The Exploring Fungi Unit

Year 3/4 Sustainability Unit

Integrating Biological Sciences and The Arts

Australian Curriculum Cross-curriculum Priority: Sustainability
OI.2 – Systems
All life forms, including human life, are connected through ecosystems on which they depend for their wellbeing and survival.
OI.7 – Futures
Actions for a more sustainable future reflect values of care, respect and responsibility, and require us to explore and understand environments.

The Exploring Fungi Unit

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Funded by: AAEE
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Unit Mycologist: Dr Sandra Tuszynska
Thanks for generously sharing resources:
Queensland Mycological Society, North American Mycological Association, British Mycological Association, Creative Commons

The Project Authors

Sandra Tuszynska (PhD) Sandra is an agricultural scientist with a PhD on the cellular mechanisms of mycorrhizal fungi (root fungi) in protecting plants from heavy metal and other stresses. She loves fungi and the special role that fungi play in ecosystems as decomposers and regenerators. As a biophile, Sandra is a passionate science communicator and advocate for biodiversity, sharing biological facts in public forums. In her current role at Woodfordia, the home of the Woodford Folk Festival and The Plating Festival, she is an Environmental Projects Officer engaging citizen science, land and biodiversity restoration projects, research and development. Sandra loves to create engagements and communication pathways for a biologically informed future, in which we cooperate with the fascinating and rich biodiversity that sustains life on Earth.

Alieta Belle (Bachelor Visual Arts, Grad Dip Teaching) Alieta is a practicing teacher in a Queensland Independent Primary School, The River School. She works with networks of professionals in environmental and arts fields to enrich student learning and offer real-world hands-on experiences to students. Alieta's Media Arts students entered their fungi video 'The Hidden World of Fungi' into the Sunshine Coast Council's Young Eco-Documentary Film Competition and won first place. Alieta was asked to submit work samples to ACARA for the curriculum area of Media Arts and these are being used on the ACARA website nationally. Alieta has published numerous articles nationally about the importance of integrating The Arts with other subject areas in the curriculum. She co-ordinates the participation of her students, in the Sunshine Coast Kids in Action Environmental Conference each year, promoting active citizenship in the area of Sustainability. Alieta is a passionate advocate for Environmental Education being taught in schools.

Exploring Fungi Unit Introduction

Exploring Fungi is a fascinating and engaging unit offering multiple outdoor, hands-on learning opportunities, including looking for fungi in the field, conducting a mushroom growing experiment, identifying fungi types, setting up a fungi garden and integrating sketching and photography as research tools.

Through this inquiry into the Kingdom of Fungi, students will be exposed to exciting Sustainability ***Systems*** and ***Futures***, knowledge and understanding. The emphasis in this unit is on beneficial fungi and their roles in ecosystems, as well as how we can work with them. Fungi perform an incredibly important role in ecosystems worldwide, yet many people know little about fungi and their hidden world. Investigating fungi is a fascinating topic for students. Once students learn about the significance of fungi and how to identify them, they begin to see fungi everywhere and appreciate their essential roles in the ecosystem.

Many of us are generally unaware that at least 90% of plants rely on a symbiotic relationship with fungi to survive. Other types of fungi are responsible for breaking down organic material in ecosystems. Students will come to learn that the '*mushroom'* we see is just the fruiting body of the whole organisms. They will be in awe to discover that a network of fine white filaments known as mycelium, is the real driving force behind the power of fungi. The mycelium either infiltrates a decomposing log or operates in an underground network which links plants across entire forest ecosystems, giving rise to the term the *Wood-Wide-Web*! The fruiting body is similar to a fruit or a flower and is the reproductive part of the lifecycle of fungi bearing their spores.

Fungi are classified as a separate kingdom distinct from plants and animals, (more closely related to animals). Fungi have the potential to play a major role in future solutions for food security, plastic biodegradation, and climate change issues. Wonderful resources and teacher background notes have been developed to support the delivery of this exciting content to your students. Enjoy the learning journey…

Preparation for Teaching this Unit of Work:

- This Unit is packed with resources to make the teaching and learning sequence extremely engaging and memorable.
- Please ensure you read the complete unit to get acquainted with the content and resources before beginning.
- Background *Teacher Information* has been embedded into every lesson.
- *Lesson Resources Preparation* list has been embedded into every lesson, so you can have all lesson materials sourced, printed and prepared prior to teaching.
- Consider when is the best season for the visible part of the fungi, the fruiting body, to be seen in your area. Consider teaching this unit at the optimal time of year to see fungi fruiting bodies (but don't let this be a barrier, as some fungi may be fruiting all year round in certain areas).
- There is a mushroom growing experiment planned for lesson 6. Please ensure you have ordered the oyster mushroom logs needed for the experiment, with enough time for them to arrive.
- During lesson 10 it is recommended that students have access to microscopes (or magnifying lenses) to look more closely at fungi. Does the school have microscopes available for use? Are you able to source a light microscope from parents or members of the community? A very enjoyable and highly recommended activity is to use a digital microscope with the whole class, to view the features of fruiting bodies and their mycelium. This microscope can be purchased for as little as $20 and attached to a computer screen, or interactive board via a USB cable to display specimens to a very high magnification. Try to get access to some microscopes before this lesson.
- Ensure you have read the Health and Safety guidelines for working with fungi and completed any risk assessments required by your school. Please note that while some fungi are poisonous and some individuals may be sensitive to the spores of fungi, fungi can be handled with caution. We encourage teachers to make sure that students are made aware of the risk of and protocols for handling fungi.

Health and Safety Information: Teacher Notes

The two most important safety rules are:

- NEVER eat a fungus in the field.
- ALWAYS wash your hands after touching fungi.

Safety in the field and classroom:

- Most of the safety issues are common to any work in the field. It is important to carry out a risk assessment before venturing out, taking into account the topography of the site, local hazards and the nature of participants.
- Teachers are advised to conduct a risk assessment before engaging with the activities and experiments in this unit. Don't worry, this is not a dangerous unit. However, each school has their own safety guidelines to adhere to.
- Check with the Principal before bringing fungi specimens into the classroom.
- A sheet of the main *Foray/Fungi Hunt Rules* has been created to display in the classroom. This file can be amended to suit your context.

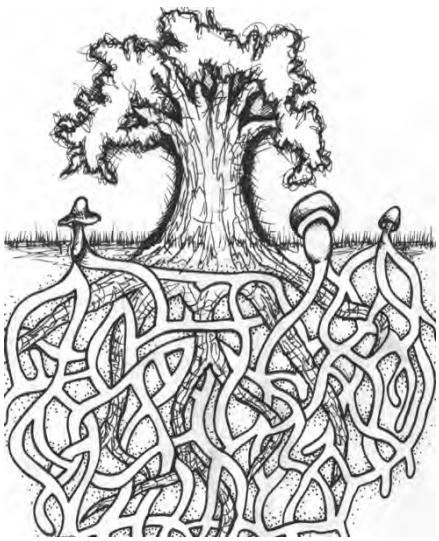
Picking fungi:

- Decide if students are allowed to collect fungi specimens and establish protocols to be followed.
- If fungi are being collected, it is important to dig up the whole specimen (using a blunt knife if necessary) as features at the base of the stem can be important for identification. Once collected, store in a plastic container and work with as soon as possible, as many fungi don't keep for long.

Teachers refer to this resource for informed safety advice:
Collecting and preserving fungi specimens,
a manual by the Queensland Herbarium
https://www.qld.gov.au/__data/assets/pdf_file/0032/67478/fungi-coll-manual.pdf

Suggested 10 Week Lesson Progression

Week	Name of Lesson
Week 1	Lesson 1: Getting to Know Fungi
	Lesson 2: Beneficial Roles of Fungi Introduction
Week 2	Lesson 3: Beneficial roles of fungi: Mycorrhizal Fungi
	Lesson 4: Beneficial roles of fungi: Decomposers
Week 3	Lesson 5: Grouping Fungi: shape, colour, texture
	Lesson 6: Grouping Fungi: shape, colour, texture Part 2
Week 4	Lesson 7: The Features of Mushrooms
	Lesson 8: Fungi Hunt and Essential Tools
Week 5	Lesson 9: The Life Cycle of Fungi
Week 6	Lesson 10: Magnifying Fungi
Week 7	Lesson 11: Fungi Mission Task
	Student Fungi Mission Research
Week 8	Lesson 12: Conclude Oyster Mushroom Growing Experiment
	Student Fungi Mission Research
Week 9	Lesson 13: Innovating with Fungi and Mapping What We've Learnt
	Student Fungi Mission Research
Week 10	Lesson 14: Fungi Gardens and Learning Celebration Part 1
	Lesson 15: Fungi Gardens and Learning Celebration Part 2



Amazing Resources Linked to Lessons

- Our Exploring Fungi Unit mycologist, Dr Sandra Tuszynska has created 12 videos linked to the lessons to bring this investigation to life
- Visit the Exploring Fungi video page: https://vimeo.com/user113329904
- There are over 30 additional resources linked to the lessons to make rich and enjoyable for the students.

9. Classifying Fungi Part 1
Exploring Fungi | five views

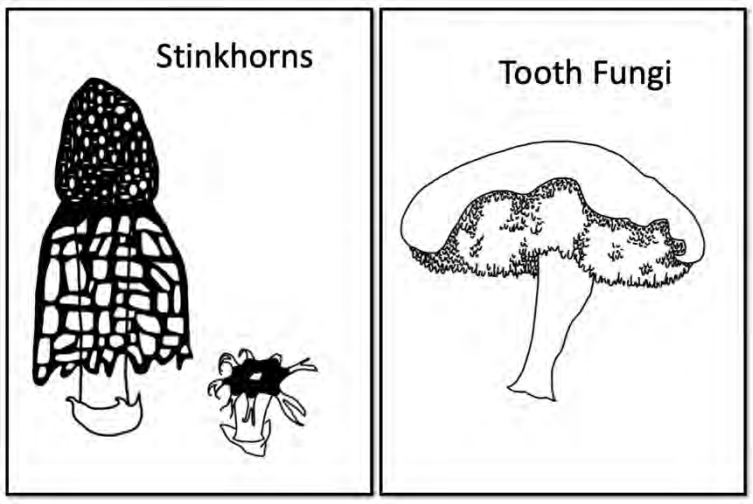
5. What Are Fungi?
Exploring Fungi | six views

4. Fungi History To Now
Exploring Fungi | three views

3. Fungi In Our Lives
Exploring Fungi | two views

2. Unit Introduction
Exploring Fungi | five views

1. Exploring Fungi Welcome
Exploring Fungi | one views



Oyster Mushroom Growing Experiment

- There is a mushroom growing experiment planned for lesson 9.
- Please ensure you have ordered several oyster mushroom logs or mushroom growing kits from an online supplier with enough time for them to arrive.
- Either the oyster mushroom 'log' in a plastic cover or a mushroom growing kit (packaged in a box) is easily available from numerous suppliers across Australia. Simply search online for: 'oyster mushroom growing kit' or 'oyster mushroom log.'
- Each supplier will provide growing instructions to follow. (This unit also provides instructions on how to set up the experiment).
- An experiment record sheet for students and lesson teaching notes are provided to guide the experiment. Please read ahead to be prepared for the experiment.
- It is preferable to buy numerous 'logs' or mushroom kits for this experiment, enabling students to work in groups to record the growth experiment. Students will then be able to compare growth rates at the end of the experiment between groups.

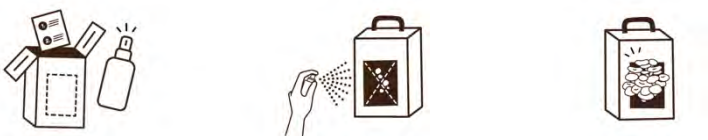
Some Supplier Links:

- Life Cykel: https://lifecykel.com/collections/grow-your-own
- Little Acre: https://littleacre.com.au/growkit

1. An oyster mushroom log. (30cmhigh)

2. Close-up of a mushroom log. The white mycelim is visible through the plastic cover.

3. An oyster mushroom growing kit. Inside it contains the mushroom log in plastic.



4. Each mushroom kit supplier will provide growing instructions to follow.

Lesson 1: Getting to know fungi

Curriculum Links	
Sustainability Priority	**OI.2 – Systems** All life forms, including human life, are connected through ecosystems on which they depend for their wellbeing and survival
	OI.7 – Futures Actions for a more sustainable future reflect values of care, respect and responsibility, and require us to explore and understand environments
Science	ACSSU073: Living things depend on each other and the environment to survive
	ACSSU072: Living things have life cycles

Lesson Focus - Engage Phase

The focus of the first lesson is to excite students' interest and enthusiasm to explore and understand fungi and their roles in ecosystems. The emphasis in this unit is on beneficial fungi and their roles in forest ecosystems, as well as how we can work with them. Teachers will engage students' prior knowledge to discover what they already understand about fungi, their features, life cycle, and their connection with other living things and the environment. Teachers will record inquiry questions generated by the students as they respond to the lesson resources.

Lesson Outcomes

Students will:

- get excited about fungi
- record their prior knowledge about fungi in their science journals
- learn that the visible fruiting body is only a part of the whole fungus
- begin to recognise that fungi play a vital role in ecosystems globally
- consider the basic features of fungi
- label the fruiting body, mycelium and spores
- reflect on new terminology introduced during the lesson

Lesson Resources Preparation

Unit Videos: https://vimeo.com/user113329904

- '**1. Exploring Fungi Welcome'** introduced by Dr. Sandra Tuszynska (46 sec)
- '**2. Unit Introduction'** with Dr. Sandra Tuszynska (53 sec)
- **'3. Fungi in Our Lives'** with Dr. Sandra Tuszynska (42 sec)
- '**4. Fungi History to Now'** with Dr. Sandra Tuszynska (1:49 min)
- **'5. What are Fungi?'** with Dr. Sandra Tuszynska (1:26min)

Video Link:

- YouTube clip: **'Introduction to Fungi'** by Frank Gregorio (4min)
  https://www.youtube.com/watch?v=7ojzbeaZDqk

Documents:

- R1 Word Wall
- R2 Fungi Lifecycle 1 (printed copy for all students)
- R3 Fungi Lifecycle 2 (printed copy for all students)

Lesson Vocabulary

fungus fungi mycelium hypha hyphae fruiting body mushroom mycology mycologist spores ecosystem

Background Teacher Information Lesson 1

Fungi are found in diverse environments in Australia and globally. The visible fruiting bodies of fungi are only a part of what makes up the entire organism. The structure that gives rise to the fruiting body is the mycelium network comprised of long, individual fungal cells called hyphae.

