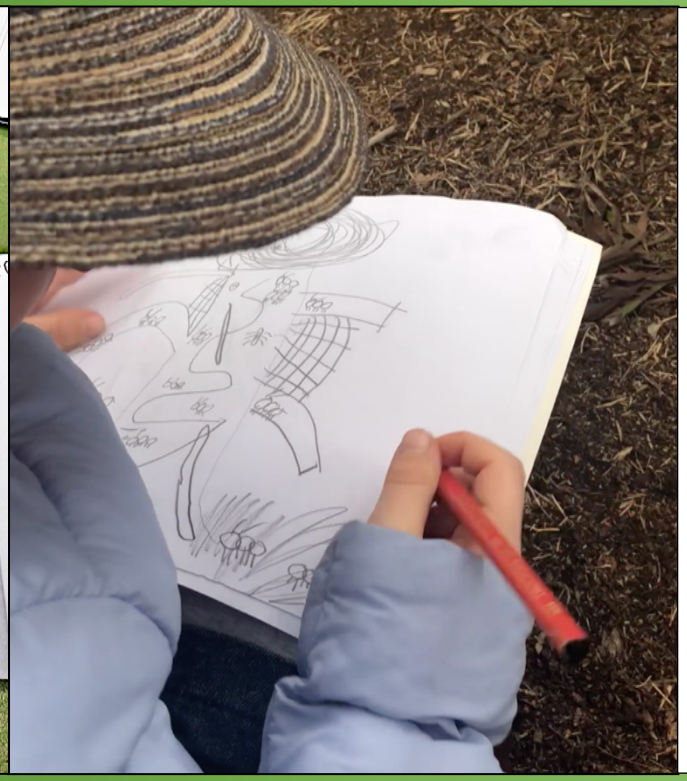
Ecology: What lives here?
Year 1



IMS LEARNING

Students investigate their schoolyard environment. They record, organise, categorise, and represent their observations and communicate their ideas. Students generate recording and representing methods to investigate different schoolground habitats, including the diversity of living things, their interactions and needs. These include birds eye view and plot mapping, tallying of recordings, tabulation of data, bar graphing and diagrammatic drawings. They discuss the structure and function of invertebrates and their adaptation to schoolground habitats.

INTERDISCIPLINARY MATHEMATICS AND SCIENCE (IMS) LEARNING

DEAKIN UNIVERSITY
MACQUARIE University
VANDERBILT UNIVERSITY
Australian Government
Australian Research Council

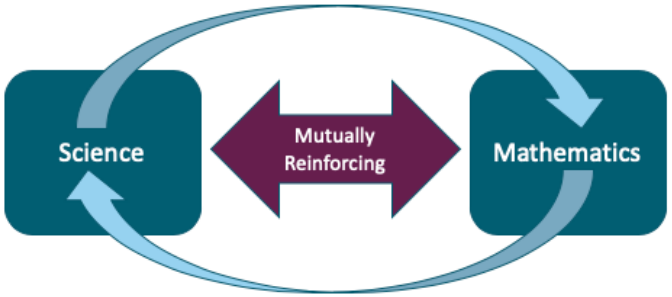
This teaching and learning sequence is one of a number that are designed to productively integrate mathematics with science, using a guided inquiry approach in which students construct, share, evaluate and revise multimodal representations to establish conceptual understanding. See website https://imslearning.org/

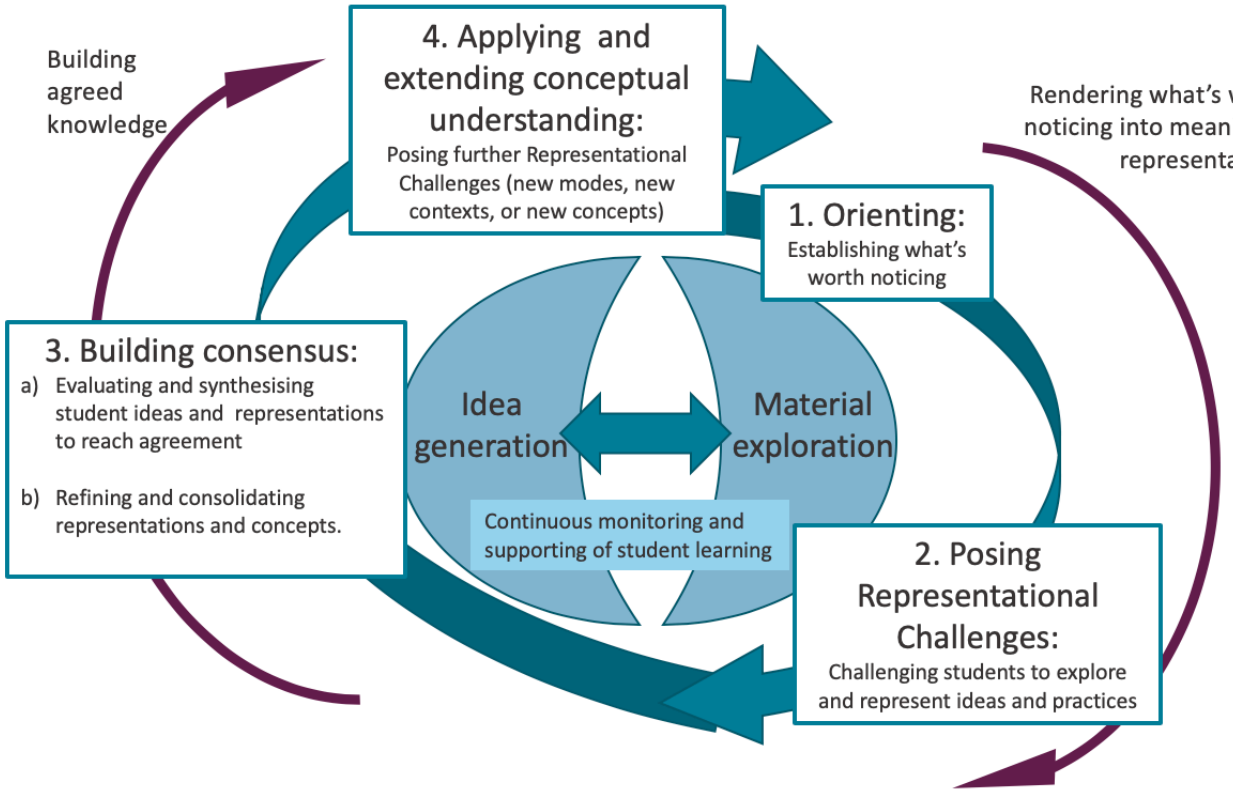
Interdisciplinary Mathematics and Science (IMS) Learning

IMS aims to enrich learning through two interconnected principles, which are key to the nature of the unit design and the pedagogy. The first principle concerns a focus on students constructing, evaluating, and refining multimodal representations, enacted through a four-stage IMS pedagogical model. The second principle concerns interdisciplinarity: the relation between science and mathematics. The project can be found at https://imslearning.org/
Below we describe the key features of the approach.

