Australian National Botanic Gardens

Lesson Plan

Module 1

Plant Life Cycles

We acknowledge the Traditional Owners of Country throughout Australia and recognise their continuing connection to land, waters and culture. We pay our respects to their Elders past, present and emerging.

Plant Science Learning Hub

Students need a space to learn that is fun and rewarding. The Australian National Botanic Gardens has developed a Plant Science Learning Hub that aims to inspire and engage students in plant science and the stories surrounding Australian flora. With clear links to the Australian Curriculum for school years four to six, the Plant Science Learning Hub will provide a valuable resource for students and educators.

- **Plant Life Cycles**
- Plant Structure
- Pollination
- Seeds

This series provides educators with authoritative plant science content that has a uniquely Australian perspective. The Gardens manages globally significant scientific collections of living plants and herbarium specimens of Australian native flora. We provide educational experiences for students from pre-primary to tertiary levels, leveraging our scientific collections, participation in national and international conservation projects and outreach programs to engage the community in valuing, conserving, and appreciating Australia's diverse plant heritage.

Module learning objectives

The following learning objectives apply to the Plant Life Cycles Module..

1. Understand the life cycle of a flowering plant.
2. Investigate and describe the life cycle of one or more native Australian plants.
3. Identify the differences and similarities between the life cycles of flowering plants and animals.
4. Recognise and describe how environmental conditions or events can trigger seed germination and affect plant life cycles.

Each lesson within the lesson plans and the field kits has individual learning intentions appropriate to the activity.

Contents

Lesson Three: Collecting and Dissecting Seeds

LEARNING INTENTIONS

Students will be able to:

- Find seeds in their local area and identify and describe features of seeds.
- Dissect and identify the parts of a seed: embryo (developing plant), seed coat and endosperm (food storage) that are responsible for the growth of the plant.
- Understand the role of the seed in the plant life cycle.

CURRICULUM LINKS

This material provides opportunities for students to engage in the following Australian Curriculum content descriptions (Version 9.0):

Science understanding

AC9S5U01 Examine how particular structural features and behaviours of living things enable their survival in specific habitats (year 5)

AC9S6U01 investigate the physical conditions of a habitat and analyse how the growth and survival of living things is affected by changing physical conditions (year 6)

Science as a human Endeavor

AC9S5H01 examine why advances in science are often the result of collaboration or build on the work of others (year 5)

AC9S5H02 investigate how scientific knowledge is used by individuals and communities to identify problems, consider responses and make decisions (year 5)

AC9S6H01 examine why advances in science are often the result of collaboration or build on the work of others (year 6)

AC9S6I01 pose investigable questions to identify patterns and test relationships and make reasoned predictions (year 6)

Science Inquiry

AC9S4I01 pose questions to explore observed patterns and relationships and make predictions based on observations (year 4)

AC9S4I03 follow procedures to make and record observations, including making formal measurements using familiar scaled instruments and using digital tools as appropriate (year 4)

AC9S4I04 construct and use representations, including tables, simple column graphs and visual or physical models, to organise data and information, show simple relationships and identify patterns (year 4)

AC9S4I05 compare findings with those of others, consider if investigations were fair, identify questions for further investigation and draw conclusions (year 4)

AC9S5I01 pose investigable questions to identify patterns and test relationships and make reasoned predictions (year 5)

AC9S5I03 use equipment to observe, measure and record data with reasonable precision, using digital tools as appropriate (year 5)

AC9S5I04 construct and use appropriate representations, including tables, graphs and visual or physical models, to organise and process data and information and describe patterns, trends and relationships (year 5)

AC9S6I03 use equipment to observe, measure and record data with reasonable precision, using digital tools as appropriate (year 6)

AC9S6I04 construct and use appropriate representations, including tables, graphs and visual or physical models, to organise and process data and information and describe patterns, trends and relationships (year 6)

CONTENT INFORMATION

Life cycle stages and processes of a flowering plant

The life cycle stages of a generalised flowering plant include **seed**, **seedling**, **plant**, **flowering plant** and **fruiting plant**, which depend on the intervening processes of **germination**, **growth**, **maturation**, **pollination** and **seed dispersal**. These stages and processes are elaborated below.