The observable features of a fruiting body are used as a guide to identify and group different species. For example, some fungi have mushroom shaped fruiting bodies, others are in the form of brackets or shelf fungi, yet others are in the shape of puffballs. Students will find this diversity both interesting and fascinating!

As a reference for the unit, students will be given two fungi life cycle diagrams to glue into their science journal. To fortify student's understand of fungi as more than just the fruiting body, it is good to refer to these diagrams each lesson as students build their understanding of the complete fungi life cycle. These resources can be enlarged and displayed in the classroom.

The introductory videos will give students the sense of how fascinating and diverse fungi are. Students will gain an overview that fungi are vitally important to the Earth's ecosystems and that their role is often unseen, unrecognised and misunderstood.

One of the significant benefits about studying fungi, is that fungi can be used to illustrate a wide range of biological principles important to learn in primary education.

Exploring Fungi

Lesson 1 Teaching Sequence

Introduction:

1. Introduce that a mycologist is a scientist who studies fungi. Explain that mycologist Dr. Sandra Tuszynska has prepared a series of presentations to help learners explore the AMAZING and often hidden world of fungi all around us, learn about the superpowers of fungi in ecosystems and how we can work with fungi to create a more sustainable future. Throughout the unit Dr. Sandra **Tuszynska** (pronounced: two-shins-car) will be our guide and mentor.

2. Watch the video '**1. Exploring Fungi Welcome'** with Dr. Sandra Tuszynska.

3. Watch the video '**2. Unit Introduction'** with Dr. Sandra Tuszynska.

4. Inquire about student prior knowledge of fungi. Ask students to write down notes or create an annotated sketch in their science journals to illustrate any knowledge they have on this topic. Allow enough time (5-10min) for students to complete this task. This record will form part of evidence at the end of the unit documenting what students have come to learn. Ask students to consider the following questions, when thinking about what they know:

    - Have you seen fungi growing locally? What location or environment did you see fungi growing?
    - What do you know about the life cycle of fungi?
    - Can you name any features of fungi? What words help you describe the features?
    - What do you think is the purpose of fungi in the environment?
    - What are you interested in knowing?
    - Do you know examples of fungi in the food we eat?

   As a whole class, discuss student prior knowledge about fungi.

5. Introduce the initial inquiry question: *What are fungi and why are they important?* Ask students to write this overarching question in their science journals. Explain that throughout the unit, students will discover answers to these questions and are encouraged to write journal entries and notes documenting their learning.

6. Watch **'Introduction to Fungi'** YouTube clip. Facilitate a discussion about information presented in the video that the students didn't know prior and found interesting.

7. Make a list of everyday items that contain fungi after viewing **'3. Fungi in Our Lives.'** Make a class list for display and students record in their science journal. Continue to add to the list in later lessons.

8. Give students an overview of the 10 week *Exploring Fungi Unit* and the types of activities they will engage in such as going on a field trip around the school grounds to look for fungi, drawing and photographing specimens, learning how to classify fungi based on observable features, drawing a cross-

section, conducting an experiment by growing oyster mushrooms, creating a fungi garden and learning about fungi innovations.

9. Review and record these questions before watching the **'4. Fungi History to Now'** video:

    - What is the name of the ancient fungi?
    - How long ago did it exist on earth?
    - Approximately how many species are in the Fungi Kingdom today?
    - How many of these species have been described by humans?

    Listen for the answers when the video is playing and pause to record answers. Discuss and record any big ideas presented in this video.

10. Learn about the basic features of fungi and the commonly used terminology, *fruiting body, mycelium, spores*. Watch **'5. What are Fungi?'** with Dr. Sandra Tuszynska once through. Then pause the video to display the fungi diagram. Ask students to draw this simple diagram and label the fruiting body, mycelium and spores.

11. Give each student a copy of the resources **R2** and **R3** depicting the fungi lifecycle. Glue the diagrams into student science journals using a double page spread so both diagrams can be seen side by side. These diagrams will be used as a reference throughout the unit. Ask students to locate the fruiting body and mycelium in the diagrams.

12. Show students the **R1 Word Wall** printed key words for lesson 1 such as fungi, mycelium, fruiting body etc. introduced during the lesson and display the words. Explain that scientists use specific terminology when describing life cycles, features and processes and that we will begin to use these words when describing what we are learning.

13. In conclusion, ask students to make a journal entry and record any new understandings they have taken from the lesson or questions they are wondering about. Remind students of the initial inquiry question: *What are fungi and why are they important?*

Lesson 2: Beneficial Roles of Fungi Introduction

Curriculum Links	
Sustainability Priority	**OI.2 – Systems** All life forms, including human life, are connected through ecosystems on which they depend for their wellbeing and survival
	OI.7 – Futures Actions for a more sustainable future reflect values of care, respect and responsibility, and require us to explore and understand environments
Science	ACSSU073: Living things depend on each other and the environment to survive
Visual Arts	ACAVAM111: Use materials, techniques and processes to explore visual conventions when making artworks

Lesson Focus - Engage Phase

The first lesson aimed to reveal the fascinating and essential role fungi play in ecosystems. This lesson will focus on showing students the existence of symbiosis or co-operation between plants and fungi, which enables nutrient exchange between the partners and for plants to communicate with one another via the fungi network. This relatively new scientific understanding will excite students' interest to explore fungi and their roles in ecosystems further. This lesson will focus on introducing mycorrhizal fungi (root symbiotic fungi) and the beneficial and unseen role they play in forest ecosystems. Students will engage with art making to represent this special relationship.

Lesson Outcomes

Students will:

- learn about different beneficial roles fungi have in ecosystems
- focus on learning about mycorrhizal fungi and their relationship with plants
- integrate learning about mycorrhizal fungi through art making
- creatively represent the symbiotic relationship between mycorrhizal fungi and plant roots

Lesson Resources Preparation

Unit Videos: https://vimeo.com/user113329904

- '**5. What are Fungi'** with Dr. Sandra Tuszynska (1:26 min)
- **'6. Fungi Superheroes Introduction'** with Dr. Sandra Tuszynska (1:23 min)

Video Link:

- YouTube clip: **'How trees secretly talk to each other'** BBC News (1:50min) https://www.youtube.com/watch?v=yWOqeyPIVRo
- YouTube clip: **'How Trees Talk'** narrated by Suzanne Simard (4:22 min) https://www.youtube.com/watch?v=kjvBBWsNIgY&feature=share&fbclid=IwAR09fewjkhTc3uPE3_8UzMntpF1LFpKfRs1Ogp3wFFeigb7NK2tPcjA3NIs

Documents:

- R1 Word Wall
- R4 Fungi Types Worksheet (printed copy for all students)
- R5 Art Task Booklet (printed copy for all students)
- R6 Root fungi
- R7 Fruiting Bodies

Lesson Vocabulary

mycorrhizal fungi root symbiotic fungi root fungus endophytes endophytic fungi decomposer decomposing function nutrients symbiotic

Background Teacher Information Lesson 2

Lesson two elaborates on the plethora of new information introduced in lesson one. The focus of this lesson is to further investigate the amazing relationship between fungi and plants. This offers students big picture thinking about the importance of fungi globally and their unseen role supporting other life forms.

Not all fungi do the same job. There are three distinct types of fungi with beneficial roles in ecosystems: **decomposers** (break down organic matter), **mycorrhizal fungi** (root symbiotic fungi living in a relationship with plants) and **endophytes** (living inside of and benefiting living plants). In this lesson, students will be introduced to the three different types of fungi and then focus on learning more about mycorrhizal fungi.

When looking at fungi fruiting bodies, one can sometimes tell what role they play. Decomposers can be seen on wood breaking it down. While fruiting bodies found on the ground are likely to be partnering up with plants, where the fungi provide plant roots with nutrients and receive photosynthetic sugar from plants in return. This an example of mutual symbiosis, where both partners benefit and rely on each other for survival. Mycorrhizal fungi are commonly called 'root symbiotic fungi' or 'root fungus.' This can be explained to the students whilst using the word wall resource.

This lesson will begin to use the visual arts medium of drawing to express the relationship between fungi and plants. Creative expression is a pedagogy that aids deeper integration of new learning. Use the provided art task booklet, linked to the visual arts curriculum to engage the art task.

The key elements that need to be shown in the drawing are, a tree with roots, fungi mycelium wrapping around the roots, a fruiting body attached to the mycelium, as well as the release of spores from the fruiting body, which continues the fungal life cycle and enables the symbiotic relationship of the fungi with other trees. Remind students that the fruiting body is not always mushroom shaped and takes on many different forms, depending on the species of mycelium that produces it. Encourage the students to artistically explore their own style, with only these parameters.

In this lesson, students will draw their first draft. Students will need further class time (reserved art time) each week to complete the art task. Students will need a selection of painting and drawing materials to complete this visual arts component of the unit. Integrating art helps make learning fun and meaningful.

Exploring Fungi

Lesson 2 Teaching Sequence

Introduction:

1. Review the main features of fungi from the previous lesson. Highlight that the visible fruiting bodies of fungi are only a part of what makes up the entire organism. The structure that gives rise to the fruiting body is the mycelium network.

2. Explain that not all fungi have the same role in the ecosystems. Review the **R4 Fungi Types Worksheet** with students before watching the **'6. Fungi Superheroes Introduction'** video.

3. Watch **'6. Fungi Superheroes Introduction'** and ask each student to complete the accompanying worksheet. Replay and pause the video to assist students with recording the information.

4. Introduce the lesson focus on **mycorrhizal fungi** and discuss the word wall labels for lesson two. Explain that this type of fungi wraps their mycelium around the roots of plants underground and work together with plants in symbiotic relationship. Discuss the meaning of *symbiotic*.

5. Screen **'How Trees Talk'** to share an overview of the importance of mycorrhizal fungi. Facilitate a discussion with students about what they found most interesting.

6. Review these questions before watching the final short animation (1:50min) about mycorrhizal fungi, **'How trees secretly talk to each other:'**

    - What do mycorrhizal fungi and trees give and receive from each other?
    - Can you list the benefits to plants of working with the fungal networks underground?

    Listen for the answers when the video is playing. Ask students record responses in their science journal, replaying and pausing the video as required. (Teacher to also model note taking and create a list for display in the classroom titled 'Mycorrhizal Fungi Superheroes').

<u>Art Activity:</u>

7. Hand out a copy of the **R5 Art Task Booklet** to each student. Read through the booklet together.

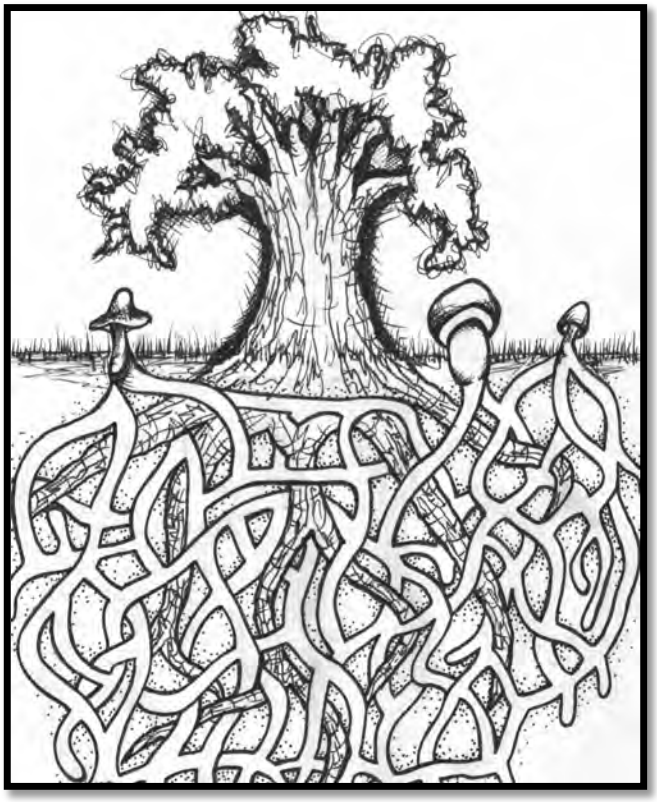
8. Display an enlarged copy of the **R6 Root Fungi** illustration. Use this illustration as inspiration for student's own representations.

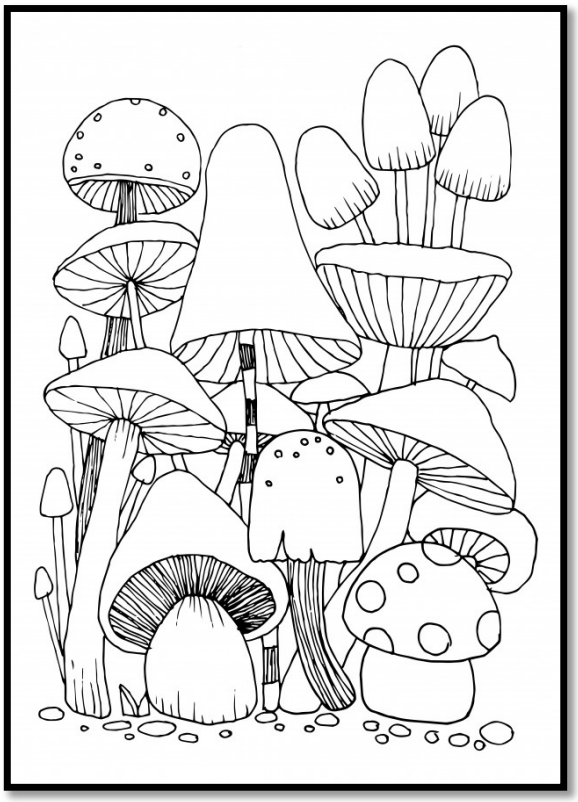
9. Ask students to use their imagination and draw their own version of a mycorrhizal fungi that includes:

    1) A **fruiting body** (any shape and colour)
    2) A network of **mycelium underground connected to the fruiting body**
    3) Mycelium underground **attached to plant or tree roots**
    4) The release of **spores** from the fruiting body

10. Encourage students to use different lines, forms and colour to differentiate between the plant roots and mycelium so both can be clearly seen. Encourage students to have fun and create inventive and original fungi fruiting body shapes.