Student constructed representations

The teaching and learning sequences follow a guided inquiry pedagogy that focuses on students constructing, evaluating, refining, and extending multimodal representations. This is a literacy focus built on the insight that learning in both science and mathematics involves students being inducted into the representational practices that underpin explanation and problem solving. Representations diagrams, models, equations, graphs and tables, and symbols as well as written text. The approach involves a number of stages through which the teacher guides student learning. These stages, although distinct, often cycle and repeat within and across lessons. The model (to the right) showing these stages has been developed as an outcome of the IMS research.





Interdisciplinarity

In the teaching and learning sequences, the mathematics and science activities are built around interrelated concepts, with the principle that the learning in each subject enriches learning in the other. For instance, measuring, graphical work and data modelling generally are freshly developed in science contexts in ways that raise questions and promote deeper knowledge in science, and the science context raises questions that can be further explored mathematically.

Stages of the IMS Pedagogical Model

Orienting: Teachers pose questions, explore students' ideas and orient them to the learning focus by a variety of means such as asking for predictions, questioning what they have noticed, asking for ideas about what could be measured, and eliciting prior knowledge. This provides a way to focus students' attention on what is worth noticing about the school environment, or about data sets for instance, and could be interesting to explore.

Posing representational challenges: Students are challenged to explore and represent their ideas and practices, for instance they may be challenged to represent the movement of their shadow over a day, involving decisions about what to measure and how to represent patterns in length, and angle, or to use particle representations to predict, investigate and explain why a saucer of water evaporates more quickly in warm, or windy places.

Building consensus: This involves two stages. First, using the student ideas and representations to compare, evaluate and then synthesise these to reach agreement about which aspects of these effectively show patterns in data, or suggest explanations. Second, these ideas are refined by students, and consolidated to establish a shared understanding of the concept and associated representations. In this process students develop knowledge of the role of representational work in learning.

Applying and extending conceptual understanding: Students are given new representational challenges to extend their new knowledge and practices in related situations, or further concepts are introduced through representational tasks, to repeat the cycle.

In these stages the teacher is constantly monitoring and responding to students' representations and ideas. The approach can be seen as 'assessment as learning'. The focus on student production has been found to allow the teacher significant insights into student thinking. The art of teaching in this way involves setting appropriate tasks, preparing students strategically through questioning and challenges, and guiding their work to reach consensus about the key ideas and their representations. The sequences all involve a close association of material exploration, and the generation of ideas.

These stages have much in common with the 5Es that underpin Primary Connections (PC). The stages line up as Orienting = Engage, Posing Representational Challenges = Explore, Building Consensus = Explain; and Applying and Extending Conceptual Understanding = Elaborate. The 'Evaluate' stage appears in the IMS pedagogy as a continuous process of monitoring and formative assessment (assessment 'for' and 'as' learning) throughout the stages. Most sequences have a summative evaluative task, but this sits outside the cycle. Distinct from the 5Es, the IMS stages are explicitly focused on representations as central to learning (consistent with the PC focus on literacy), and structured to lead from noticing what is of interest to investigate, through the generation of representations, to generating class agreement on key concepts as systems of representations and representational practices.

The teaching and learning sequences follow these stages explicitly, but they cycle in different ways, in different lessons and in different topics. In some lessons there are more than one cycle, or even interweaving cycles for science and mathematics. In other cases, a cycle is spread over a number of lessons. Sometimes, activities have more than one role, such as an extension representational challenge acting as an orientation into a further concept. Nevertheless, we believe the movement from opening up what is noticed, to exploration and representation construction, to evaluating and building consensus, is a fundamental and powerful aspect of effective teaching and learning. Tasks in the sequences are designed to be approachable at a range of levels. This, together with teacher open questioning and targeted scaffolding, enables differentiation of the learning.

Supporting differentiation of learning in the IMS learning design

In the IMS learning sequences the student- guided inquiry design enables diverse student learning needs to be responded to within the regular classroom. The open learning tasks are designed flexibly to enable students to work at their own level, and at their own pace, to develop their understanding and skills in a variety of ways. Variation in student responses offers a resource for promoting, encouraging and refining learning as students demonstrate, in different ways, what they know and understand. With teacher support, students learn from each other's ideas and productions. The focus on student-constructed representations, and open questioning and discussion, enables the teacher to monitor individual students' understandings and cater for their learning needs over time.

Features of the learning sequences that enable embedded and teacher-supported differentiation

There are three distinct aspects of the IMS pedagogy that enable differentiation.

Open questioning, guided inquiry and open tasks provide the teacher with insight into individual student learning and understanding that:

a) enables teacher decisions for on-the-spot feedback, and individualised monitoring and support of student learning through targeted learning adjustments, scaffolding, and extension challenges.

"Giving them (students) more freedom is a good approach because they're more capable than I thought they would be, but they still needed the support as well. So, giving students the initial freedom to do whatever they thought they could do and then helping them from that…"

b) enables support for students to navigate tasks with multiple entry points, solution pathways and outcome possibilities, whilst negating possible student stigmatisation from the withdrawal from their peer group, or students assigned a different task.

"the fact that they are open-ended so they (the students) can come to a solution in a variety of different ways. There was not one student where I had to really modify an activity for, they could participate in the activity, they could all have success in the activity but they all got something from it and because it was open-ended…"

c) enables the development of creative and critical thinking skills, and higher-order thinking, as student responses are not limited

"…I always found everything was just deeper level thinking."