1. Seed

A plant's life begins as a **seed**. Once dispersed, seeds of some species will germinate straight away, assuming that temperatures and light and water availability are suitable. Seeds of other species have evolved ways to postpone germination until they experience specific conditions. They do this by having dormancy mechanisms or particular germination requirements (or both). For example, some seeds remain dormant until they experience specific temperatures, light conditions, rain events or a bushfire, or perhaps a special combination of factors! Some seeds may remain for years in the soil seed bank until conditions are just right for germination. Once the seed experiences dormancy alleviation, or receives the right cues for germination, the seed will take in water through its outer layer, causing its **seed coat** to expand and crack open. The **embryo** inside is made up of a shoot and a root that emerge from inside the seed and begin to grow.

2. Seedling

Once a seed has germinated it begins to grow into a **seedling**. Its roots grow down into the soil and its shoot grows upwards towards the sun, even if the seed is upside down in the soil. The shoot develops into a stem with either one or two leaves. These first leaves are called **cotyledons** and are not considered 'true leaves'. They provide the developing seedling with nutrients until it grows true leaves that can perform photosynthesis and produce food.

INQUIRY QUESTIONS (ENGAGE)

Explain the learning intention for the lesson and introduce the topic to the students.

If you have not already shown the videos produced by the Australian National Botanic Gardens in a previous lesson, you could use one or both of these to engage students. The life cycle story starts in Video 1 at the National Seed Bank, which collects and provides long-term storage for the seeds of precious Australian plant species. We also look at germination cues in the seed bank laboratory. Video 2 continues the life cycle story in the nursery where seedlings are grown into mature plants which then flower.

The videos explore the life cycle stages of a plant through seed, seedling, plant, flowering plant and fruiting plant. The videos also discuss the processes that allow the life cycle to move between stages, these are germination, growth, maturation, pollination and seed dispersal.

The videos are appropriate for use through any of the Plant Life Cycles module and can be used to engage students at the outset of a lesson, or to summarise key information and apply some of the concepts in a real-world context at the end of a lesson.

These videos can be found in the Plant Life Cycles resources section of the Plant Science Learning Hub.

Life Cycles Video 1 - Seed to seedling

Life Cycles Video 2 - Seedling to seed dispersal

Ask questions such as:

What seeds can you think of, or do you know about already?

What does a seed look like?

Where do seeds come from?

What do you think is inside a seed?

At what stage of a plant life cycle does a seed develop?

Is it possible for a seed from a certain species to grow a plant of another species? For example, can a eucalypt seed grow a banksia plant?

STRATEGIES TO FACILITATE QUESTIONING AND DISCUSSION COULD INCLUDE:

- Talk with a partner (turn and talk).
- Think, Pair, Share. (Project Zero Thinking Routine)
- KWL Chart to track what a student knows (K), wants to know (W), and has learned (L) about a topic, can be used before, during, and after research projects.
- Write in journal and share with others.
- Individual student writing.
- Drawing.

Record the students' answers and wonders on the board or a flipchart.

LESSON SEQUENCE (EXPLORE)

There are three activities in this lesson:

In Activity 1, students collect seeds by wearing 'seed socks' outdoors.

In Activity 2, students sort and identify the seeds they found based on their characteristics.

In Activity 3, students dissect a seed.

ACTIVITY 1 – COLLECT SEEDS

The seed sock activity is a great way to find out what kinds of plants grow in different environments. Different environments can have different vegetation, wildlife, soil and climate. You might be surprised at how many seeds hitch a ride on your socks using tiny hooks or barbs.

Did you know that hook and loop fastening tape was invented when George de Mestral took his dog for a walk in the woods? Prickles with small hooks got stuck on his clothes and his dog's fur. Picking these off inspired the invention of the tape.

To do this, you will need to prepare the following:

- A few days before the lesson, instruct students to bring in a pair of old fluffy or woolly socks big enough to be worn over their shoes.