11. In conclusion, remind students of the initial inquiry question: *What are fungi and why are they important?* As a group reflect on the drawings. Identify the key elements present: mycelium connecting with plant roots underground, mycelium connected with fruiting bodies which produce spores. Discuss the different techniques students have used such as form and colour to highlight the symbiotic relationship.





Lesson 3: Beneficial Roles of Fungi: Mycorrhizal Fungi

Curriculum Links	
Sustainability Priority	**OI.2 – Systems** All life forms, including human life, are connected through ecosystems on which they depend for their wellbeing and survival
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Science	ACSSU073: Living things depend on each other and the environment to survive
Visual Arts	ACAVAM111: Use materials, techniques and processes to explore visual conventions when making artworks

Lesson Focus - Engage Phase

This lesson will extend student understanding of the beneficial role mycorrhizal fungi play in ecosystems. Students will engage with video content created by mycologist Dr Sandra Tuszynska about mycorrhizal fungi. Dr Sandra Tuszynska explains how fungi help feed plants and microscopic organisms, bringing to life a fascinating symbiotic system existing between plants and fungi that has far reaching consequences.

Lesson Outcomes

Students will:

- extend their understanding about mycorrhizal fungi
- integrate learning about mycorrhizal fungi through note taking, discussion and art making
- continue to creatively represent the symbiotic relationship between mycorrhizal fungi and plant roots

Lesson Resources Preparation

Unit Videos: https://vimeo.com/user113329904

- **'7. Fungi Superheroes Mycorrhizal Fungi'** with Dr. Sandra Tuszynska (10:24 min)

Documents:

- R1 Word Wall
- R5 Art Task Booklet
- R6 Root fungi

Lesson Vocabulary

microscopic organism agriculture carbon root mass rehabilitate

Background Teacher Information Lesson 3

In this lesson, Dr. Sandra Tuszynska delivers some deeper understandings about mycorrhizal fungi, extending on information already shared. The Sustainability Cross-curriculum priorities are really interwoven through this presentation, as students begin to explore how life forms are connected through ecosystems in so many ways. Topics covered are how mycorrhizal fungi extend a plant's root mass, aide plant nutrition and protection, share sugars with microscopic organisms in the soil to feed them, assist plants to store carbon, aide communication between different tree species, support whole ecosystems adapt to change, help rehabilitate contaminated soil and help agriculture. What Superheroes!
The conversational delivery style, with our mycologist guide allows detailed understandings to be shared, giving teachers the creative role of unpacking the key points and engaging students with new concepts.

Exploring Fungi

Lesson 3 Teaching Sequence

Introduction:

1. Review the information recorded in student science journals from the previous lesson about mycorrhiza fungi and discuss the most interesting points students learnt.

2. Introduce the lesson focus of extending and consolidate understanding about mycorrhizal fungi. Explain that Dr. Sandra Tuszynska has created a 10min video, sharing in more detail why mycorrhizal fungi are Superheroes!

3. View **'7. Fungi Superheroes Mycorrhiza'** in manageable sections. Pause, discuss and summarise the information presented together. As the leading learner, guide students to take notes, make sketches, explore different ways of record key learning such as mind maps. Reflect on the questions: *Why are mycorrhizal fungi important? Are they Superheroes?* (Teacher continue to add key points to the class display about 'Mycorrhizal Fungi Superheroes').

Art Activity:

4. Ask students to take out their root fungi drawing and art task booklet from the previous lesson. Reflect on the basic elements that need to be included in the artwork:

    1) A **fruiting body** (any shape and colour)
    2) A network of **mycelium underground connected to the fruiting body**
    3) Mycelium underground **attached to plant or tree roots**
    4) The release of **spores** from the fruiting body

5. Ask students if there are any elements in their original drawing, they would alter to more clearly communicate the relationship between mycelium and plant roots? Are there any new additions students would like to include in the drawing to communicate what they are learning about mycorrhizal fungi? e.g. add some microscopic organisms living around the underground mycelium and tree roots. Give students time to enhance their draft drawing as required.

6. Look at the examples of the student drawings and paintings in the **R3 Art Task Booklet**. Discuss the student's use of colour and form to express the symbiotic relationship between the fungal mycelium and plant roots. Ask students to consider if the images capture a relationship between mycelium and plant roots? *Can you see the hidden world of connection between plants and fungi in these artworks?*

7. Explain to students that they will use their draft drawing as a guide and begin to make a good copy on a large sheet of paper using either paint or drawing materials.

8. Support students with the necessary art painting materials, space, time and enthusiasm!

9. Encourage students to select different colours and forms for the plant roots and mycelium so both can be clearly seen. If students are using lead pencil to draw the forms on their good copy artwork, encourage the use of very faint lines. Explain that using lead pencil first, is not always necessary as the draft drawing can be used as a guide when painting or drawing.

10. In conclusion, reflect on the artwork progress together at the end of the session. Discuss the different techniques students are using such as colour and form to highlight the symbiotic relationship. Identify the key elements present: mycelium connecting with plant roots underground and mycelium connected with fruiting bodies which produce spores.

Please allocate additional class time for students to complete and enjoy this visual art task.

When the artworks are complete, display them on the classroom walls to remind students of the important role mychorrhizal fungi play in the environment, hidden from our view and yet so essential to our own survival and that of the planet.

Lesson 4
Beneficial Roles of Fungi: Decomposer Fungi

Curriculum Links	
Sustainability Priority	**OI.2 – Systems** All life forms, including human life, are connected through ecosystems on which they depend for their wellbeing and survival
	OI.7 – Futures Actions for a more sustainable future reflect values of care, respect and responsibility, and require us to explore and understand environments
Science	ACSSU073: Living things depend on each other and the environment to survive

Lesson Focus - Engage Phase

This lesson will extend student understanding of the beneficial roles fungi play in ecosystems. This lesson will focus on introducing decomposer fungi and endophytes as superheroes! Students will engage with video content created by mycologist Dr Sandra Tuszynska about decomposer fungi. Students will learn how decomposer fungi are being used by scientists to help with sustainability and environmental pollution.

Lesson Outcomes

Students will:

- extend their understanding beneficial roles fungi play in ecosystems
- focus on learning about decomposer fungi
- learn how decomposer fungi are being used in environmental innovations

Lesson Resources Preparation

Unit Videos: https://vimeo.com/user113329904

- **'8. Superheroes: Decomposers Endophytes'** with Dr. Sandra Tuszynska (12:03 min)

Documents:

- R1 Word Wall
- R4 Fungi Types Worksheet (already glued into science journals)

Lesson Vocabulary

cellulose lignin pollution solutions biomagnification innovation decontamination

Background Teacher Information Lesson 4

In this lesson, Dr. Sandra Tuszynska delivers a new video focusing on the beneficial roles of decomposer (and endophytic fungi) in ecosystems. Sandra highlights some of the current uses of decomposer fungi, in innovations aimed at improving sustainability and solving environmental problems. Through this exposure to innovations using decomposer and endophytic fungi, students will understand the value of their function in ecosystems and for the future. Decomposer fungi are commonly seen when looking for fungi fruiting bodies in the environment. They can be seen attached to fallen logs and trees. Students will love finding our more about their superpowers!

The video presentation is 12min in length and is best viewed in sections with discussion about each main topic introduced. Topics covered are:
0:00- 3min: Introducing decomposers and endophytes. Learning what plants are made from.
3min- 12min: Innovations for environmental solutions using decomposers (endophytes in one example).
Topics include: new fuel source with endophytes, plastic solutions using decomposer fungi, cleaning up contamination in the environment with decomposer fungi. What Superheroes!

Exploring Fungi

Lesson 4 Teaching Sequence

Introduction:

1. Review the **'R4 Fungi Types Worksheet.'** Explain that we will learn more about endophytes and decomposer fungi in this lesson. Consider these questions: *Why are decomposer fungi and endophytes important? How are they Superheroes?*

2. View **'8. Superheroes: Decomposers Endophytes''** in sections. Pause, discuss and take notes of the key information. (Teacher to also list key points on a class display about 'Decomposers' and 'Endophytes').

   Below are the timed sections of the video to pause and discuss:

   - **0:00-3min:** Introducing decomposers and endophytes. *What is wood composed of?*
   - **3-4min:** New fuel innovation (endophytes)
   - **4-7:30min:** Plastic pollution solutions with decomposer fungi and the Mutarium invention
   - **7:30- 9min:** Pollutants and biomagnification
   - **9-11:30min:** Decomposer fungi helping clean up the environments

3. In conclusion, review the word wall. Reflect on the function of decomposers that enable them to be used in sustainability solutions for current environmental issues and into the future.

Lesson 5: Grouping Fungi: shape, colour and texture

Curriculum Links	
Sustainability Priority	**OI.2 – Systems** All life forms, including human life, are connected through ecosystems on which they depend for their wellbeing and survival
	OI.7 – Futures Actions for a more sustainable future reflect values of care, respect and responsibility, and require us to explore and understand environments
Science	ACSSU044: Living things can be grouped on the basis of observable features and can be distinguished from non-living things
	ACSSU073: Living things depend on each other and the environment to survive
	ACSSU072: Living things have life cycles
Visual Arts	ACAVAR113: Identify intended purposes and meanings of artworks

Lesson Focus: Engage Phase

Students are invited to explore and engage with the diverse, colourful and varied forms of fungi fruiting bodies. Our *Exploring Fungi Unit* mycologist, Dr. Sandra Tuszynska will introduce the main fungi groups, describing the way fungi are grouped based on shape and external features. Students will engage with a fun classifying task using illustrations and photographs of Australian fungi. Students will then go on a foray (fungi hunt) around the school grounds or a nature strip to look for different fungi fruiting bodies and their mycelium.

Lesson Outcomes

Students will:

- learn that there are distinct groups that macro fungi are divided into
- be introduced to the importance of key characteristic features in fungi identification
- observe features of fungi in the field by going on a foray
- reflect on new terminology introduced during the lesson

Lesson Resources Preparation

Unit Videos: https://vimeo.com/user113329904

- **'9. Classifying Fungi Part 1'** with Dr. Sandra Tuszynska (10:14 min)

Documents:

- R1 Word Wall
- R8 Fungi ID Cards (printed copy for groups)
- R9 Foray Safety
- R22 Taxonomic Classification (teacher notes)
- Fungi- coll-manual (excellent teacher reference)
- School map (optional)

New Lesson Vocabulary

Life cycle mature foray stem stipe cap pileus gills scales volva annulus ring skirt pores morphology morphological groups visual key species macro fungi

Background Teacher Information Lesson 5

Going on a fungi foray in the natural environment is a brilliant way to introduce a key scientific skill of observation and documentation. It is also a fun way to help students connect with the environment around them. The importance of children learning through inquiry in the environment via hands-on activities, cannot be overstated and is well documented. Engaging students in learning outside the classroom stimulates their learning and inquiry. When children are excited about their learning, it fuels their desire to learn more.

This unit has been designed to engage with students' natural curiosity. Before explaining and understanding too much about the structure and biology of fungi, this lesson aims to give students exposure to fungi that may be present in the school grounds. There are many items that can be taken on a foray, such as recording sheets, cameras, pencils, clipboards, magnifying glasses, mirrors, notebooks and field guides. In the first instance, walk with your class around the school grounds with minimal equipment to survey the presence of fungi. Then plan for further investigations based on your findings.

Please also read the **'R22 Taxonomic Classification'** teacher resource in preparation for this lesson. The observable features of a fruiting body are used as a guide to identify and group different fungi species. This is a great entry level for students to begin to understand how fungi are classified. The Kingdom of fungi is classified into five major phyla. This teaching unit is focused on exploring macro-fungi (fruiting bodies visible to the naked eye) that can be found in the natural environment. This unit therefore is looking at only two of the main phyla of fungi called Basidiomycota and Ascomycota. The major difference between the two groups is how their spores develop. Students will learn about spores in more detail later in the unit.

From these two phyla alone, fungi can be further classified generally into at least 20 different groups. These two phyla contain groups of fungi with particular shapes which are their distinguishing features for example mushroom (toadstool), phallic or coral shapes. This classification of fungi will be introduced to the students and is very engaging.

The lesson 5 video, **Classifying Fungi Part 1,** will give students the sense of how macro-fungi are grouped and will inspire students to go out to look for these different fungi hidden around us. Before heading into the field, a classification activity has been designed for students using fungi illustrations and photographs.

The Foray Activity: How you as a teacher, would like to group students for best engagement when on a fungi foray around the school grounds, is up to you. Having additional parent helpers, a teacher aide, local volunteers or citizen scientists is always beneficial to support students with smaller adult to student ratios. Prior to the foray, you can investigate if there are any sites that have evidence of fungal fruiting bodies and mycelium (fluffy white threads usually present within decomposing logs or leaf litter) that you can guide students to. However, the keen eyes of children will be the first to spot fungi in the field.

If you think that it will not be possible to find fungi or mycelium on the school grounds, it is still worthwhile surveying the school grounds with students, facilitating student's awareness of the built environment of the school and how it impacts the presence of fungi. It is also worthwhile to organise an excursion to a local nature reserve and compare the two environments. The 'R9 Foray Safety' rules document can be modified to add any additional protocols relevant to your school context.