Peer learning, collaborative learning and student voice increases student engagement as students learn from and with their peer group.

Students learn collaboratively as a whole class and in mixed ability peer groups. Student are encouraged to share ideas, co-construct investigations, designs, data and representations. Through purposeful guided reflection, targeted scaffolding, prompts and extension challenges, students engage in comparative discussions and review of peer representations (e.g. graphical representations) to build their understandings.

"…we were able to cater for everyone without making it obvious to them that we had to modify the activities, which I think is really important for their confidence and self-esteem and learning too."

"…coming from their peers and it's quite interesting because when they actually get feedback from their peers as well I find that they really do put it into practice a lot quicker, it's quite interesting, as opposed to coming from the teacher all the time, it's coming from someone different. That has been a really interesting pick up that we have found..."

Multimodal representational challenges cater for diverse learner needs and provide differentiated insight into students' conceptions.

Teachers have identified that a focus on multimodal representation enhances learning for students with language difficulties, who are English Second Language (ESL), and/or have literacy support needs, since they are not so constrained by their language skills. Access to multiple modes reduces the effects of language demands as barriers to learning. Students' multimodal representations provide teachers with insight into individual students' knowledge, skills and learning needs.

"…this has been really interesting, seeing children that don't speak up as often really come up with some really insightful representations. I mean, they're a lot further ahead than what I thought."

"show me what you know through your drawings' and often that speaks volumes because children find it difficult to articulate at the time. They might understand more than what they are conveying… But they are actually showing me so much of their knowledge through their diagrams."

Ecology: Sequence Overview

In this **teaching and learning sequence** students identify and describe examples of the external features and basic needs of living things. They describe how different habitats meet the needs of living things. They identify and describe the changes to living things and things in their local environment. They suggest how the environment affects them and other living things. A key focus for activities in an IMS Learning: Ecology unit is the development of MEASURE. Activities are designed so that measuring arises naturally out of the need to describe, identify patterns, and compare findings and observations . An example would be the need to devise a measure of a particular animal's prevalence in different habitats, leading to a need to control the area sampled. Students use their senses to explore the world around them and record informal measurements to make and compare observations. They record, organise, categorise and represent their observations, and communicate their ideas to others.

Lesson Sequence - Outline

Lesson 1: Living and non-living things – Differentiating living and non-living things (pre sequence assessment task)

Teacher determination of student understanding of the characteristics of living things with pre sequence assessment task. Students distinguish and categorise living and non-living things with own examples.

Lesson 2: Living things in the schoolground – Mapping the schoolground and investigation preparation

Viewing a map of the schoolground, students predict what might live in the schoolground and where they live? They represent their own predictions on their own school map.

Lesson 3: Schoolground Investigation – Living things and places (Organisms and habitats)

Students investigate the school grounds for living things. They identify, count and record living things in their own plot. Students describe the habitat, plants and animals.

Lesson 4: What living things did we find in the schoolground?- Sharing the findings (Ecosystems: Organism needs, habitats and interactions)

Students identify the location of their group plots on a bird's eye view map of the school grounds. Whole class discussion and exploration of living things, identifying their needs and interactions, based on student findings in their plots/habitats. They development of whole class data set/display.

Lesson 5: Where and why did we find living things in different habitats? Comparative analysis - making connections and considering diversity

Making connections and inferences, students create plot and class data displays. They ask questions of and explore aspects of the data on living things – distribution, diversity, needs for survival and interactions.

Lesson 6: Communicating the findings and making inferences (post sequence assessment task)

Students share their findings, sharing information across the classes. Students making inferences about the distribution of living things and connections between the where and why? Students explain the connection between diversity, distribution, habitat and the needs of living things. Post sequence assessment task.

Note: This sequence draws on the Primary Connections ***Schoolyard Safari***. It has been adopted in conjunction with, and as an extension of this Unit.
https://www.primaryconnections.org.au/curriculum-resource/schoolyard-safari

Conceptual Underpinnings for Interdisciplinary Thinking and 'Ecology Progressions'

Interdisciplinary Principles Underpinning the Science-Mathematics Concepts	**An Ecology Understanding Progression** (see note below)
Measure: A key focus for activities in this Ecology sequence. Measures depend on the instrument, or approach – different animal or plant counting methods will yield different results. **Invention:** Students invent displays that allow for comparison, tabulating, tables, graphs. **Location:** Describing location, the need to compare measures across a particular space will raise the question of how to display data on a map. **Variation of measure:** Students recognise natural variation and can discuss and consider if differences in population, in different locations, are real or the result of measuring approaches. **Sampling:** When we count within a restricted area, we make claims about that type of habitat more generally.	**Stage 1 – Analogy to Humans: Organisms** Differentiating living and non-living things. Criteria for life based on resemblance to familiar organisms, people. **Stage 2 – Organisms and Places: Habitat** Exploring habitat, animal and plant diversity and animal and plant features. Focusing on the relationship between organisms (living things) and their habit (home) with consideration of seasons. **Stage 3 – Organism's Needs: Ecosystem** Relating organisms to habitat (conditions) considering organism's needs and the ways they are satisfied. Unidirectional relationship: habitat satisfies needs **Stage 4 – Habitat Partitions: Biodiversity** Considering how qualities/partitions of the environment affect survival, reproduction and numbers/abundance of organisms. **Stage 5 – System Components: Variation** Organism physical structures and behaviours that support life are considered. Spatial mapping and visual representation of data.

Note:
An Ecology Understanding Progression - Adapted from a study by Lehrer and Schauble (2012), developing a progression in modelling practices for learning ecology across the K-6 grade levels. Lehrer, R., & Schauble, L. (2012). Seeding evolutionary thinking by engaging children in modelling its foundations. *Science Education*, *96*(4), 701-724.