To collect seeds on the day, students will need:

- An old pair of socks that can get dirty (or ruined) and that will fit OVER their shoes
  Fluffy or woolly socks work best
- A paper or plastic bag
- Tweezers to remove the seeds from the socks
- A magnifying glass for a closer look at the seeds
- A flat pan or tray

Instructions:

1. Explain the learning intentions to the students and ask if they have any ideas on methods or techniques to collect seeds in the garden. Explain that they are going to use seed socks.
2. Head out to a lawn, field or nature area where you can do a nature walk. It is better if the field has not been mown recently but stay away from grass and undergrowth that is too long to be walking in safely. Discuss with students that there are areas that we should not be collecting seeds without permission, such as a botanic garden, national park or nature reserve. See the section General Guidance for Collecting and Exploring our Natural Environment at the end of this activity.
3. Instruct students to put their socks on over their shoes.

4. Let students walk around the area you have chosen for this experiment. The further they walk, the more seeds they are likely to collect.

5. When they have finished walking, instruct students to carefully take off their socks and put them in the paper bag, being careful not to lose any seeds in the process.

6. When you are back in the classroom, instruct students to carefully remove their socks from the bag and lay them on the tray.
7. Instruct students to remove any seeds they find on their socks using the tweezers.

8. Tell students to take a closer look with their magnifying glasses and analyse what they collected on their socks. Ask prompting questions such as, *How many seeds did you find? How many different types of seeds did you find? What type of plants do you think the seeds came from?* Note that if you are moving onto Activity 2, you may not want to spend a lot of time analysing seeds yet. It is possible that the seeds are mostly weeds or grass seeds. This still provides a discussion point for students if you ask, *Why is there an abundance of weeds and grass seeds?*

9. Allow students time to record any new discoveries or learnings in their science journal. A fact sheet is provided in the Resources section of this document that can be used as a reading to extract key information.

Alternative option 'Seeds, seeds and more seeds':

Head out into nature and select a seed collection area. Your area should contain plants that you have identified as seed sources.

Choose the best plant specimens and look for the seeds. They may be on the plant, for example in a seedpod or flowerhead. They could be inside a fruit or cone. Or they could already be on the ground. Try and find as many different seeds as you can.

A few tips from the Gardens on collecting and storing seeds.

- Use old envelopes or cotton pillowcases for collecting and drying your seeds. A template for a seed packet can be found in the Resources section of this document. Avoid plastic bags or glass jars. This is a good discussion point on why we don't use plastic or glass – because glass and plastic may trap moisture and could cause the seeds to to grow mould.
- Place the bags of woody fruits on a windowsill in the sun for speedy seed release.
- Once the seeds have been released and collected, store them in a dark, cool place in a dry, airtight container. A relative humidity level of 16% or less is ideal.
- Write on the package the name of the plant, the date and place where you collected the seed.

Extension idea 'Grow your socks':

Did you know you can even grow your seed socks? Instead of removing the seeds with tweezers, leave them on the socks and plant your socks in a tub of soil. Water them after planting and check your socks daily, adding more water as needed. You can also spray the socks with water and put them into small plastic bags. Hang the bags in a sunny window. Watch your socks grow.

Discussion

How do the seeds attach to your socks? (look for barbs, hooks, spines etc. with a magnifying glass)

What else might the seeds attach to? (e.g. animal fur, animal paws)

Why would a seed have structures to attach to an animal? What advantage does it get? (dispersal)

Where should we not be collecting seeds without the appropriate permissions? Why? (in a botanic garden, a national park or a nature reserve)

General Guidance for Collecting and Exploring our Natural Environment

The general principle of 'leave no trace' applies any time we are in our natural environment. Respect the environment, take your rubbish with you, stick to paths, don't make campfires unless permitted to do so, respect wildlife by not feeding or otherwise interacting or interfering, and leave what you find (unless permitted to take plant material).

Many of our activities ask students to use real specimens or examples collected from the field. Collection in your school grounds presents no problems; however, if you want to collect outside of the school grounds, you need permission from the landowner or managing authority and potentially a collecting permit.

For private property, contact the landowner.

For government-managed property, contact the managing authority. Parks managed by the Commonwealth and links to their managing authorities are listed here. Collecting elsewhere is managed by the relevant State or Territory government. See individual state or territory websites for details.

In addition, do not remove plants from an area without permission and do not plant anything anywhere (outside the school grounds or permitted area) without permission.