Exploring Fungi

Lesson 5 Teaching Sequence

1. Engage students with a discussion about what key insights they learnt from the previous lesson. Ask students if they have noticed any fungi or mycelium growing locally since the last lesson? Let the class know that during this lesson, they will be going on what mycologists call a *foray*, a fungi hunt (usually to collect fungi, but in this case to scope their presence) around the school grounds to identify some of the fungi living around them. Ask if students can recall what fungi features might be visible with the naked eye in the environment? If the environmental conditions are optimal, we can see the fruiting bodies of fungi and also mycelium (my-silly-arm) growing on or under logs, in leaf litter or in the soil.

2. Mention that before we go on our foray around the school grounds, we will watch a video made by our learning guide Dr. Sandra Tuszynska, to find out how mycologists begin to classify and group fungi. Excite students' interest by commenting that the fungi fruiting bodies come in an astonishing range of sizes, shapes, colours and textures. Remind students that fungi are classified into their own Kingdom of living organisms and very little is known about them compared to animals and plants. This is why it is so important to study fungi.

3. Before watching the '**9. Classifying Fungi Part 1,'** ask students why they think scientists group living things? Why do mycologists group fungi?

4. Watch the video and pause to discuss the key points presented in the video. Engage with student knowledge of this topic.

Introduce the Fungi ID Challenge Activity:

5. Introduce the **'R8 Fungi ID Cards'** resource. Explain that each fungi identification card, represents a different *morphological group*. The definition of morphological groups is how fungi are grouped according to their various forms or shapes.

6. The Fungi ID cards were created by an artist to help students recognise distinct fungi types. Briefly compare the different cards, highlighting the use of single lines to represent the different fungi forms. Discuss the use of stylization by the artist, to depict only the essential elements that would help the viewer to identify the groups. Highlight that photography is another artistic medium that is being used for a scientific purpose to aide identification.

7. Organise students to work in groups with space to display the resource. Give each group a set of the Fungi ID cards and collection of fungi photographs to match.

8. Explain the task is to classify the collection of fungi photographs into the correct morphological group, based on the observable shapes and features that appear in the photograph. Demonstrate matching one photograph with an illustrated Fungi ID card. Discuss your decision-making process out loud to the class.

9. Regroup and reflect on how the classifying activity went.

10. Prepare the class to go on the fungi hunt/foray around the school grounds:

    - Explain that this will be the first foray to survey fungi around the school grounds
    - Remind students that they will be looking for fruiting bodies and mycelium
    - Highlight the importance of **observation** as an essential scientific skill
    - Note that in following lessons we will learn how to properly record, draw and photograph fungi and will return to any discovered fungi sites to record these further
    - Take the class science journals and pencils to an outside area, ready for use at the end of the lesson
    - Outline the class expectations for how to move as a group when outside, as directed by the teacher

11. Outline the Foray Safety Rules using resource **'R9 Foray Safety.'** Enlarge to display in the classroom.
    - No picking, disturbing or touching the fungi fruiting bodies
    - Never eat any fungi growing in the wild
    - Carefully look for mycelium on dead logs, and in leaf litter
    - Use gloves if directed by your teacher

12. Read this excerpt from one of Australia's pioneering fungi specialists, J.H Willis (written in 1934) before going on the foray and identify if any of these types of environments are within the school grounds:

    > "… Once you have discovered a rare species and your interest is fairly captivated, it is amazing how fungus fever will grow; every patch of bush and scrub is a hunting ground - rich in possibilities; even rotting logs, fence-posts, lawns or manure heaps in the garden, become potential treasure mines. Perhaps the greatest thrill in hunting Australian fungi is the knowledge that few others have been in the field, that very little is known about our fungi, and that any specimen may prove an addition to the list of **species** already recorded."

13. Ask the class to list areas around the school grounds that would be good to investigate. Consider the location of garden beds, fenceposts, lawns, compost heaps, timber logs, leaf litter, nature corridors. If available, print copies of the school site map for groups to mark the general locations of any fungi found, or allocate roles to students to draw a 'mud map' of the school grounds and location of any fungi discovered.

14. Encourage students to tune their attention to all of the aspects of a fruiting body, including colour, size, shape and smell and look out for the different groups described by Dr. Sandra Tuszynska.

15. Head out for the first fungi foray. There's an amazing hidden world waiting to be explored!

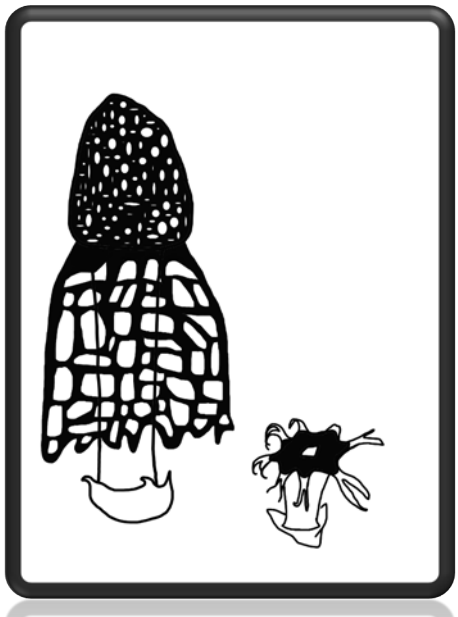
16. Regroup to reflect on what has been discovered or not discovered. Preferably sit together outside instead of inside the classroom.

17. Facilitate discussion with the students to generate further inquiry thinking about fungi: their habitats, identification and role in ecosystems. Ask students to consider the built landscape of their school, "Do the school grounds integrate access to the natural environment such as established trees, gardens, soil, plants and living organisms such as fungi? Where did you see fungi or mycelium grow? Did you see decomposing fungi growing on logs? Did you see any fungi growing in the soil near plants? Do you think they might be mycorrhizal fungi?

18. Reflect on the lesson 5 world wall terminology. Ask if students know what 'species' means? Explain that a species is a group of organisms, in this case fungi, with the same features, lifecycle and capabilities to

interbreed and multiply. For example, humans can only reproduce with other humans but not with other animals, even though we have similar features. Add the new labels to the word wall display on return to class.

19. Hand out the student science journals and pencils. Ask students to make a journal entry and record notes about any fungi fruiting bodies or mycelium they discovered, any new understandings they have taken from the lesson and questions they are wondering about.



Lesson 6: Grouping Fungi: shape, colour, texture Part 2

Curriculum Links	
Sustainability Priority	**OI.2 – Systems** All life forms, including human life, are connected through ecosystems on which they depend for their wellbeing and survival
	OI.7 – Futures Actions for a more sustainable future reflect values of care, respect and responsibility, and require us to explore and understand environments
Science	ACSSU044: Living things can be grouped on the basis of observable features and can be distinguished from non-living things
	ACSSU073: Living things depend on each other and the environment to survive
	ACSSU072: Living things have life cycles
Visual Arts	ACAVAR113: Identify intended purposes and meanings of artworks

Lesson Focus: Engage Phase

Students will engage with two exciting fungi resources to extend their understanding of how fungi are grouped using observable features. Students will use a simple key to sort fungi into groups based on observable features and collate a mini fungi field guide to take on their next foray.

Lesson Outcomes

Students will:

- practice sorting macro-fungi into distinct groups using a key
- understand the importance of the key characteristic features when classifying fungi

Lesson Resources Preparation

Unit Videos: https://vimeo.com/user113329904

Documents:

- R1 Word Wall
- 1.4 Key to the Fungal Treasures (printed copy for all students)
- 4.4 Fields of Fungi Mini Field Guide (printed copy for all students)

Background Teacher Information Lesson 6

The two fantastic resources used in this lesson come from the North American Mycological Association publication called 'The Fungus Files': https://namyco.org/fungus_files.php

The **'Key to the Fungal Treasures'** resource introduces the principal of using a dichotomous key as a scientific tool to help classify fungi into groups. The key consists of a series of yes/no choices that lead the students to group the fungi illustrations into the correct group. Asks students to place each image on the key before gluing into place.

The **'Fields of Fungi Mini Field Guide'** is an excellent resource for all students to take on forays and use during this unit. Make sure you have collated one booklet prior to the lesson and know how to direct the students to do this. Without teacher guidance, the booklet collation can be very confusing for students!

Give students a home task to look for fungi and document their findings during the week to extend their understanding and awareness of fungi in their local environment. Encourage students to take photographs.

Exploring Fungi

Lesson 6 Teaching Sequence

1. Engage students with a discussion about what key insights they learnt from the previous lesson about macro fungi.

2. Introduce the **'1.4 Key to the Fungal Treasures**' resource. Explain what a dichotomous key is and how scientists use keys to divide organisms into smaller and smaller groups to classify them.

3. Demonstrate how to use the resource using one fungi image. Read aloud the questions and thinking process to arrive at the grouping.

4. Ask students to complete this activity independently, with help as needed.

5. Demonstrate how to assemble the '**4.4 Fields of Fungi Mini Field Guide,'** before asking students to make their own booklet.

6. In conclusion, give students a home task to look for fungi mycelium and fruiting bodies during the week in their local area. Encourage students to draw, take photos or take notes of their finds.

Lesson 7: The Features of Mushrooms

Curriculum Links	
Sustainability Priority	**OI.2 – Systems** All life forms, including human life, are connected through ecosystems on which they depend for their wellbeing and survival
	OI.7 – Futures Actions for a more sustainable future reflect values of care, respect and responsibility, and require us to explore and understand environments
Science	ACSSU044: Living things can be grouped on the basis of observable features and can be distinguished from non-living things
	ACSSU072: Living things have life cycles
Visual Arts	ACAVAM111: Use materials, techniques and processes to explore visual conventions when making artworks

Lesson Focus: Explore Phase

The focus of this lesson is to look in more detail at how mycologists describe the various features of fungi, specifically studying the mushroom shaped fungi. Our *Exploring Fungi* mycologist Dr. Sandra Tuszynska has prepared a video describing the features of mushrooms. Students will use shop-bought common mushrooms as a case study, looking at the observable features of mushroom. Students will learn the principles of scientific drawing labelling the various morphological parts of the mushroom with scientific terminology. Students will practice their scientific drawing skills and draw the whole mushroom and a cross section.

Lesson Outcomes

Students will:

- learn about the general characteristics of the mushroom shaped fruiting body; its shape, texture and presence of gills or pores
- examine the mushroom cap's shape, texture, cap margin, gills and stem shape, colour and texture
- identify the gills as the structure from where spores are released
- learn the principles of scientific drawing
- reflect on new terminology introduced during the lesson

Lesson Resources Preparation

Unit Videos: https://vimeo.com/user113329904

- '**10. Classifying Fungi Part 2'** with Dr. Sandra Tuszynska (10:20 min)

Documents:

- R1 Word Wall
- R10 Mushroom Details (printed copy for each student)
- R11 Scientific Drawing Guide (printed copy for each student)
- R12 Student SD sample
- R13 Cross section pic

Equipment:

- Mushrooms for each student, chopping board, knife

New Lesson Vocabulary

scale scientific drawing specimen cross section bracket

Background Teacher Information Lesson 7

This lesson requires that each student has access to a shop bought mushroom to illustrate and cut into a cross section (one mushroom per student would be ideal). The skill of learning to do a scientific drawing engages both the science and visual arts curriculums. The actual process of drawing helps students observe in more detail and integrate their learning in a deeper way.

Throughout the course of this unit, students will make numerous scientific drawings to record both the observable features of the fruiting body and document the reproductive phase of the fungi life cycle. In this lesson, students will observe in more detail the gills of a mushroom.

The **'R11 Scientific Drawing Guide'** and **'R12 Student SD sample'** have been created to assist with the teaching of scientific drawing principals. The process is unpacked in the teaching sequence. Learning to draw a specimen to scale for students can be difficult. This aspect of scientific drawing has been modified to make it easier for students to accomplish. Students are encouraged to fill one blank page with the drawing of their specimen and then measure the actual size of the mushroom once the drawing is complete. In this way, students can draw a bracket next to the specimen and record the true height/ width etc. in centimetres.

Alternatively, you could guide your students to measure the mushroom specimen first and then multiply the measurements to enlarge the drawing on the page. In the first instance, this makes the act of freely observing and drawing the specimen more complicated due to the mathematics involved and the needs of a full class with different measurements. You may wish to delve further into scale and integrate a mathematics lesson with the scientific drawing!

Exploring Fungi

Lesson 7 Teaching Sequence

1. Ask students if they have seen any fungi or mycelium growing locally since the last lesson?

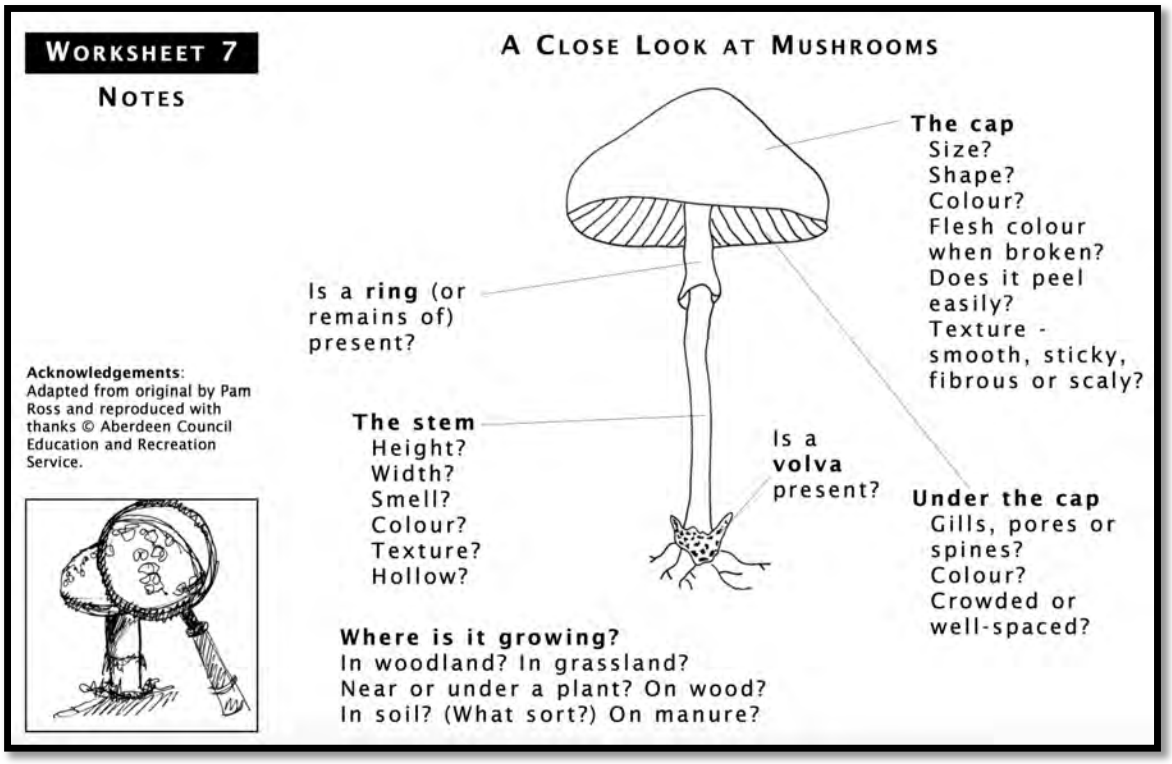
2. Mention that Dr. Sandra Tuszynska will show us what features mycologists examine when classifying mushroom shaped fungi, such as the cap shape, cap margins, gills and stem shape.