Curriculum Focus: Science and Mathematics Learning

Learning focus	Key Curriculum Outcomes (Victoria Curriculum)
Science ideas and practices • Students investigate living and non-living things in the school grounds, recording and processing their findings: living things, locations, interactions, needs and characteristics. • Students reflect on their predictions and findings and compare with others. • Students communicate the cause of variation in natural systems: variation, diversity and survival needs.	**Science** **Biological sciences:** Living things have a variety of external features and live in different places where their basic needs, including food, water and shelter, are met (VCSSU042) Living things grow, change and have offspring similar to themselves (VCSSU043) **Science Inquiry Skills** ***Questioning and predicting*:** Students respond to and pose questions, and make predictions about familiar objects and events (VCSIS050) ***Planning and conducting:*** Students participate in guided investigations, including making observations using the senses, to explore and answer questions (VCSIS051) ***Investigation*:** Students use informal measurements in the collection and recording of observations in the school grounds (VCSIS052) Students use a range of methods, including drawings and provided tables, to sort information (VCSIS053) ***Analysing and evaluating:*** Compare observations and predictions with those of others (VCSIS054) ***Communicating*:** Students represent and communicate observations and ideas about changes in objects and events in a variety of ways (VCSIS055)
Mathematics ideas and practices • Assign numerical values to systems of living things in order to answer questions and raise questions for further investigation. • Observe, count and record the number of living things in set locations. • Develop spatial mapping skills by drawing a map of the school grounds. • Identify on a formal map a designated location within the school grounds. • Measure, record, analyse and interpret numerical data, comparing the number and type of living things found in different locations. • Students design graphical representations (e.g. bar graphs) to compare and contrast the number and type of living things found in different locations.	**Mathematics** **Number and place value** Represent and solve simple addition problems using a range of strategies including counting on (VCMNA089) Recognise, model, read, write and order numbers to at least 100 (VCMNA087) **Patterns and algebra** Recognise the importance of repetition of a process in solving problems (VCMNA094) **Using units of measurement** Tell time to the half-hour (VCMMG096) Students use informal units of measurement to order objects based on length and area (VCMMG115) **Chance** Identify outcomes of familiar events involving chance and describe them using everyday language such as 'will happen', won't happen' or 'might happen' (VCMSP100) Choose simple questions and gather responses (VCMSP101) **Data representation and interpretation** Identify a question of interest based on one categorical variable. Gather data relevant to the question (VCMSP126) Collect, check and classify data (VCMSP127) Create displays of data using lists, table and picture graphs and interpret them (VCMSP128)

Ecology – What Lives here: Equipment/Resources

Lesson		Equipment/Resources
All Lessons		**Students:** student workbooks (unlined), pencils, coloured markers and rulers **Teachers:** Board (IWB/whiteboard) and or butchers' paper for shared recording, pens and computer
1	Living and non-living things	Pre Sequence Assessment Task (Appendix 2) Interactive Whiteboard (IWB) or Projector Living and non-living things link: https://www.youtube.com/watch?v=zFGydQHh0KA
2	Living things in the schoolground – Mapping the schoolground and investigation preparation	Interactive Whiteboard (IWB or Projector Link to bird's eye view map of school (i.e. google maps) A3 Print out of bird's eye view of school grounds
3	Schoolground Investigation Part 1: Field Work Preparation Part 2: Field Investigation	Hats and sunscreen Field Investigation Resource Box: measuring tape, meter ruler, perimeter markers (e.g. traffic cones) magnifying glasses, spoons, small containers, nets (catch and release), gloves Camera/iPad (per group) – Record locations of plots and living things found
4	What living things did we find in the school ground? Sharing the findings	Photos - printouts of photos from previous lesson (plot locations and examples of living things found)
5	Where and why did we find living things in different habitats? Looking deeper into the data Comparative analysis - making connections and considering diversity	White-board - Google maps Group butchers Paper/Cardboard Photos, drawings (from previous lesson) Glue
6	Communicating the findings and making inferences	As per Lesson 5 Glue, display materials Post Sequence Assessment Task (Appendix 2)

Appendices

1 - Teacher Notes: Criteria for living things, alternate conceptions and aerial (birds eye view) school mapping example
2 - Post Sequence Assessment Task

LESSON 1: Living and non-living things - differentiating living and non-living things

(Approximate duration: 20 minutes Pre Sequence Assessment Task and 60 minutes lesson)

Learning focus:

Science ideas and practices

- Recognise the characteristics of living things.
- Make decisions about status and behaviours of living things based on analogy to humans
- Distinguish living things from non-living things
- Sort living and non-living things based on observable Characteristics

Mathematics ideas and practices

- Organise and present examples of living things in a two-way table
- Spatial mapping, using and/or drawing school maps to predict where living things might be found in the school grounds (preparation for continuation next lesson)

Learning intention:

- Describe the difference between living and non-living things and be able to name several examples

Equipment/Resources

Living and non-living things link:
https://www.youtube.com/watch?v=zFGydQHh0KA

Equipment required for all lessons

Students: student workbooks (unlined), pencils, colours and rulers

Teachers: Board (IWB/whiteboard), and or butchers' paper for shared recording and pens

The lesson at a glance:

In this lesson students consider different characteristics of living things to distinguish between living and non-living things. Students develop their understanding that living things breathe, eat (animals), move (plants will move to track the sun or open and close flowers or leaves), grow, reproduce, respond to environment/stimuli.

Preparation: Prior to commencing this lesson the students complete the below "Establishing Prior Learning and Understanding Task". Teachers are to ascertain student knowledge, understanding and learning needs.

Establishing Prior Learning and Pre Sequence Assessment Task

(Approximate duration 20 minutes – to be completed prior to first lesson)

Pre Sequence Assessment Task

- Read the questions as a literacy support. Students answer independently.
  Answers can be shown through text or drawings with labels.