ACTIVITY 2 – SORT AND IDENTIFY YOUR SEEDS

In this activity, students will sort the seeds they have collected, think about how they are dispersed and identify them.

To do this, you will need:

- Student copies of resource: Seed Packet Worksheet
- Teachers may need to provide seeds if there are not enough seeds in the local area that can be collected. Seeds from another source could include native seed mix purchased from a nursery, birdseed and/or a mix of packet seeds.
- Blank paper/science journal workbook
- Pencil
- Ruler
- Small envelope

Instructions Part 1 Sort the Seeds:

1. Students can work in pairs or small groups for this activity.
2. Depending on the amount and variety of seeds gathered in Activity 1, use those collected or a collection of seeds from another source. Seeds from another source could include native seed mix purchased from a nursery or collected, birdseed and/or a mix of packet seeds. Have students think about what the seeds look like and what characteristicsthey have. Ask for ideas on what groupings they could use to sort the seeds. For example:

    Is the seed in a fruit or a woody cone or pod?

    Is it small or large?

    Is it smooth or rough?

    Is it wing-shaped or pointy?

    Is if flat or round?

    Is it heavy or light?

    Does it have any structures like hooks or hairy parachutes?

    How heavy is it?

The Australian National Seed Bank uses the following terms to describe seeds, students can use their own terms to describe what they see.

Appendage terms used: hairs; spine(s); wing; aril; pappus; plug; bristle(s); awn(s); elaiosome; hook(s); aerenchyma (spongy tissue with air channels); glume(s)

Shape terms used: rectangular; ovoid; reniform (kidney-shaped); globose; fusiform; irregular; lanceolate; cylindrical/terete; sectoroid (like an orange segment); pyramidal; cordate (heart-shaped); cuneate (wedge-shaped); falcate (sickle-shaped)

Texture terms used: rugose (wrinkled); finely textured; pitted; smooth (at high magnification); reticulate (net-like); tuberculate (covered in nodules); spinose; striate; plumose (feathery); ciliate; scabrous (covered in small rough projections); tomentose (covered in cottony hairs); papillose (covered in papillae); costate (ribbed); chartaceous (papery)

3. Students should choose their categories and write them on a sheet of paper like the example below, allowing enough space in each box for the seeds to be placed. This could also be done into small bowls or containers.

Round	Long	Pointy

Furry	Hard and furry	Light

4. Allow students time to sort their seeds into each category.
5. If time allows, instruct students to sort the seeds again, this time into categories of how they think they would travel for dispersal. *Would they float on the wind? Would an animal take them to another place? Would they drop from the top of the plant to the ground? What other ways could they be transported?*

Wind	Gravity	Explosion

Animals	Water	Other?

Instructions Part 2 Identify the Seeds:

1. Have students compare their seeds. Ask prompting questions: *Did you find any seeds you recognise? Can you identify any seeds from weeds or grass? How do the seeds differ?*
2. Provide copies of the Seed Packet worksheet found in the Resource section of this document.
3. Guide students to create their own seed packet. Using small envelopes or the provided template (cut out and glue), make a seed packet for one of the types of seeds that were found. Students will need to:
    - Identify their seed using a seed chart.
    - Work out the species of plant they think the seed is from.
    - Write the plant name and draw a picture of the plant on the front of their packet.
    - Write the date they collected the seed and where they collected it from.
    - Research and write instructions for growing their seed on the reverse side.

Discussion Points:

What observations can we make about the seeds collected?

Did you find more of one type of seed than another?

Were you able to identify all the seeds?

What are some of the identifying characteristics of the seeds you found?

Do you think we found all of the types of seeds in this environment? Why or why not?

ACTIVITY 3 – DISSECT A SEED

Dissecting something means cutting it into sections so that we can see the different parts more clearly. Before we dissect a seed, we need to soften the seed coat so that it is easier to cut. Soaking, especially in hot water, softens the coat and assists the seed to germinate faster.