3. Watch the '**10. Classifying Fungi Part 2'** video. Discuss the new identification information presented in the video, such as the function of the gills and other features.

4. Remind students that the fruiting body is one part of the fungal life cycle. Compare the mushrooms to other common fruits such as the apple, highlighting that the apple is only one part of the tree.

5. Use the '**R10 Mushroom Details'** resource as a guide to examine and discuss the features of the common mushroom in more detail. Display the resource and/or give students a printed copy as a reference.

6. Have a selection of shop-bought mushrooms on display for students to look at and touch. Invite students to examine the common mushroom more closely, specifically looking at the cap shape, cap margins, gills and stem shape. Ask the detailed questions on the worksheet when looking at the specimens.



Scientific Drawing Activity

7. Explain that scientific drawings:
   - are an important scientific skill
   - all scientists need to be able to produce a quality scientific drawing
   - allow the observer to record important features of the specimen.
   - help you to recall details of features at a later time

8. Display the **'R11 Scientific Drawing Guide'** for the whole class to view. Give each student a copy to glue into their science journal to refer to during the unit.

9. Read through the key principals and steps of scientific drawing with the class.

   - Carefully examine the main features of the specimen
   - Draw only what you see, not what you think should be there or what you'd like to see
   - Make drawings large and clear, so the features can be seen
   - Draw in pencil, keep your drawing neat and clean
   - Use single lines when drawing, avoid sketchy lines
   - Do not shade the drawing

10. Explain that scientific drawings need to include: a title, label, scale, underlined scientific names. Elaborate on each element using the **'R11 Scientific Drawing Guide'** text.

11. Show student examples of a scientific drawings of the common mushroom and point out the features. Use the **'R12 Student SD sample'** resource.

Drawing Activity 1:

12. Ask students to draw a large scientific drawing of their whole mushroom specimen on one page of their science journal. Give students time to complete their drawing and include all the required elements.

13. When the drawing is completed, ask students to measure and record in (cm):

    - the height of the real mushroom specimen
    - the height of the cap
    - the height of the stem
    - the width of the cap

14. Display these measurements next to the drawing using brackets to denote the different parts and their actual heights/lengths. Demonstrate how to do this. This allows people who view the drawings, to understand the real size of the mushroom.

15. Review the drawings as a class. Discuss what was difficult or easy about the process. Inquire if students were able to understand the mushroom in more detail because they drew it? Ask if they noticed or learnt anything new about the mushroom from drawing it?

Drawing Activity 2:

16. Introduce the idea of a cross-section and what additional information this view can offer scientists.

17. Demonstrate how to cut the mushroom to create a cross section, with two equal mirror images of the mushroom. Use a chopping board and small sharp knife to cut through the centre of the mushroom vertically for the students.

18. Discuss the features that can be seen in a new light when looking at the cross section.

19. Ask students to complete a scientific drawing of their cross section, using the scientific drawing principles and processes from activity 1 and check their work includes all of the elements.

20. In conclusion, review the lesson vocabulary and update the word wall.

Lesson 8: Fungi Hunt and Essential Tools

Curriculum Links	
Sustainability Priority	**OI.2 – Systems** All life forms, including human life, are connected through ecosystems on which they depend for their wellbeing and survival
	OI.7 – Futures Actions for a more sustainable future reflect values of care, respect and responsibility, and require us to explore and understand environments
Science	ACSSU044: Living things can be grouped on the basis of observable features and can be distinguished from non-living things
	ACSSU073: Living things depend on each other and the environment to survive
	ACSSU072: Living things have life cycles
Visual Arts	ACAVAM111: Use materials, techniques and processes to explore visual conventions when making artworks
	ACAVAR113: Identify intended purposes and meanings of artworks

Lesson Focus: Explore Phase

In this lesson students will discover the tools used by mycologists and fungi enthusiasts in the field, such as fungi ID recording sheets and field guides. Students will also learn the principles macro fungi photography to assist with identification. Students will go on their second foray to identified sites around the school grounds or offsite in a local natural reserve, to look for different fungi fruiting bodies and mycelium, armed with new documentation and identification skills.

Lesson Outcomes

Students will:

- explore field guides and foray equipment
- learn what information to record when recording fungi in the field
- learn how to photograph fungi to offer the best opportunity to identify fungi
- observe different features of fungi in the field by going on a foray
- observe that fungi depend on living things and the environment to survive
- practice the key scientific skills of observation and documentation in the field
- reflect on new terminology introduced during the lesson

Lesson Resources Preparation

Video/ Web Links:

- **'The Hidden World of Fungi'** student-made video by The River School (2min) https://vimeo.com/230121790
- **QuestaGame App** https://questagame.com
- **iNaturalist App** http://inaturalist.org/

Documents:

- R1 Word Wall
- R9 Foray Safety
- R14 Surveying and collecting fungi
- R15 Student Record Sheet (printed copy for each student)
- R16 Detailed Record Sheet
- 4.4 Fields of Fungi Mini Field Guide (made into booklets)
- School map (optional)

Equipment:

- **Fungi Explores Tool belt:** collection of rulers, tape measures, school cameras, clipboards, magnifying lenses, hand mirrors, field guides, science journals and pencils, mushroom samples

New Lesson Vocabulary

field guide GPS dressed, undressed, top side, underside substrate common name scientific name habitat distribution flesh frequency etymology upper surface lower surface spore print vegetation

Background Teacher Information Lesson 8

This lesson introduces the students to tools used by mycologists and fungi enthusiasts. Field guides showcase the diversity of fungi in local areas, and can generate great excitement and act like a treasure resource for students. Try to locate field guides that are relevant to your local area. If you can't find these, there are several Australian fungi field guides available.

iNaturalist and QuestaGame are a fun way to contribute biodiversity data to scientists. The Apps are played as a game, which serves as a documentation tool, where players submit photographs of their findings in the field with as much description and notes as possible. The App also captures the GPS data resulting in mapping of the sightings. Other players and scientists then provide possible identification and other information about the submitted sightings, the depth of which relies on the person's skill level and equipment used.

Schools can sign up and BioQuest their school grounds by submitting any biological specimens encountered on the school grounds or a nearby nature reserve, helping scientists with data collection about current biodiversity status of a given area. This provides an active and exciting opportunity for students to be engaged in real world and global citizen science initiatives. Have a good look at both iNaturalist and QuestaGame website to decide how your school can incorporate using it with this and other units.

To add another level of interest and engagement to the *Exploring Fungi Unit*, it is highly recommended that either app be uploaded to one or more school iPads or other devices, enabling students to take this technology out into the field to document their findings and participate in this citizen science initiative. Opportunities like this enrich learning for students. The technology can be used not just for fungi identification but for other lifeforms too.

Notes about photographing fungi
When submitting photographs of fungi for identification, it is important that they include the following angles:
dressed = in situ - this is a photograph of the specimen in its natural untouched state as found
undressed = a photograph of a specimen when debris around it is brushed aside but the specimen remains in or on its substrate (food source)
top side = the top of the cap is photographed to record its shape, colour and texture
underside = a photograph of the gills. A mirror can be used to take a photo of the underside, without removing the specimen from its substrate. Alternatively placing the phone or camera on the ground and pointing it to capture the underside of the specimen, also works well.

Exploring Fungi

Lesson 8 Teaching Sequence

1. Ask students to share any fungi drawings or observations recorded as part of their home task to look for local fungi.

2. Explain the lesson 8 focus and outcomes.

3. Display the **'R14 Surveying and collecting fungi'** resource to explore the use of collection and photography in mycology. Explain that the intended purpose is to use the photographs to assist with fungi identification and gathering of data. Fungi specimens must be dried before being sent to the herbarium for identification, and they look very different when dried out, so drawings with descriptions and photos are very important documents, to help mycologists identify fungi. For this purpose, several views need to be taken.

4. For fungi to be identified from photographs they need to be photographed correctly (and even then, it is extremely difficult to know exactly which species some fungi are). Introduce the key aspects needed for a good photograph: focus and framing.

5. Introduce the terminology of: *dressed, undressed, topside and underside* views of fungi, showing examples. Mention that we will take the school cameras on the foray and students can practise photographing these views.

6. Introduce the app called **iNaturalist or Questagame**. Display the website on the whiteboard. Explain that citizen scientists from all around the world take photographs of plants, animals and fungi and upload their photos for identification by scientists and other citizen scientists to help with biodiversity research. Look at some of the fungi images that have been uploaded to site or app. Explain that these digital resources are a fun way to share discoveries with a global community of people interested in using technology to help scientists preserve biodiversity for the survival of the Earth.

7. Demonstrate how to use the iNaturalist or QuestaGame app on the school device and let students know this can be used as one of the tools to document findings on the foray planned for this lesson.

8. Introduce some of the tools mycologists use in the field to record and identify fungi sightings starting with **field guides.** Have a selection of fungi field guides available for students to look at, especially ones identifying local fungi.

    - Point out and discuss the **key headings** often included in fungi field guides such as: common name, scientific name, general description, fruiting body, substrate, habitat, distribution, frequency, cap, stem, pores, gills, flesh, upper surface, lower surface, spores, spore print, smell, notes, comments, etymology, look-alikes.

    - Discuss the meaning of any of these headings and the value of having this information. For example, explain that **substrate** means: the organic material that a fungus lives on and receives nutrients from. Remind students that **spores** are the reproductive unit of fungi. Some fungi release their spores from **pores**, others from **gills**. The presence of pores or gills assists with classifying fungi into groups.

8. Introduce the **Fungi Explorers Tool belt**:

- Show students a range of equipment fungi enthusiasts take on a foray including a ruler, tape measure, recording sheets, cameras, pencils, clipboards, magnifying lenses, mirrors, notebooks, field guides.

- Hand around small magnifying lenses with some mushroom samples, explaining that these are great tools for examining gills and pores more closely.

9. Show students an example of an **identification record sheet** (resources **R15** and **R16**)

- Explain it is important to record as much information as possible including what the fungal fruiting body looks like, the date found, what it was growing on and details of nearby vegetation.

10. Watch a short video **'The Hidden World of Fungi'**, made by Year 5 students about their foray to their school creek.

11. Prepare the class to go on the fungi foray around the school grounds:

- Remind students that they will be looking for fruiting bodies and mycelium
- Highlight the importance of **observation** as an essential scientific skill
- Remind students they will draw and photograph fungi using the new skills learnt
- Ask students to fill out a fungi identification sheet for any fruiting bodies found
- Outline the class expectations for how to move as a group when outside, as directed by the teacher
- Outline the foray safety rules, using the **'R9 Foray Safety'** resource.

12. Hand out the *Fungi Explorers Tool Belt* materials and fungi identification sheets to record fungi located at school.

13. Head out for the fungi foray.

14. When in the field, here are some of the ecological concepts you could discuss with students to help integrate the learning:

- If a specimen is growing near a tree, discuss the symbiotic relationships mycorrhizal fungi have with plants (although technically the fungi specimen may not be a mycorrhizal species, you would have to dig under the specimen and follow its mycelium to see if it associated with any roots).

- If a specimen is located on a decaying log, talk about the specific role of fungi as decomposers.

15. Regroup to reflect on what has been discovered. Preferably sit together outside. Assist students to upload fungi images to the iNaturalist or QuestaGame app at the end of the lesson or at a later date. Remember there is a two week window to submit the sightings.

16. Use the word wall resource. Reflect on some of the key words introduced during this lesson. Add the words to the Word Wall on return to class.

Lesson 9: The Lifecycle of Fungi

Curriculum Links	
Sustainability Priority	**OI.2 – Systems** All life forms, including human life, are connected through ecosystems on which they depend for their wellbeing and survival
	OI.7 – Futures Actions for a more sustainable future reflect values of care, respect and responsibility, and require us to explore and understand environments
Science Knowledge and Understanding	ACSSU073: Living things depend on each other and the environment to survive
	ACSSU072: Living things have lifecycles
Science As a Human Endeavour	ACSHE050 & ACSHE061: Science involves making predictions and describing patterns and relationships
	ACSHE051 & ACSHE062: Science knowledge helps people to understand the effect of their actions
Science Inquiry Skills	ACSIS053 & ACSIS064: With guidance, identify questions in familiar contexts that can be investigated scientifically and make predictions based on prior knowledge
	ACSIS054 & ACSIS065: With guidance, plan and conduct scientific investigations to find answers to questions, considering the safe use of appropriate materials and equipment
	ACSIS055 & ACSIS066: Consider the elements of fair tests and use formal measurements and digital technologies as appropriate, to make and record observations accurately

Lesson Focus: Explain Phase

The focus of this next explain phase, is for students to understand in more detail the fungal lifecycle. They will learn about the reproductive features of fungi including spores. Students will set up a four-week controlled experiment, where they will observe an oyster mushroom develop from mycelium. Over the following weeks students will monitor the fruiting of the oyster mushrooms by taking measurements such as weight, size and yield of the growing mushrooms.