Key question: **What do you think might live in our schoolground?**

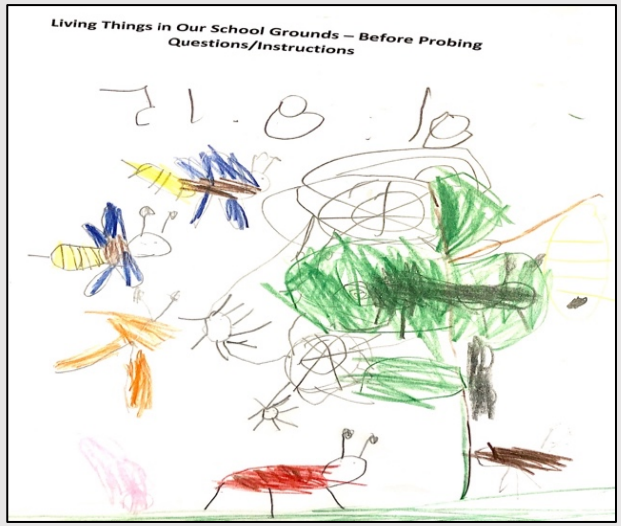
Teacher guided title **"Living Things in Our School Grounds – Before"**

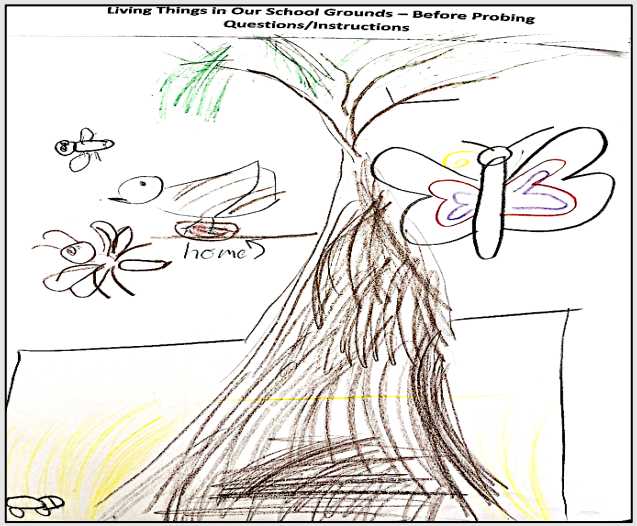
Probing Questions/ Instructions. (teacher read and prompted)

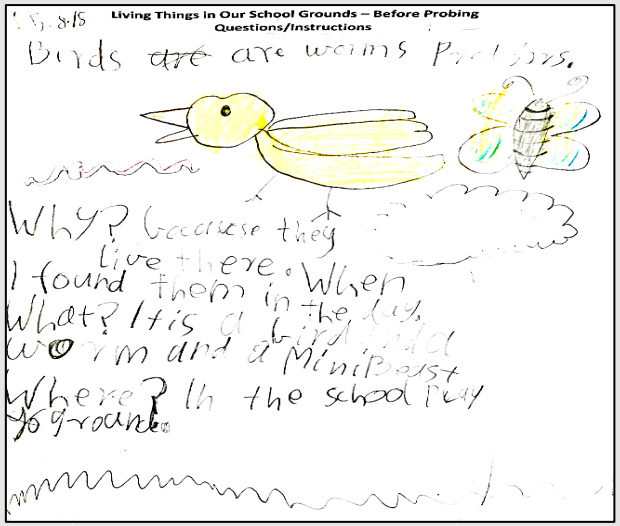
Draw a picture of a living thing you think you'd see in the school ground. *Show in the drawing how you know that it is living (labelling, drawing characteristics of a living thing)*

- **Where** do you think you might find it? **Why? When?** Drawing/labelling answer. **What does it do or need?** Show this in your drawing etc.
- Can you think of another different living thing/s you might find in the school ground? **How** is it/are they different? Draw and label/explain your response.
- Are they found in **different types of places? Why?** Show your answer. **How do they compare? What** do they do differently?
- **How many** of these living things do you think we might find in the school grounds? Students record estimations.

Samples of student work: Examples of a range of student responses identifying living things, habitat attributes and needs of living things.







LESSON 1: Living and non-living things - differentiating living and non-living things

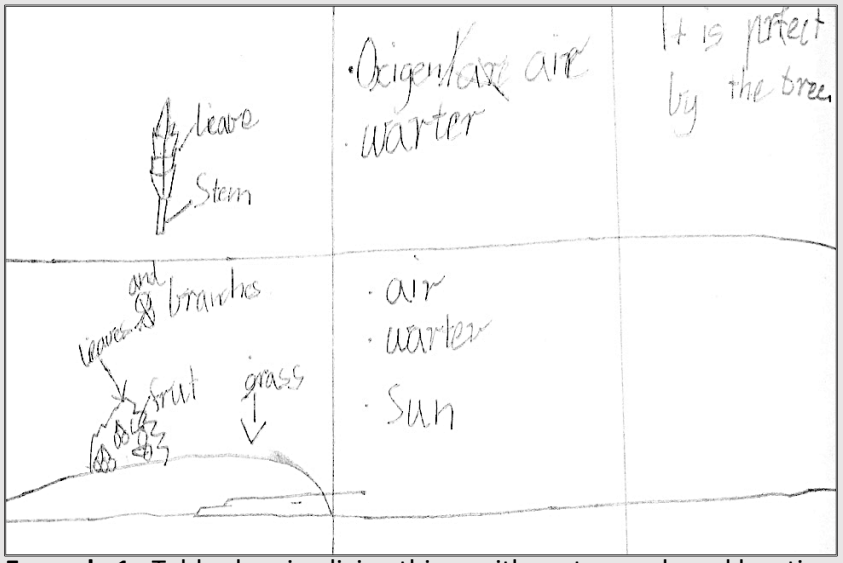
(Approximate duration 60 minutes)

Learning focus	**Pedagogical stage**	***Lesson Outline*** *(NB: time allocations a guide only)*	**Monitoring and supporting learning**
Science: Living and non-living things Recognise the characteristics of living things Sort living and non-living things based on observable Characteristics Ecology Understanding Stage 1: Analogy to Humans Students make decisions about status & behavior of living things based on analogy to humans	***Orienting*** Students are oriented to consider the differences between living and non-living things	**Living and non-living things** *(15 minutes)* **Probing Question:** ❖ *How can you tell the difference between something that is living and non-living?* Write all student ideas on the board "Let's make a list of living and non-living things" Watch the video https://www.youtube.com/watch?v=zFGydQHh0KA Review student ideas and add new understandings, acknowledging any changing student understanding together on the board **Teacher Note:** **Stimuli prompt (if needed)** We are living things – what do we need or do that tells us that we are living? (breathe, eat (animals only actually), move (plants will move to track the sun or open and close flowers or leaves), grow, reproduce, respond to environment/stimuli) Demonstrate how, in order to classify as a living thing, something must have ALL these characteristics NB: Be prepared to allow for a 'once living' category such as wood	Can students identify the characteristics of living things? What range of ideas do students have about living things? What are the common student misconceptions, understandings and possible unexpected/not typical or ideal responses? (See Teacher Notes)