For this activity you will need:

- Student copies of Resource: Seed Dissection Instructions and Worksheet
- A bowl
- Large Seeds – Lima or White Bean seeds are easiest to source and dissect. This activity can be attempted with any seed, however some are easier to dissect than others
- Hot water
- Knife to cut the seed

Instructions:

1. Ask students questions. *Why are we dissecting the seed? What do we expect to see? Why do you think we are soaking the seeds? How will the seed change when it is soaked? What do you predict will happen?*
2. Support the students to carry out the instructions. Remember to consider the safety aspect of hot water and knife-use and use appropriate tools and strategies to minimise any risks for your context.
    - Wash the seeds first in a bowl of room temperature water. Any seeds that float will not germinate and can be thrown away.
    - Tip out the water and cover with warm water.
    - Leave the seeds overnight to soften.
    - Rinse the seeds the next day and place on paper towel to dry.
    - Select one or two seeds to dissect.
    - Using a knife, carefully cut the seed in half lengthways (longitudinal) and place the two halves in front of you.
3. Examine the seed. *What do you see inside? Does any part of the seed look like a familiar plant part? Can you see the embryo? Can you see a small root-like structure? Are there any leaves yet?* Measure the seed with a ruler.
4. Students should record what they see on the worksheet.

Discussion

Why did we throw away floating seeds?

How did our results match our predictions?

What did you find inside the seed?

Did the findings match your predictions? Did anything surprise you?

Why is it important for us to know about the structure of a seed?

How can we use the information we have learnt from this task?

CONCEPTS EXPLAINED AND VOCABULARY DEFINED (EXPLAIN)

The following resources are provided to assist teachers to facilitate a class session to explain concepts and terms that have been introduced to students through the activities.

- Teachers' Notes (these can be found by searching in the Plant Science Learning Hub).
- If you have not already shown the videos produced by the Gardens in a previous lesson, you could use one or both of these to engage students. The life cycle story starts in Video 1 at the National Seed Bank, which collects and provides long-term storage for the seeds of Australian plant species. We look at germination cues in the seed bank laboratory. Video 2 continues the life cycle story in the nursery where seedlings are grown into mature plants which then flower and bear fruit. The videos explore the life cycle stages of a plant through seed, seedling, plant, flowering plant and fruiting plant. The videos also discuss the processes that allow the life cycle to move between stages, these are germination, growth, maturation, pollination and seed dispersal. The videos are appropriate for use through any of the Plant Life Cycle Module and can be used to engage students at the beginning of a lesson, or to summarise key information and show some real-world applications at the end of a lesson. These videos can be found in the plant life cycles resources section of the Plant Science Learning Hub.
  Life Cycles Video 1 - Seed to seedling
  Life Cycles Video 2 - Seedling to seed dispersal
- Seed Packet Worksheet
- Seed Dissection Instructions and Worksheet

APPLYING AND EXTENDING THE LEARNING (ELABORATE)

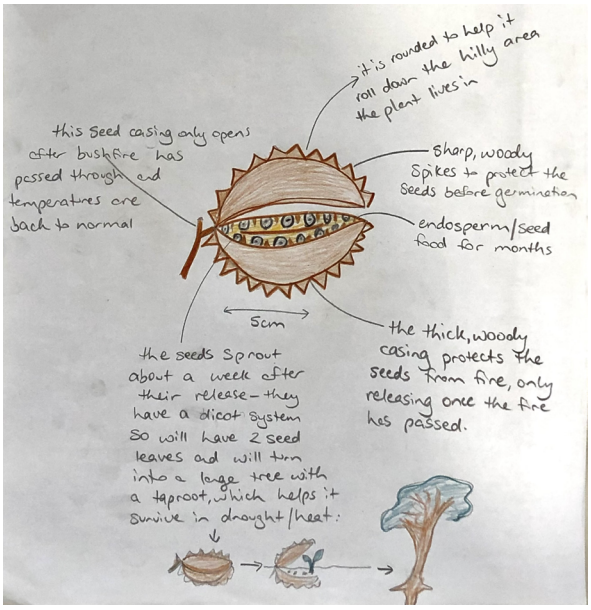
Applying the Learning

How will your seed change and develop into the next life cycle stage? What do you think it needs to germinate and grow? Design an experiment to investigate this topic. Decide on an investigation question and record the data/information you would collect, the steps you would follow and the equipment you would need to carry out this investigation.

