in pollination • label the parts of the bee involved in pollination • sequence the life cycle of a bee • explore the features of flowers used to attract pollinators.	• contribute to discussions about flowers, bees and pollination • construct a cross section diagram of the internal parts of a flower • represent a life cycle of a bee • create a labelled diagram of the features of a flower used to attract pollinators.	***Session 1*** Pollinating parts • explore the internal parts of a flower used in pollination ***Session 2*** The bees' knees • explore the life cycle of a bee • explore the parts of the bees involved in pollination • explore why and how bees pollinate flowers ***Session 3*** Flower power • explore features of flowers that attract pollinators • create labelled diagrams of a flower highlighting those features.	**Formative assessment** • Science journal entries • Class discussions • Science chat-board and word wall contributions • 'Cross section of a flower' (Resource sheet 3) • 'Diagram of a bee' (Resource sheet 4) • 'A bee pollinator' (Resource sheet 5) • 'Blooming flowers' (Resource sheet 6)

* These lesson outcomes are aligned to relevant descriptions of the Australian Curriculum. See page 2 for Science and page 7 for English and Mathematics.

		SCIENCE OUTCOMES*	LITERACY OUTCOMES*	LESSON SUMMARY	ASSESSMENT OPPORTUNITIES
		Students will be able to:	Students will be able to:	Students will be able to:	
EXPLORE	**Lesson 3** Ants and seeds ***Session 1*** Seed detectives ***Session 2*** Spreading seeds	• explore the scientific definition of fruit • investigate food preferences of ants • observe the behaviour of ants and discuss how this behaviour is linked to seed dispersal.	• use discussion to clarify ideas, make predictions and explain observations • record observations and explanations about seed dispersal.	***Session 1*** Seed detectives • explore different types of fruit and their seeds • draw a cross section of a tomato and one other fruit ***Session 2*** Spreading seeds • explore why seeds are dispersed from the parent plant • investigate food preferences of ants in the school grounds and how ants disperse the food.	**Formative assessment** • Science journal entries • Class discussions • Science chat-board and word wall contributions • 'From flower to fruit' (Resource sheet 7) • 'Information note for families' (Resource sheet 8) • 'Ant dispersal investigation planner' (Resource sheet 9)
EXPLAIN	**Lesson 4** Coming together	• explain interactions between flowering plants, ants and bees • sequence the stages of the life cycle of flowering plants and insects • use scientific terminology to explain parts and processes of these interactions.	• use correct scientific terminology to describe their understandings • contribute to discussions explaining the interactions between flowering plants, ants and bees.	• make word chains to explain interactions between flowering plants, bees and ants • use cards to match scientific terminology to describe important parts and processes of these interactions.	**Formative assessment** • Science journal entries • Class discussions • Science chat-board and word wall contributions • 'Life cycles jumble 1' (Resource sheet 10) • 'Life cycles jumble 2' (Resource sheet 10)

* These lesson outcomes are aligned to relevant descriptions of the Australian Curriculum. See page 2 for Science and page 7 for English and Mathematics.

		SCIENCE OUTCOMES*	LITERACY OUTCOMES*	LESSON SUMMARY	ASSESSMENT OPPORTUNITIES
		Students will be able to:	Students will be able to:	Students will be able to:	
ELABORATE	**Lesson 5** Leaving home	• explore a range of seed dispersal methods • investigate and make claims with evidence on a seed's method of dispersal .	• discuss the relationship between seed dispersal and the environment • use a table to record observations • use group discussion to clarify ideas, make predictions and discuss claims about seed dispersal.	• observe seed dispersal methods and discuss observations • investigate seed dispersal tests to decide on the dispersal method of a range of seeds.	**Summative assessment** of Science Inquiry Skills • Science journal entries • Class discussions • Science chat-board and word wall contributions • 'Travelling seeds procedure' (Resource sheet 11)
EVALUATE	**Lesson 6** Giving advice	• explain the interactions between flowering plants, bees and ants • describe the process of pollination and seed dispersal • explain the stages in the life cycle of a flowering plant.	• contribute to discussions about plant life cycles and interactions between living things • reflect on their learning through science journal entries.	• write a letter explaining why a tomato plant isn't producing tomatoes • arrange and annotate pictures to represent the life cycle of a flowering plant • reflect on their learning during the unit.	**Summative assessment** of Science Understanding • Science journal entries • Class discussions • Science chat-board and word wall contributions • 'Tomato troubles' (Resource sheet 1) • 'How does it grow?' (Resource sheet 2)

* These lesson outcomes are aligned to relevant descriptions of the Australian Curriculum. See page 2 for Science and page 7 for English and Mathematics.

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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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