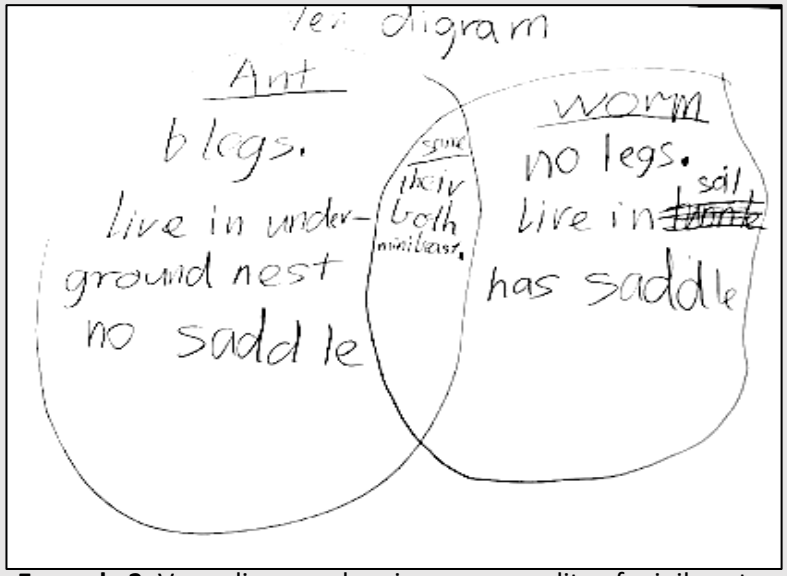
Science: Distinguish living things from non-living things Sort living and non-living things based on observable characteristics **Mathematics:** Organise and present understanding and examples of living things in tables	***Posing representational challenges*** Students are challenged to organise and categorise living and non-living things. Students individually design a suitable representation of living and non-living things.	**Representing Living & Non-Living Things** *(20 minutes)* **Individual workbooks** Organise and categorise living and non-living things and give examples **Suggested guiding questions** ❖ *How could you organise your ideas and examples of living and non-living things?* ❖ *How could you record this information?* (Table/drawing etc.) Student sharing of ideas Students record/organize their ideas about living/non-living things and examples of each in their own book **NB: While students are completing representations in books** Circulate and talk to students, guiding their consideration of the characteristics of living things and ways organizing their examples and ideas. ❖ *What would help us understand what we are showing?* NB: move students towards a table to organise living and non-living things	Can students suggest and justify their examples of living things? Are students able to appropriately classify living and non-living things? Can students record their understanding of living things in tables and/or suitable demonstrative representations i.e. labelled drawings?
Mathematics: Student agreement that *tables* are an effective way of representing living and non-living things	***Building consensus*** Students individually evaluate and synthesise other student ideas and representations	**Considering and Sharing Ideas and Representations** (5 minutes) **Gallery Walk** Students compare and contrast others' representations and ideas Teacher purposefully selects examples (do not remove yet) **PROBING QUESTIONS: during gallery walk for students and guiding questions for following discussion** ❖ *What can you tell from the different representations?* ❖ *How effective are they?* ❖ *What do they show?* ❖ *What don't they show?*	Do students make justifications about what are living things? Do students agree on examples of living and non-living things? Do students make appropriate judgement from others representations

Science: Distinguishing living things from non-living things Sort living and non-living things based on observable Characteristics	***Building consensus*** Students collaboratively collate student ideas and ways of representing to come to an agreement of what is effective and what understanding is clear.	**Whole Class Discussion and Review** *(10 minutes)* Discuss student work examples – with the above guiding questions **Review purposefully selected student examples** Encourage students to make meaning from others representations and discuss what makes some representations effective? **Teacher Note:** Select student representations that demonstrate clear understanding of, and examples of living things, and/or examples of clear ways of representing their understanding i.e. table. Some students may use a Venn diagram for living and non-living things, however this doesn't support classification. i.e. "What goes in the middle though? Can something be living and non-living?"	a) Determine appropriate explanations and examples of living things b) Identify suitable representations and conventions that are used effectively to make a representation and understanding clear i.e. *table, drawings with suitable and clear labels, titles

Samples of student work



Example 1: Table showing living thing, with parts, needs and location



Example 2: Venn diagram showing commonality of minibeasts

Science: Living Things Habitat Reinforcing living versus non-living things Student identification of living and non-living things in the school grounds **Mathematics:** Recording systems i.e. categorising, counting, tallying, describing and notating location	**Orienting** Students make predictions of what living things might be found in the schoolgrounds Developing identification of living things in a familiar context	**Predictions: What lives in our school grounds?** *(10 minutes)* Students record in their books (drawings, labels, number sentences etc.) Students represent their predictions– ❖ *What might live in our school grounds?* Quantify: Ask students to estimate the number of living things they think might be found. ❖ *How many different living things?* Encourage students to 'show' their estimate (labels, tallies and/or number sentence) and explain their responses and consider and represent **what, when, where, how many and why** Next Lesson - Where are living things in the school grounds? (mapping)	Can students identify different locations where living things might be found in the school grounds? What are the different reasons students give for suggested locations (food and shelter)? Can students describe and classify the types of places living things/different living things might be found? (e.g. garden, trees, dry soil etc.)

LESSON 2: Living things in the schoolground: What are they? Where do they live? Mapping the schoolground

(Approximate duration 60 minutes)

Learning focus:

Science ideas and practices

- Reinforce understanding and recognition of living things and non-living things
- Recognise that living things live in different places where their basic needs; including food, water and shelter, are met.

Mathematics ideas and practices

- Spatial mapping: Bird's-eye view mapping of where living things might be in the school grounds
- Partitioning areas to identify suitable plots
- Estimating the area and perimeter of plots

Learning Intention:

- Develop reasoned predictions and estimations about the animals and plants that live in the school grounds.