Germination Experiment. Conduct the experiment by either following on from the investigation students designed in the point above or by completing one of the germination activities provided by the Australian National Botanic Gardens in the next lesson on germinating seeds (Life Cycles Module Lesson 4, Germinating Seeds, which can be found by searching on the Plant Science Learning Hub).

Design your own seed. Choose an environment for your seed to grow in, such as a dry or wet forest. Is the climate warm or cold? Think about how your seed needs to be adapted to

survive in this environment. How thick will the seed coat be and how does this benefit the seed? What shape would the seed be and why? How big would the embryo (developing plant) and endosperm (food source) be and why? Is a larger or smaller cotyledon (the first leaves that grow) better? Students plan and draw/sketch ideas of their design solution that includes labelling, materials and equipment to be used, measurements and justification for choices. Students may want/need to construct a prototype to test ideas and make modifications. Share and discuss your seed design with others.



Take a look at the Australian National Botanic Gardens: Alive with Learning Propagation Guide. It contains information on collecting seeds, specific Australian plants and seed collecting techniques and information on how to propagate plants from seed. https://parksaustralia.gov.au/botanic-gardens/pub/plant_propagation.pdf

EXTENSION IDEAS FOR FURTHER RESEARCH

Ferns make spores. The units of inquiry in the Plant Science Learning Hub focus on angiosperms (flowering plants). Some plants don't flower or produce seeds at all. Ferns do not flower but reproduce sexually from spores. Look under the fronds of a fern and you will see rows of tiny round spore sacs. The spores will drop off the plant and eventually make new plants. Research the fern life cycle, which has two distinct stages. Mature plants produce spores on the underside of the leaves. When these germinate, they grow into small heart-shaped plants known as prothalli. Male and female cells are produced on these plants and after fertilisation occurs the adult fern begins to develop. Further information is available at https://www.anbg.gov.au/ferns/fern.spore.prop.html

How do animals disperse seeds? Animals often eat seeds and the seeds come out in their poo. They drop to the ground and make new plants. How else can animals disperse seeds? What other ways can seeds be moved from one place to another?

Seeds are dispersed at different times. When is the best time of the year to do this activity? What are the growing seasons for plants in your area?

First Nations Calendars and Seeds. What do the First Nations calendars tell us about how Aboriginal and Torres Strait Islander people use seeds?
https://www.csiro.au/en/research/indigenous-science/Indigenous-knowledge/Calendars/About

Did you know seeds can predict the weather? When the red seeds of the Jirndiwili tree (*Erythrina vespertilio*) fall to the ground Gooniyandi people know that the Jangala rain will start soon. You can read this on the Gooniyandi seasons calendar, developed by members of Muludja community from the Kimberley region in Western Australia and CSIRO. The calendar can be found here:
https://www.csiro.au/en/research/indigenous-science/Indigenous-knowledge/Calendars/Gooniyandi

QUESTIONS AND ACTIVITIES FOR REFLECTION (EVALUATE)

Students review and reflect on their learning journey by:

- Revisiting the learning intentions and original inquiry questions:

  What seeds can you think of, or do you know about already?

  What does a seed look like?

  Where do seeds come from?

  What do you think is inside a seed?

  At what stage of a plant life cycle does a seed develop?

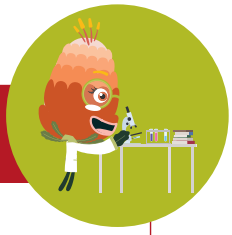
  Is it possible for a seed from a certain species to grow a plant of another species? For example can a eucalypt seed grow a banksia plant?

- Identifying further questions.

  What questions haven't I had answered yet?

- Identifying what students have learned from others and their own research.