Lesson Outcomes

Students will:

- learn about the life and growth cycle of fungi
- learn about the role of spores in the lifecycle
- learn that spores come from the fruiting body
- learn that spores are located and dispersed in different ways depending on the species of fungi
- set-up an experiment to observe the fruiting body forming from the mycelium

Lesson Resources Preparation

Unit Videos: https://vimeo.com/user113329904

- **'11. Classifying Fungi Part 3'** introduced by Dr. Sandra Tuszynska

Web Links:

- How to Make a Spore Print PDF: British Mycological Society https://www.britmycolsoc.org.uk/education/primary

Documents:

- R1 Word Wall
- R2 Fungi Lifecycle 1 & R3 Fungi Lifecycle 2 (glued in science journals)
- R17 Spore Facts
- R18 Lifecycle Wheel (printed copy for each student)
- R19 Experiment Record 1 **or** R20 Experiment Record 2
- R21 Experiment Set up
- How to make a spore print. pdf

Equipment:

- **spore print**: paper, knife, cover, mushrooms. **Experiment:** mushroom logs and set-up for experiment

New Lesson Vocabulary

photosynthesis moisture humidity temperature dispersal reproduction germination primordium button

Background Teacher Information Lesson 9

Students have spent several lessons engaging with completely new concepts about fungi, that fungi are integral to and play a vital role in global ecosystems. The vastness of the fungal network is contrasted with the unseen and hidden nature of the fungi themselves. The surprise and excitement of discovering fungi is the 'hook,' making learning fun, live and meaningful. This teaching sequence has been designed for this expansive understanding to settle into the imagination of children's minds, developing a desire within the learner to want to know more. The students have spent several lessons engaging and exploring the diversity of fungi in their local area and have been exposed to the exciting diversity of fungi fruiting bodies through resources and engagement with Dr. Sandra Tuszynska's expert knowledge. During this next explain phase, teachers harness the interest that has been generated and offer students a deeper understanding of how fungi survive and contribute to the ecosystem. The focus of this lesson is to understand in more detail the fungal lifecycle and the reproductive features of fungi including spores. Here, learning remains interactive and fun.

The explanation provided in this unit about the lifecycle of fungi is appropriate for this year level. Explaining the fungal lifecycle is like the question about which came first, the chicken or the egg? Sexual reproduction in fungi occurs through the sharing of, or the exchange of genetic information between two spores. This lesson summarises the key factors that identify fungi as belonging to its own Kingdom: (1) has spores (2) doesn't depend on sunlight as an energy source (3) fungi feed by absorbing nutrients from the organic material in which they live. Animals, like humans also have to get their energy source from outside of themselves. Decomposer fungi gain their energy by breaking down organic material from dead or dying plants. Plant symbiotic fungi receive carbohydrates (plant sugars) provided to them by plants, in exchange for nitrogen and other nutrients provided by these fungi to plants. Plants and algae make their own food from sunlight, water and carbon dioxide in the process of photosynthesis.

A fun activity planned for this lesson is making a spore print with a shop bought mushrooms. If your budget allows, provide a mushroom to each student for this activity. Alternatively use 2-3 mushrooms for a whole class activity or ask students to bring in a fresh mushroom from home. Select a mushroom variety that has obvious gills under the cap. Read the 'How to Make a Spore Print pdf' and background information.

The introduction of a 2-4 week experiment will enable students to observe and document how fruiting bodies (mushrooms) develop from mycelium. It would be preferable if numerous 'mushroom logs' or oyster mushroom kits were bought for this experiment, enabling students to work in groups to record the growth experiment and for the class to compare the growth rates at the end of the experiment between groups. Students will be engaged with monitoring the fungal growth and practicing scientific recording skills. Follow the growing instructions from the oyster mushroom 'log'/kit supplier as to the best conditions to grow the mushrooms for this experiment, while also following the steps in the teaching sequence. All students need to monitor the experiment daily for the following 4 weeks. Please allocate time (10min) in the class timetable to do this recording aspect of the experiment each day. Please ensure that the oyster mushroom experiments can be cared for over the weekend. An experiment record sheet has been designed for each student (**R19** or **R20)**. Please print this to A3 size to ensure students have enough space to record their observations and measurements. e.g. Day 2 observation: "mycelium more concentrated at the cut compared with the day before." Once the primordia (baby mushroom) starts to emerge, students can measure the height. As the cap starts to emerge students can also measure the width e.g. Day 8: Fruiting body height: 1cm, width: 0.5 cm. The mushrooms will grow in clusters from the cut in the 'log.' It may be a slow start, but once the fruiting body starts to grow, it can mature very rapidly, and this is exciting for students to observe and document.

Exploring Fungi

Lesson 9 Teaching Sequence

1. Introduce the lesson 9 focus and outcome, mentioning that we will be learning more about the lifecycle of fungi, including their reproductive structures called spores. Explain that the class will set up an experiment to grow oyster mushrooms from mycelium.

2. Read **'R17 Spore Facts'** to the students.

3. Summarise the key factors that make fungi its own Kingdom:

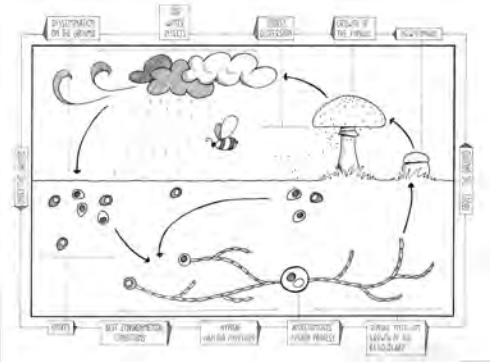
    - fungi produce **spores**, used for reproduction
    - fungi don't depend on sunlight as an energy source
    - fungi feed by absorbing nutrients from the organic material in which they live

4. Watch the '**11. Classifying Fungi Part 3'** video focusing on spores.

5. After viewing the presentation reiterate some of the important facts about spores and the lifecycle of fungi:

    - Different types of fungi release their spores in different ways and from different surfaces. Some release their spores from their gills, spines or tubular lining, other fungi use weird and wonderful ways to release their spores from inside their fruiting body.
    - Many fungi use enormous amounts of force equivalent to launching a rocket, to release their spores!
    - Fungi spores can also survive travel through space, maybe to colonise other planets?
    - Spores can be dispersed by wind, rain, insects, birds, animals, water currents and on clothing.
    - Spores don't contain much stored energy (food source) and need to land on a food source in order to grow into hyphae and eventually mycelium (a group pf hyphae creating a mycelium network).
    - Spores, mycelium and fruiting bodies are made of chitin, one of the most complex and strongest biologically made substance on Earth. Insects are also made of chitin.

<u>Fungi Life Cycle Description</u>



6. Describe the life cycle as simply as possible. Display the **'R3 fungi Life Cycle 2'** diagram and refer to the dot points below. Students can refer to the diagrams glued into their science journals.

    - **Fungal fruiting bodies grow from mycelium.** Remember mushroom shaped fungi are only one type of fungi (point to the fruiting body and the mycelium underground).

    - **Mycelium originates from two spores sharing their genetic makeup** (point to the illustration of the spores, featuring two different colours to represent this).

- **When the conditions are right including moisture, humidity and temperature, mycelium from a certain species of fungi will grow a fruiting body** (point to the different sized fungi growing next to a mature mushroom).

- **When the fruiting body matures and the conditions continue to be beneficial, the fruiting body will produce spores. That is the main role of the fruiting body** (point to the spores being released from the mature mushroom under the cap).

- **Spores are released into the environment by the fruiting body or can be dispersed by insects and other creatures.** Many insects and other animals like snails, bettongs and wallabies feed on fruiting bodies of fungi, consuming their spores and dispersing these spores when they poo in other parts of the ecosystem. This is especially important for the root symbiotic (mycorrhizal fungi) such as truffles, which are concealed underground and rely on animals to dig them up and disperse their spores.

- **Germination occurs when a spore lands on a suitable substrate and when the conditions are right, it will germinate a hypha** (point to the hyphae threads extending out of a spore underground).

- **When hyphae from different spores of the same species merge, they will produce mycelium that is capable of forming a fruiting body** *(point to the hyphae threads merging).*

- **And the cycle continues.**

7. Ask students to label their **'R3 fungi Life Cycle 2'** diagram with the words: spores, mycelium, mature fruiting body, hyphae, substrate.

8. Look at the **'R18 Lifecycle Wheel'** resource. Discuss the key words describing the lifecycle of a mushroom: spores, germination, mycelium, primordium, button and mushroom. Remind students that the mushroom-shaped fungi are just one type of fungi fruiting body form. Explain that the term 'mushroom' in this wheel is referring to the mature fruiting body.

<u>Spore Print Activity</u>

9. Use a store-bought mushroom to make a spore print. Explain that a spore print is a mass of mature spores that have fallen from the fruiting body. Spore prints are really useful for identifying agarics (mushroom shaped fungi with gills) in the field. Spores are so small you usually need a microscope to see them, but by making a spore print we can see thousands of spores together making a pattern. Different fungi produce different coloured spore prints.

10. Demonstrate the steps setting up a spore print:

    - Use the freshest mushroom possible, making sure it is fully mature and open.
    - Gently take off the mushroom stem without damaging the gills.
    - Use a sheet of thick white paper or cardboard.

- Gently place the mushroom cap with the gills facing downwards onto the paper. There is no need to press down.
- Cover with a glass jar or bowl so the mushroom doesn't dry out and the spores aren't blown around the paper. Leave overnight.

11. Hand out the spore print directions to the students. It would be preferable for each student to have one mushroom each as this is an exciting experiment for students. Ask students to collect the needed materials and follow the experiment directions. Designate a space in the classroom that this experiment can be conducted and left overnight undisturbed.

12. Ask students to predict in their science journal what colour the spore print will be, what shape they expect to see and why they think this is. (**Teacher note**: you can tell if the spore will be dark if the gills are dark. In this case the white paper will capture the dark brown spore print. If the gills are white or creamy like with the oyster mushroom, dark paper will show the spore print).

13. Complete the spore print experiment the following day. The spore prints are best fixed with hair spray to ensure the print is not smudged. Either reflect on the findings of the spore print when completing this activity or at the start of the next lesson. Reflect on predictions, the spore colour, the pattern created, and the new knowledge that spores are contained within shop-bought mushrooms.

<u>Introduce the Oyster Mushroom Experiment</u>

14. Explain that each group will set up their experiment and record results each day.

15. Look at the mushroom log together and identify the white mycelium enclosed in the plastic casing.

16. Discuss the *Science as a Human Endeavour* strand, where "science knowledge helps people understand the effect of their actions" (ACARA). Explain that by setting up this experiment we are looking after the mycelium by supplying it with the right conditions to grow and develop fruiting bodies. This in turn creates food for people and animals.

17. Hand out the investigation record sheet (use sheet **R19** or **R20** depending on how many cuts the supplier advises to put in the log).

18. Go through the experiment recording sheet. Explain that as the fruiting body emerges from the log/kit, students will measure its height and width each day or even once in the morning and once in the afternoon (they grow very fast!) with a ruler or tape measure, being careful not to touch them, as they are quite delicate.

19. Explain the health and safety guidelines for this experiment. Oyster mushrooms are edible, and you can eat them once they have grown, but this means you should avoid touching and handling them during their development to reduce contaminating the mushrooms.

20. Weigh and record the mushroom log or oyster mushroom kit contents (out of the packaging).

21. Demonstrate how to set up the oyster mushroom experiment correctly and safely. Follow the supplier notes or **'R21 Experiment Set up.'**

22. Talk about what makes this experiment a fair test. Ensure all experiments are set up fairly so results can be shared.

23. Explain the ongoing experiment monitoring and care needed and clarify student expectations and roles. Record data daily and expect to make scientific drawings, graph, tabulate, photograph (or video) the experiment as it proceeds and write up the results and conclusions.

24. Watch for tiny nodules of mycelium developing. This is a sign the fruiting body is developing a **primordium.** Explain that once the mushrooms have reached a reasonable size they will be harvested, weighed, photographed, drawn and possibly eaten.

15. After setting up the experiment, ask students to make predictions in their science journal:

    - What do you predict will happen?
    - How fast do you think the fruiting body will grow?
    - How many fruiting bodies do you expect to grow and why?
    - What do you think the mycelium needs to be able to grow mushrooms?
    - How would you measure the growth of the fruiting bodies?
    - How wide and high do you think the fruiting bodies will grow?

16. Add new terminology to the Word Wall and review the words we are coming to know well.

Lesson 10: Magnifying Fungi

Curriculum Links	
Sustainability Priority	**OI.2 – Systems** All life forms, including human life, are connected through ecosystems on which they depend for their wellbeing and survival
	OI.7 – Futures Actions for a more sustainable future reflect values of care, respect and responsibility, and require us to explore and understand environments
Science Knowledge and Understanding	ACSSU044: Living things can be grouped on the basis of observable features and can be distinguished from non-living things
	ACSSU072: Living things have lifecycles
Science Inquiry Skills	ACSIS054 & ACSIS065: With guidance, plan and conduct scientific investigations to find answers to questions, considering the safe use of appropriate materials and equipment
Visual Arts	ACAVAM111: Use materials, techniques and processes to explore visual conventions when making artworks

Lesson Focus: Elaborate Phase

Lesson 10 elaborates on ways mycologists further classify fungi, based on the types of spores fungi produce. Students will be introduced to the microscopic features of fungi by examining fruiting bodies with magnifying lenses, and if resources permit, through more sophisticated equipment such as a microscope. This allows students to connect more closely to the scientific concept of morphology (the study of the form or features of living things). Microscopic examination also allows for the development of a more intimate relationship with fungi. Students will be able to focus in more detail on the lifecycle of fungi by understanding their reproductive unit – the spore.