Equipment/Resources

Link to Bird's eye view map of school (i.e. google maps)

A3 Print out of bird's-eye view of school grounds

Equipment required for all lessons
Students: student workbooks (unlined), pencils, colours and rulers

Teachers: Board (IWB/whiteboard), and or butchers' paper for shared recording and pens

The lesson at a glance: In this lesson students are introduced to the concept of habitat.
Students consider location characteristics and the living things found in that area- what is there and where do they live? They develop their 'bird's-eye view' mapping skills by mapping where they predict living things are, and what they are, in the school grounds.
Students further develop their understanding that living things breathe, eat (animals), move (plants will move to track the sun or open and close flowers or leaves), grow, reproduce, respond to environment/stimuli and consider these characteristics and needs within locations.

NB: Prior to this lesson, in lesson 1, students were asked to predict how many living things and what living things they would find where.

LESSON 2: Living things in the schoolground: What are they? Where do they live? Mapping the schoolground

(Approximate duration 60 minutes)

Learning focus	Pedagogical stage	Lesson Outline *(NB: time allocations a guide only)*	Monitoring and supporting learning
Science: **HABITAT –** Introduce the concept and terminology **Stage 1: Criteria for habitat are based on analogy to home** ⇩ **Stage 2: Associate Organisms and Places** Reinforcing living things versus non-living things (previous lesson)	***Orienting*** Students are oriented to consider the needs of living things and reason why certain living things might be found in certain places	**Where do living things live in the schoolground?** *(10 minutes)* **Whole Class Discussion** (students referencing their books - previous lesson) • List (on the board) the living things students think will be found in the school grounds **Probing Questions: (think- pair-share)** Focus on through student contribution ❖ *How do you know that they're living?* Student reasoning - Reinforcing living things v's non-living things (previous lesson) ❖ *Why do they live there?* Needs: food, water, protection and shelter From student discussion and identification of places where living things live introduce the term 'habitat': Explicit naming	Do students suggest different feasible locations for different living things? How well do students describe the needs of living things; food, water protection and shelter in different locations

<table>
<tr>
<td>Mathematics:
Teacher modelled, co-constructed display of student predictions in a table

Science:
Habitat
Student identification of and reasoning of possible habitats for specific living things in the school grounds</td>
<td>Orienting
Students identify a variety of locations in the school grounds and reason why living things might be there</td>
<td>Organising ideas: Where and Why?
(15 minutes)
Whole Class- teacher guided/modelled
Revise students answers and write up as a table – Teacher models

Below is an example of layout for predictions tables-

Completed as whole class one column at a time, as explained below
Teacher note: only an example – use student data and ideas

“What living things are in our school grounds?”
<table>
<tr><th>LIVING THING</th><th>Where might they live? HABITAT (modelled language)</th><th>Why might they be there?</th></tr>
<tr><td>Snails</td><td>Under rock, etc. list responses</td><td>Shelter Safety
Moist etc.</td></tr>
<tr><td>Spiders</td><td>Web, in a tree
Grass</td><td>To catch insects flying, food</td></tr>
</table>
Discussion centred on HABITAT:
❖ Where do you think each of these living things might live? (add students responses – Column 2)
❖ Why? Discuss with students why each animal might live in these places? (e.g. Web in tree – to catch food, flying insects)
(add student responses – Column 3)</td>
<td>Can students nominate a variety of habitats and living things found in the school grounds?

Do students make links and distinctions between the habitats of different living things?

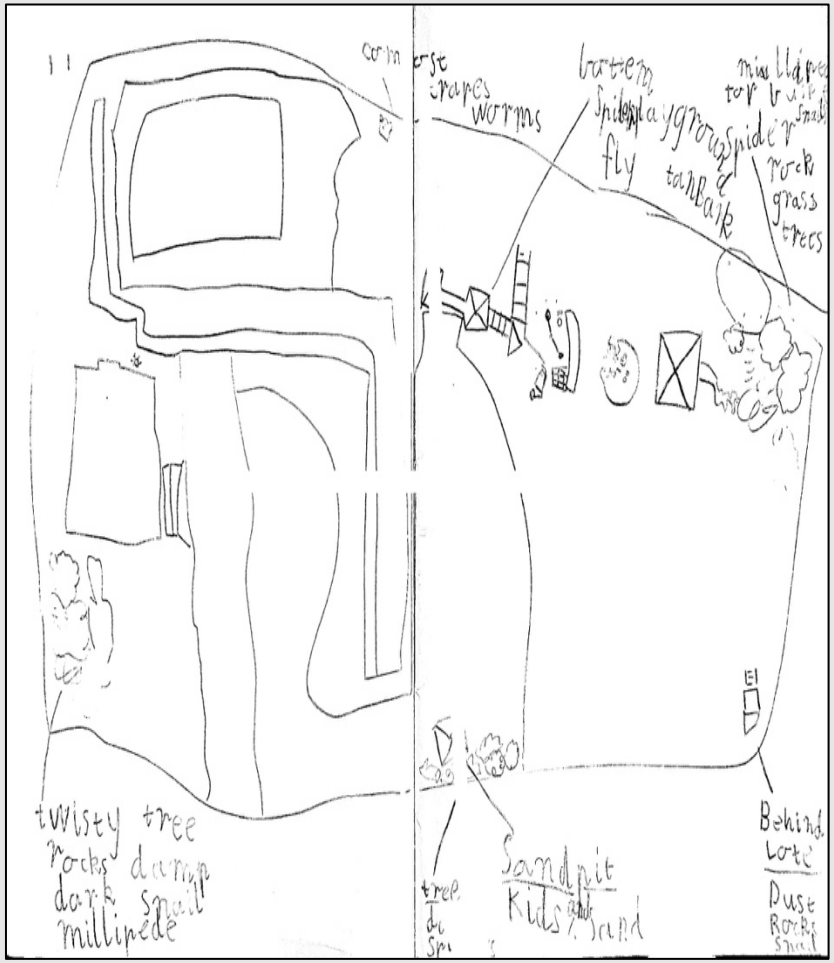
Do students have reasoned explanations for habitat locations (i.e. considering needs)</td>
</tr>
</table>