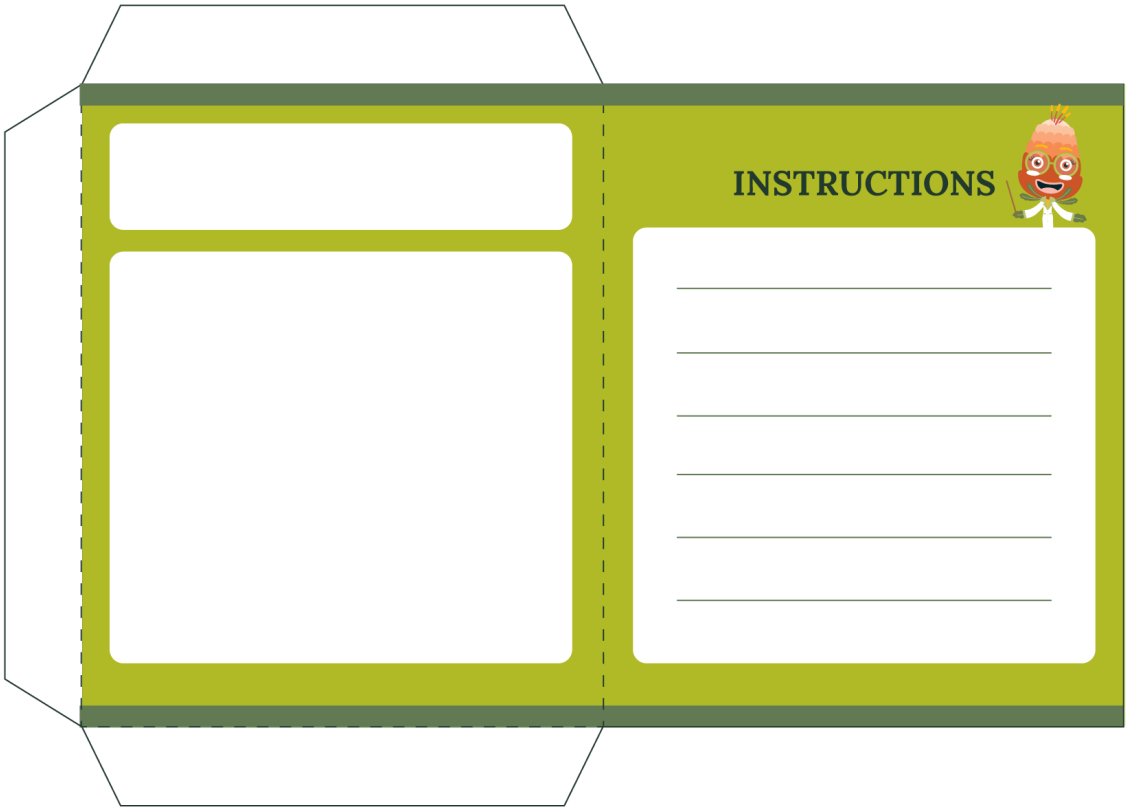
  What new knowledge do I have about plant life cycles that I didn't know before?



RESOURCE – WORD BANK

life cycle	**germination**	**growth**	**pollination**
reproduction	**seed dispersal**	**seed coat**	**embryo**
endosperm	**roots**	**cotyledons**	**stamen**
filament	**anther**	**pistil**	**stigma**
style	**ovary**	**ovules**	**fertilisation**

RESOURCE – SEED PACKET WORKSHEET



RESOURCE – SEED DISSECTION INSTRUCTIONS AND WORKSHEET

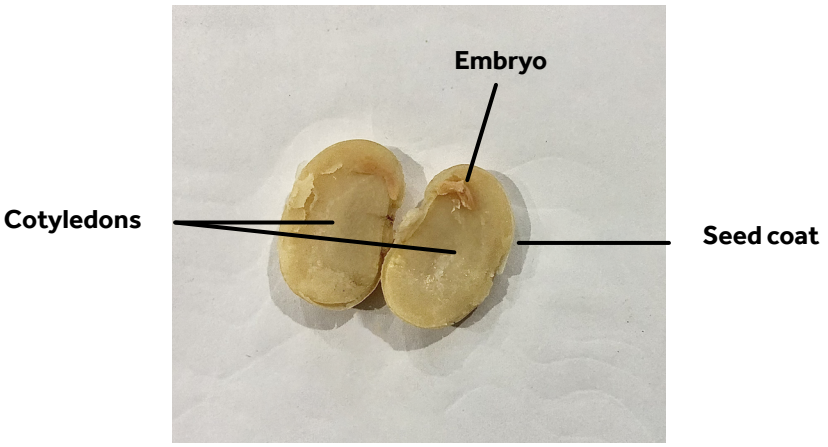
Seed Dissection Instructions

1. Wash the seeds in a bowl of room temperature water. Any seeds that are floating will not germinate and can be thrown away.
2. Tip out the original water and cover the seeds with fresh warm water.
3. Leave the seeds overnight to soften.
4. Rinse the seeds the next day and place on paper towel to dry.
5. Select a few seeds to dissect.