Lesson Outcomes

Students will:

- reflect on the role of spores in the fungal lifecycle
- classify fungi into groups depending on the location of spores on/within the fruiting body
- examine microscopic features of fungi under the microscope
- draw the features they observe through a lens or a microscope

Lesson Resources Preparation

Documents:

- R1 Word Wall
- R9 Foray Safety
- R22 Taxonomic Classification (teacher reference)

Already glued into science journal:

- R2 Fungi Lifecycle 1
- R3 Fungi Lifecycle 2
- R18 Lifecycle Wheel
- R11 Scientific Drawing Guide

Equipment:

hand lenses, stereo microscope, digital microscope, light microscope, ready-made spore containing microscopy slides

New Lesson Vocabulary

microscope micro macro taxonomy phylum Basidiomycota Ascomycota magnification

Background Teacher Information Lesson 10

Does the school have microscopes available for use? Are you able to source a **light microscope** from parents or members of the community to view fungal spores? A very enjoyable and highly recommended activity is to use a **digital microscope** with the whole class, to view the features of fungal fruiting bodies and their mycelium. This microscope can be purchased for as little as $20 and attached to a computer and/or a large screen via a cable to display specimens to a very high magnification. Use of this technology will provide an intimate investigation of fungi with the whole class. If you have access to a light microscope, make a slide with shop-bought, button mushroom spores, by using the same technique as demonstrated with the spore print activity on paper. Leave the downturned mushroom on the slide the afternoon before this lesson, allowing time for the spores to release onto the slide. If you are using a light microscope, it is also possible to purchase slides containing spores and other microscopic features to use in the lesson.

Students absolutely love working with scientific tools such as microscopes. Looking through a microscope and other scientific equipment, allows students to feel what it is like to be a scientist. Throughout this unit we are promoting **citizen science**; empowering students to contribute to scientific research from an early age. Using a microscope allows a deeper understanding of the observable features of fungi, their structure and function. Depending on your access to microscope numbers and types, students may need to have an alternate learning activity offered such as viewing images or videos of microscopic fungi features sourced from the internet.

While observing the microscopic features of fungi, such as a slide with gills containing spores, the teacher can mention taxonomy. Refer to the hierarchy explained in the **'R22 Taxonomic Classification'** resource. Explain that macro fungi are divided into two main groups or **phyla**, based on their spore bearing structure. These phyla are called **Basidiomycota** and **Ascomycota.** Unless previously known or examined through a microscope, it is difficult to determine which phylum a particular specimen belongs to.

This lesson involves collecting specimens with students to view under the microscope. Alternatively, prior class, you can pick a **variety** of fruiting bodies and mycelium from the natural environment, being mindful they remain fresh and making sure not to collect from protected areas such as a national park or a nature reserve. **Bracket fungi** do not need to be dug out of the ground as they grow on wood and can be collected several days before the class. You might need a sharp knife to dislodge a bracket fruiting body from the wood, but many will pop off easily.

The Oyster Mushroom growing experiment: All students will continue to monitor their experiment daily. Please allocate time in the class timetable to complete the recordings. Once fruiting bodies begin to emerge, students can also create a series of scientific drawings in their science journal to practice this scientific skill and document the growth.

Exploring Fungi

Lesson 10 Teaching Sequence

Examining the spore print and learning more about spores

1. Ask students to look at the spore prints created during the previous lesson. Reflect on what students understand about spores, spore colour, spore dispersal and their role in the fungal lifecycle.

2. Note that the correct identification of fungi species can only be done using microscopes, through identification of spores under the microscope. Spores have various shapes and have special ornamentations e.g. spikes, which are specific to specific genera of fungi.

Collecting fungi in the field

3. Introduce the guidelines for collecting specimens from the field, with **'R9 Foray Safety'** resource.

4. Take students to an area in the school grounds where fungi are likely to be present.

5. Using the guidelines, allow students to take samples or collect branches that display fruiting bodies.

6. Bracket fungi, for example, display a surprising variation in shape of spore releasing organs on the underside of the fruiting body and these are fascinating to look at. Either investigate the fruiting bodies on a branch or break off a specimen and bring this back to the classroom. Alternatively use a pocketknife to carefully remove fruiting bodies from their substrate.

Magnifying fungi using lenses and microscopes

7. Back in the classroom, demonstrate how to use the microscopes and/or hand lenses so students can appreciate the finer texture and structures of a variety of fruiting bodies. Talk about magnification and its measurement.

8. Explain to students that because spores are very small, they can only be seen using a light microscope which magnifies them 100s of times. If a light microscope is being used, slides containing spores and other microscopic features that have been purchased can be used.

9. Consider grouping students in pairs, so they can share and discuss their observations with a partner. When independently viewing the specimens under the microscopes/lenses, ask students to locate which structure they think the spores come from and observe as many parts of the specimen as possible.

Drawing and describing magnified features of fungi

10. Ask students to do a scientific drawing in their science journals describing what they see. Ask that they think about the biological purpose and function for each observed feature and include annotations with these thoughts. Remind students to include labels e.g. pores, gills and a title such as, 'Underside of the fruiting body' or 'Top side of the fruiting body'. Refer to the scientific drawing notes (R11).

11. Assist students to figure out the scale of their drawing, i.e. how does their drawing relate to the real size of what they have drawn? What magnification did the microscope use?

12. **Recommended activity:** Use a **digital microscope** attached to a digital screen to view fungi and mycelium of special interest. If access to microscopes is limited, use this type of microscope for a whole class microscopic investigation. Make sure you have examples of fruiting bodies with pores and gills on the underside. Also look for hairs and scales on the various caps. Discuss the fungal features you observe together such as the gills or pores and ask students to draw and describe what they see (as outlined above).

13. In conclusion, regroup and ask students to discuss their findings and share their drawings.

14. Reflect on some of the scientific terminology used during this lesson. Update the word wall.

Lesson 11: Fungi Mission Task

Curriculum Links	
Sustainability Priority	**OI.2 – Systems** All life forms, including human life, are connected through ecosystems on which they depend for their wellbeing and survival
	OI.7 – Futures Actions for a more sustainable future reflect values of care, respect and responsibility, and require us to explore and understand environments
Science Knowledge and Understanding	ACSSU044: Living things can be grouped on the basis of observable features and can be distinguished from non-living things
	ACSSU072: Living things have life cycles
	ACSSU073: Living things depend on each other and the environment to survive
Science As a Human Endeavour	ACSHE051 & ACSHE062: Science knowledge helps people to understand the effect of their actions
Science Inquiry Skills	ACSIS060 & ACSIS071: Represent and communicate observations, ideas and findings using formal and informal representations

Lesson Focus: Evaluate Phase

Students will be given a *Fungi Mission* outlining their task to communicate important facts about fungi to others, promoting the sustainability values of care, respect, responsibility and understanding of interconnected environments.

Lesson Outcomes

Students will:

- Reflect on their learning
- Begin to develop a project that shares with others what they have learnt about fungi

Lesson Resources Preparation

Unit Videos: https://vimeo.com/user113329904

Documents:

- R24 Fungi Mission Task

Background Teacher Information Lesson 11

Students will be introduced to their summative assessment task. This assessment has been designed to offer students multiple ways to represent and show what they have learnt during the Exploring Fungi unit about the importance of fungi in ecosystems, the lifecycle and classification of fungi. Students will be supported to work on their fungi project over 3 weeks during the allocated 'Exploring Fungi' sessions, additional class time and as part of their homework. Students will present their Fungi Mission task to students and parents at the end of unit, Fungi Conference. Students will consider different ways they would like to represent their learning and record these ideas in their *Fungi Mission* booklet. Teachers will need to review the student project ideas and have a 1:1 conference with students to explore their project choice. Offering choice in assessment tasks, enables diverse learners to feel engaged and motivated to share and extend their own learning. It is important to enable access to differentiated assessment tasks and strategies, ensuring options for individual, pair or small group projects are also available to students.

Exploring Fungi

Lesson 11 Teaching Sequence

1. Reflect on the depth of knowledge gained from looking at a fungal mycelium, spores and fruiting bodies under microscopes in the prior lesson. Ask: “What do you now know about the observable features of fungi and their lifecycle?”

2. Ask students to open their science journal and read their first journal entry from the start of the unit to themselves. Ask, “What did you know about fungi when we started the unit?” Encourage students to look over their journal entries, the life cycle diagrams, their scientific drawings, foray notes, oyster mushroom experiment recordings and to reflect on their learning.

3. Introduce the *Fungi Mission Task*. Give the booklet ‘**R24 Fungi Mission Task’** to each student. Explain that since there is so little known about fungi, it is our mission to educate others about what we have learnt about them. Read through the task and criteria sheet. Give students examples of the types of projects students could engage to share their fungi knowledge with others and educate others about the important role fungi play in the environment. Explain that time will be given in class to work on the project over the remaining weeks. Explain that at the end of the unit, the class will host a fungi showcase for other students and parents.

4. Ask students to record their thoughts to these questions in their *Fungi Mission Task* booklet:
    - What are the most important things you have learnt about fungi?
    - Why do you think other people need to know about fungi?
    - Why are fungi important in ecosystems?
    - What aspect of fungi most interests you?

5. Give students time to think about project ideas and record these in their *Fungi Mission Task* booklet.

6. Let students know that they will have a 1:1 teacher conference to develop and decide on their project ideas before the next lesson. Remind students that throughout this unit Dr. Sandra Tuszynska has **shared what she knows** about fungi with us, because she is passionate about caring for the environment. She really wants other people to know how important the unseen world of fungi is to the sustainability of global ecosystems and how fun it is to study fungi.

Lesson 12: Conclude Oyster Mushroom Growing Experiment

Curriculum Links	
Sustainability Priority	**OI.2 – Systems** All life forms, including human life, are connected through ecosystems on which they depend for their wellbeing and survival
	OI.7 – Futures Actions for a more sustainable future reflect values of care, respect and responsibility, and require us to explore and understand environments
Science Knowledge and Understanding	ACSSU073: Living things depend on each other and the environment to survive
	ACSSU072: Living things have life cycles
Science As a Human Endeavour	ACSHE050 & ACSHE061: Science involves making predictions and describing patterns and relationships
	ACSHE051 & ACSHE062: Science knowledge helps people to understand the effect of their actions
Science Inquiry Skills	ACSIS054 & ACSIS065: With guidance, plan and conduct scientific investigations to find answers to questions, considering the safe use of appropriate materials and equipment
	ACSIS055 & ACSIS066: Consider the elements of fair tests and use formal measurements and digital technologies as appropriate, to make and record observations accurately
	ACSIS057 & ACSIS068: Use a range of methods including tables and simple column graphs to represent data and to identify patterns and trends
	ACSIS215 & ACSIS216: Compare results with predictions, suggesting possible reasons for findings
	ACSIS058 & ACSIS069: Reflect on investigations, including whether a test was fair or not
Visual Arts	ACAVAM111: Use materials, techniques and processes to explore visual conventions when making artworks

Lesson Focus: Evaluate Phase

The Oyster Mushroom Growing Experiment was set up in Lesson 9. Students have monitored the experiment daily and recorded data. After 2 to 3 weeks of growth the experiment will come to its conclusion. Students will evaluate the data, graph their findings and reflect on their predictions. The spent Oyster Mushroom 'logs' will be used again in the *'Innovating with Fungi and Mapping What we've Learnt'* lesson.

Lesson Outcomes

Students will:

- conclude, analyse, compare, interpret and reflect upon the Oyster Mushroom experiment
- graph gathered data to analyse and understand experimental outcomes

Lesson Resources Preparation

Documents:

- R1 Word Wall
- R11 Scientific Drawing Guide
- R19 Experiment Record 1 **or** R20 Experiment Record 2

Equipment:

- Scales for weighing mushroom 'logs,' knife, masks

New Lesson Vocabulary

yield analyse bar graph

Background Teacher Information

Depending on the growth rate of the oyster mushroom experiment determines when to conclude the oyster mushroom experiment. In this lesson, students will weigh their mushroom 'log' with fruiting bodies attached, weigh the mushrooms separately, create a bar graph/s to represent the data they collected and reflect on their predictions. The oyster mushrooms will grow in clusters from each cut in the 'log'. When harvesting, cut the cluster at the 'log' surface and weigh each cluster separately recording the weight on the experiment record sheet. Depending on the mushroom 'log' supplier instructions at the experiment set-up, students may have placed one cut in each 'log' or up to 3 cuts.

Oyster Mushrooms are a commercial food source and growing kits or 'logs' are sold for the purpose of producing edible mushrooms at home. Once the mushrooms have grown to maturity, they will produce spores. Oyster Mushroom spores have been found to cause lung irritations in people working in growing rooms, exposed to a large number of spores. Please ensure masks are provided to students when they work with the mature mushrooms.

Exploring Fungi

Lesson 12 Teaching Sequence

1. Explain that in this lesson, we will conclude the oyster mushroom growth experiment by:

    a. weighing the mushroom 'log' with fruiting bodies
    b. harvesting the fruiting bodies and weighing them
    c. reflecting on predictions
    d. discussing, comparing and analysing the record sheets
    e. creating a bar graph to represent data about the fruiting body growth over time
    f. creating a scientific drawing of the harvested fruiting body

Weighting and harvesting the mushroom 'logs' and fruiting bodies

2. Demonstrate how to accurately weigh the mushroom 'log'. Ask each group to weight their mushroom 'log' and record the final weight with all fruiting bodies attached using the experiment record sheet. Ask students to compare the current weight to that prior to the experiment. Inquire, "Is the 'log' heavier or lighter?"

3. Use a sharp knife to separate the fruiting body from the 'log' surface for students. Harvest the oyster mushrooms from each opening in the 'log' making sure any mushrooms from cut 1-3 are kept separate so as students can weight and compare the yield from different parts of the 'log' in the table. Ask each group to weigh their harvested mushroom clusters and record the data in the appropriate columns.

4. Share group results with the class.

5. Wrap the spent oyster mushroom 'logs' in plastic bags and keep in the fridge for use in the *'Innovating with Fungi and Mapping What we've Learnt'* lesson.

Graphing the data

6. Demonstrate how to create a bar graph (you can use Excel to show the students how this would work).

7. Organise students to graph the data they recorded with a bar graph using day vs growth (either height or width or both), selecting the best growth cluster from either cut 1, 2 or 3. Instruct students to graph time in days (horizontal axis) verses growth in cm (vertical axis). Ask students to hand draw their individual data in their science journals using a sheet of maths grid paper and a ruler with 1cm increments for days on the horizontal axis and 1cm increments for mushroom height or width on the vertical axis.

8. Opportunities exist to use the data collected in additional maths/ science sessions:
    - share the harvested fruiting body weights from all groups and create a bar graph with information from the whole class
    - average the parameters across all of the 'logs,' to create one class graph using all the measurements recorded

Discuss experimental results

9. Ask students to read over the predictions they made at the experiment set up. Facilitate a discussion around each question, to compare results with predictions:

    - What do you predict will happen?
    - How fast do you think the fruiting body will grow?
    - How many fruiting bodies do you expect to grow and why?
    - What do you think the mycelium needs to be able to grow mushrooms?
    - How would you measure the growth of the fruiting bodies?
    - How wide and long do you think the fruiting bodies will grow?

10. Inquire, "What were you surprised about? What were the visible changes to the 'log'?" Discuss the significance of depicting the weight and growth of mushrooms. Ask students to relate to where this may be relevant e.g. when growing mushrooms commercially and learning how humans could assist growth by changing what mushrooms are fed, ie. mycelium **substrate** (food) or the amount of water, humidity and temperature. Relate this to growth cycles of fungal fruiting times, and plant flowering and fruiting times in ecosystems. Also ask students to think about their own growth and what they need to grow their own bodies.

Scientific Drawing of the harvested mushroom

11. Use a camera to document different views of the mature oyster mushroom.

12. Visual Arts assessment: Ask students to complete a scientific drawing of the underside of the oyster mushroom, using the scientific drawing principals. Refer to **'R11 Scientific Drawing Guide**.' Clearly illustrate the gills and observable features. Additional time may be needed for this activity (30min).

Lesson 13: Innovating with Fungi and Mapping What We've Learnt

Curriculum Links	
Sustainability Priority	**OI.2 – Systems** All life forms, including human life, are connected through ecosystems on which they depend for their wellbeing and survival
	OI.7 – Futures Actions for a more sustainable future reflect values of care, respect and responsibility, and require us to explore and understand environments
Science Understanding	ACSSU044: Living things can be grouped on the basis of observable features and can be distinguished from non-living things
	ACSSU073: Living things depend on each other and the environment to survive
	ACSSU072: Living things have life cycles
Science inquiry	ACSIS060 & ACSIS071: Represent and communicate observations, ideas and findings using formal and informal representations
Science as a Human Endeavour	ACSHE051 & ACSHE062: Science knowledge helps people to understand the effect of their actions

Lesson Focus: Elaborate Phase

Students will be introduced to the topic of working with fungi in innovation, where they will begin to understand that fungal mycelium can be used for the construction of everyday objects. As a hands-on activity, students will have the opportunity to use oyster mycelium to mould simple objects. This is a new type of innovation used by designers, called **biofabrication**, using biological resources in creating sustainable materials.

Lesson Outcomes

Students will:

- reflect on the role of fungi in ecosystems and what they have learnt during the unit
- understand the 'Fungi Mission' assessment task
- set up a fungi innovation experiment

Lesson Resources Preparation

Unit Videos: https://vimeo.com/user113329904

- **'11. Fungi Innovations'** with Dr. Sandra Tuszynska (7:33 min)
- **'12. Working with Mycelium'** with Dr. Sandra Tuszynska

Documents:

- R1 Word Wall
- R23 Innovation Experiment

Equipment:

- Spent Oyster Mushroom 'logs'
- Shredded paper, spray bottles, buckets and other containers to mx mycelium with paper, gloves
- Containers to act as bricks or tiles e.g. recycled take away containers

New Lesson Vocabulary

sustainability innovation biofabrication inoculate mind-map

Background Teacher Information Lesson 13

In this lesson, students will explore the topic of working with fungi in innovation. After viewing the **'11. Fungi Innovations'** video, students will begin to understand that fungal mycelium is being used in the construction of everyday objects. Using biological materials to create forms is called **biofabrication**. The mycelium has the ability to construct various shapes and forms, such as their differently shaped fruiting bodies. As it consumes wood and other organic matter, the mycelium binds it tightly and can therefore be used to grow different shapes and forms including everyday objects.

Students are asked "Why they think mycelium would be a good substance to grow objects from?" In answering this question, encourage students to reflect on the structure of mycelium and its function when it decomposes wood. Explain to students that mycelium grows in a network form, where millions of hyphae (long threadlike fungal cells) crisscross each other, creating a very strong matrix. Mycelium is sometimes called nature's glue, as the mycelium mass takes over its food source or substrate, converting into a fungal mass, strongly binding particles together. Just as fruiting bodies are formed by the mycelium into various shapes, so we can grow the mycelium into various forms by providing the right conditions for the mycelium to grow in.

In this lesson, students will set up a simple experiment to use mushroom mycelium in innovative ways to grow simple objects such as bricks and tiles. Review the experiment resources **'R22 Innovation Experiment'** and introductory experiment video '**12. Working with Mycelium'** prior to the lesson.

Students will continue to reflect on the journey of learning they have engaged over the last 9 weeks. They will draw a mind map of the lessons within the *Exploring Fungi Unit* to visualise their learning process, their understanding of concepts and how they are all interrelated. Students will be able to visualise the unit and connect the dots, giving them an overview of their own learning journey. This will reinforce their learning and help them to see how the lessons within the unit built upon their learning about fungi and their importance in ecosystems. Students will reflect on the original enquiry "What are fungi and why are they important?"

The reflection activity, asks students to draw a mind-map. Simply start with the words 'Exploring Fungi Unit' in the middle of the page in a bubble. Students can then link new bubbles to this with what they have learnt. Continue to provide class time for students to work on their Fungi Mission task in preparation for the Fungi Conference (learning celebration) at the end of the unit.

Exploring Fungi

Lesson 13 Teaching Sequence

1. Introduce that there are many people around the world who are now working with fungi in innovative ways to contribute to a sustainable future.

2. Explain that Dr. Sandra Tuszynska has compiled a video, **11. Fungi Innovations'** to showcase how designers, engineers and scientists are working with fungal mycelium to grow a variety of objects such as bricks, packaging and surfboards.

3. Watch, '**11. Fungi Innovations.'**

4. Facilitate a discussion about the innovations presented in the video and the positive ways they can contribute to sustainability solutions.

    - Which ideas were most inspiring? Why?
    - Why is better to use fungi to grow these objects as opposed to creating objects from plastic?
    - Why do you think mycelium would be a good substance to grow objects from?
      In answering this question, encourage students to reflect on the structure of mycelium and its function when it decomposes wood.

5. Watch video '**12. Working with Mycelium'** before beginning the mycelium innovation experiment.

Activity: Mycelium Innovation Experiment

6. Read through the experiment steps with the class using **'R23 Innovation Experiment'**. Display the experiment steps on a whiteboard or use printed copies for the class to see.

7. Divide the student groups based on resources available. Use the spent Oyster Mushroom 'logs' to inoculate the shredded paper with the mycelium and follow the experiment steps. Oversee the activity.

8. Replay the '**12. Working with Mycelium'** video and pause in convenient places, to make it easy for students to follow the steps with Dr. Sandra Tuskynska.

Reflection Activity: The Fungi Unit Mind-Map

9. Ask students to share the things they have learnt from the lessons in the Exploring Fungi Unit. Ask them to draw a mind-map of the unit with any important learning they have acquired, (students can include drawings in the mind-map).

10. Simply start with the words 'Exploring Fungi Unit' in the middle of the page in a bubble. Students can then link new bubbles to this with what they have learnt and create an extensive mind-map.

11. On the board or large piece of paper, create a whole class mind-map together. Ask students to share information from their personal mind-map and add it to a collective map. This can be displayed at the end of unit Fungi Conference.

12. Ask leading questions so students can describe to you what they have learnt and understood from the unit e.g. “How does the mycelium work and what does it provide in the ecosystem? Why and how do fungi use spores?” Add this to the mind-map.

13. Invite students to add anything that might be missing from their mind maps into their science journal.

14. Inquire if there is anything students feel has not been presented in the unit, which they would still like to learn about in relation to fungi. Ask students if they enjoyed the unit, what they found most fascinating, interesting or boring.

Lessons 14-15: Fungi Gardens and Learning Celebration

Curriculum Links	
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Visual Arts	ACAVAM111: Use materials, techniques and processes to explore visual conventions when making artworks

Lesson Focus: Evaluate Phase

Lesson 14: Students will take action and create a fungi garden together in the school grounds as an ongoing project, using mulch and logs. Alternatively, or in addition, students can create a fungi terrarium using mulch and branches, providing conditions for fungi to flourish, mimicking a forest ecosystem. Students will be able to monitor and record changes and the presence of fungi over time.

Lesson 15: Students will present their Fungi Mission Task to their peers and parents at the Fungi Conference, celebration of learning event. Students will promote the Sustainability values of care, respect, responsibility and understanding of interconnected environments to a wider audience.

Lesson Outcomes

Students will:

- design and create a fungi garden or a terrarium, or both
- showcase and share with others what they have learnt about fungi

Lesson Resources Preparation

Documents:

- R1 Word Wall
- R22 Fungi Mission Task

Equipment:

- **Fungi Garden:** logs, branches, mulch, bark, rakes, buckets, wheelbarrow, hose, water, rocks, gloves, tools
- **Fungi Terrarium:** an old aquarium with a lid, branches, small logs, mulch, woodchip, rocks, soil, spray bottle

New Lesson Vocabulary

terrarium

Background Teacher Information Lesson 14 & 15

Lesson 14: In this lesson students will work together to create a fungi garden, as an ongoing project to support the growth of and monitoring of fungi in the school grounds. Here students will have the chance to realise how creating habitats for fungi to grow in, allowing fungi to produce fruiting bodies and thus ensuring their survival and the important service they provide in ecosystems. Select a spot with the students before the lesson. For best results, soak the logs, bark chip and branches which do not have any fruiting bodies on them for at least 24 hrs in a bin, an old bathtub or another large container before making the garden.

Lesson 15: Students will showcase their learning to peers and parents. This will allow students to share what they have learnt about fungi and pass on their newly acquired knowledge to others. It will empower students' understanding that as they learn, they are able to also teach, or share their learning with others. Ensure students have had a practice run and feel confident talking about their project to others prior to the Fungi Conference.

Exploring Fungi

Lesson 14 Teaching Sequence

Create a School Fungi Garden

1. Choose a cool and shady spot in the school grounds with easy access to water. The size of your fungi garden will depend on the space and resources you have available. Collect branches, logs and rocks in a pile near your chosen spot. If some of the branches or logs have fruiting bodies already growing on them, that's a positive.

2. Start the garden by layering whatever mulch you have available to a thickness of at least 20cm. Green waste mulch is often available from council waste facilities.

3. Ask students to spread the mulch by hand, making sure they have gloves, or using a rake. Make sure students are careful if using a rake not to hurt anyone around them.

4. Thoroughly wet the mulch with a hose. If you have bark, or woodchip cover the mulched area with it and wet thoroughly with water again.

5. Get students to place the logs, branches and rocks by nestling them within the mulch. If you have many available, some can be buried within the mulch. Others should be in contact with the mulch

but not buried to allow fruiting bodies to emerge. Place these strategically to achieve an aesthetic look or just go for the forest look.

6. Add pot plants such as ferns or plant some vegetation within the garden. As the logs, branches and mulch decompose over time, the mycelium will create great soil for the plants.

7. Check periodically if the area is moist and if not, add water. Simply ask the students to water it thoroughly once a week.

8. Ask students to draw the garden and write up the steps they took to create it.

9. Students can record what they see from week to week in their science journals and take photographs of the garden to see any changes over time.

10. Remember there might be no fruiting bodies present, but the mycelium will still be decomposing the wood if it is moist enough.

Alternative or additional activity: Create a Fungi Terrarium

11. Explain to students that they can create a mini microclimate for fungi to grow in a terrarium. The procedure is similar to the creating fungi garden activity.

12. Soak mulch, bark and sticks overnight and let these drain well for a few hours.

13. First add about 10 cm of soil to mimic the conditions of the forest. The soil will absorb any excess moisture, but make sure it is not soggy as this will grow mould and bacteria and might start to smell without oxygen reaching the bottom of the terrarium.

14. Add about 15-20cm or more of soaked and drained mulch and bark chip.

15. Add soaked branches, small logs and rocks.

16. Add a small fern or other moisture loving plant to decorate the terrarium.

17. Spray all the added materials in the terrarium to mimic rain and close the lid. The lid should have some holes in it. If not, then don't close the lid fully to allow some air to enter.

18. Check the terrarium for moisture content at least once a week and add water as required to create humid conditions.

19. Ask students to record any changes with photos and write notes about what they see in their science journals.

Exploring Fungi

Lesson 15 Teaching Sequence

Fungi Conference- Celebration of Learning

1. Set the classroom up as an exhibition space for the *Fungi Conference.*

2. Ensure each student has the appropriate space to showcase their Fungi Mission ask. Some students may need a wall space to hang their poster, others may need a desk to display their diorama or model. Other students may need a digital screen to show their slideshow, movie or animation sequence.

3. Allow each student 3-5 minutes to present their Fungi Mission material.

4. Invite parents and other classes to visit the attend the Fungi Conference, class display and the school fungi garden. Have students stay with their project for a time to talk about it to the visitors and advocate for the protection and study of fungi.

We hope teachers and students enjoyed the *Exploring Fungi Unit*