6. Using a knife, carefully cut the seed in half lengthways (longitudinally) and place the two halves in front of you.

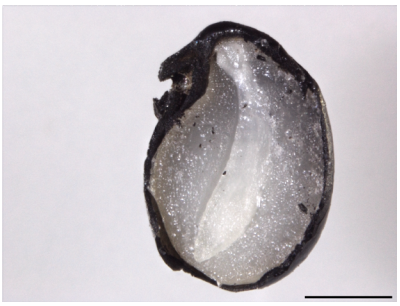
7. Examine the seed. *What do you see inside? Does any part of the seed look like a familiar plant part? Can you see the embryo? Can you see a small root like structure starting? Are there any leaves yet?* Measure the seed with a ruler.

8. Students should record what they see on the worksheet.



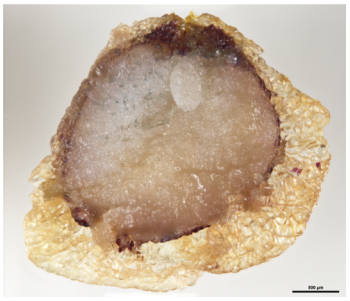
Here are some Australian Native seeds.

Seed 1 - *Dianella revoluta*



Seed 2 - *Dianella longifolia*

Seed 3 - *Arthropodium strictum*



Seed 4 - *Burchardia umbellata*

Seed 5 - *Cheiranthra cyanea*

SEED DISSECTION

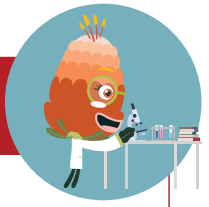
Name: Date:

Outside of seed	Inside of seed

Describe what you found when dissecting the seed

What do you think would happen next if this seed germinated and grew?

RESOURCE: STUDENT REFLECTIONS



Consider displaying sentence starters or questions, such as below, in the classroom. Alternatively they could be turned into laminated thought bubbles that are directly passed to students. Students could choose two or three to complete in their journal then share their responses with the class.

End of lesson reflections	
Today I discovered ...	I am most proud of ...
I want to know more about ...	I feel confident about ...
Something new I found out was ...	I am enjoying ... because ...
I am excited about ...	I am confused by ...
Something I am finding interesting is ...	Today I asked ...
The most challenging thing was ...	A question I have is ...

Guiding students to reflect on their own thinking	
I am starting to think differently about ...	This idea is useful for ...
I got stuck when ... and I got back on track by ...	Some things I didn't understand are ...
I figured out that ...	To help me understand better I will ...
I solved a problem by ...	Before I didn't know ...
I first thought ... but then I realised that ...	Now I realise/know ...

Reflecting on stewardship and taking action	
This information can make a difference by ...	Something I will now help others understand is ...
It is important to know about this because ...	I can make a difference by ...
Something I will now do as a result of my learning is ...	An action I/we can take is ...
Something I want to do next is ...	If we don't ... the consequences could be ...
	It is important to ... because ...

End of unit reflections – where I was and where I am now	
I used to think ...	**Revisit** your first journal entry. What do you understand now that you didn't back then?
Now I know ...	
This causes me to (re)think/ wonder ...	
I didn't know how to ...	**Review** your work so far. What has been the biggest discovery/learning/ challenge?
Now I can ...	
In the future I will ...	**Reconsider** your initial ideas. Have your ideas changed? If so how?

Source: Adapted from the *Animal adaptations: year 5 Australian science curriculum focus, 2016, by the Great Barrier Reef Marine Park Authority, licenced under Creative Commons licence CC-BY-NC-SA from: http://hdl.handle.net/11017/2990'.*

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