Mathematics: Spatial Reasoning: mapping, Map reading, Directionality Representing and communicating ideas using perspective (bird's-eye view maps)	***Orienting*** Students learn to recognise features of areas/habitats referencing aerial view/bird's-eye view map features	**Location of Habitats** *(5 minutes)* **Bird's-eye View Map Preparation (Maps – google maps)** ❖ *How could we represent/show the location of these habitats and what we might find?* Show and explain a 'bird's-eye' view of the whole school – aerial map NB: Use both terminology bird's-eye and aerial view Yr1 –Mapping preparation Teacher led discussion and student identification of different locations in the school – looking at a GOOGLE Map **Probing Questions:** ❖ *What are the different homes/habitats that we can see in this map of the school?* (grass area, trees, rocks, soil etc) ❖ *How could you show this?* **INDIVIDUAL MAPPING PREPARATION** **Own bird's-eye view school map** - map referencing with google maps) **Orientation and Directionality (Map reading)** *(10 minutes)* Students individually locate (point to) places in the school grounds on their map as teacher/student name e.g. next to, nearby, near, far, close to, behind, in front, furthest, closest, further than, closer than.	Do students make justified links or generalisations about locations and the living things found? Do students relate needs and shelter to habitat and location? What range of mapping skills are demonstrated? **Teacher circulates and provide feedback:** Can students accurately identify locations in the school on a bird's-eye view (google earth) map?

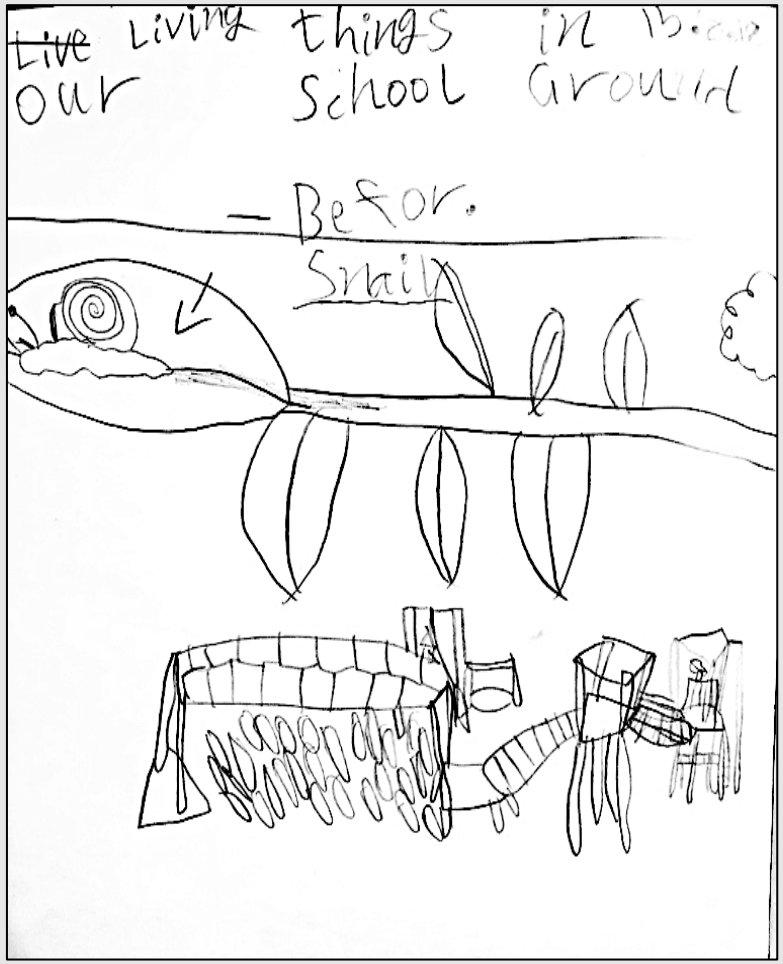
Mathematics: Spatial Reasoning: Mapping, Representing and communicating ideas using perspective (bird's-eye view maps)	***Posing representational challenges*** Students are challenged to locate and represent habitats and their predicted living things on a bird's-eye view map of the school grounds	**WHAT LIVES WHERE?** *(10 minutes)* **Independent Response/Representation – book** (own school maps as stimuli – optional to use – optional/extension: draw own bird's-eye view map) **Probing Questions:** ❖ *What are the different homes/habitats that we can see in this picture of the school?* (grass area, trees, rocks, soil etc) ❖ *How could you show this?* **TASK: S**tudents draw and label the living things discussed with the whole class in possible homes/habitat locations on their own school bird's-eye view map, or in any way they would like to demonstrate.	Are a variety of habitats identified on students maps? Do students accurately locate habitats and possible living things within the school map?
Science: Identification of possible habitats for specific living things and reasons why they live there **Mathematics:** Bird's eye view map features (i.e. title & key) & directionality	***Building consensus*** Students share, compare, evaluate each other's bird's-eye view map habitat and living things location predictions Teacher synthesises bird's-eye view maps of habitats and living things in the schoolground)	**Group Feedback, Analysis and Reflection** (10 minutes) Class identification of attributes of maps/visual representations that are easy to understand. Teacher lead Discussion, Student Sharing & Review Purposefully select students to share their bird's-eye view habitat maps Students compare and contrast others' representations and ideas. NB: Model the language -habitat (home) **Review Questions** ❖ *What can you tell from the different representations?* ❖ *How effective are they?* ❖ *What do they show?* ❖ *What don't they show?* ❖ *What features are helpful?*	How diverse and clear are students bird's-eye view map displays – layout, orientation, labelling, keys, title, arrows, directions? Do students identify attributes of bird's-eye view maps representations that make the predictions/habitats and living things easy to understand?

Samples of student work

Predictions – Where are living things in the school ground?



Example 1: Student's bird's eye view map' of the whole school



Example 2: Student's map of "Living Things in Our Schoolground"

LESSON 3: Schoolground Investigation: Living Things and Places - Organisms and Habitats

Part 1: Field Investigation Preparation Part 2: Field Investigation

(Approximate duration: 120 minutes or 2 x 60 minute sessions)

Learning focus:

Science ideas and practices

- Students identify and describe through representations, living things, their needs and interactions within the schoolgrounds.
- Students use their senses to explore the world around them to record, sort and compare their observations.
- Reinforce understanding and recognition of living things and non-living things
- Recognise that living things live in different places where their basic needs; including food, water and shelter

Mathematics ideas and practices

- Spatial mapping: Bird's-eye view mapping of where living things might be in the school grounds
- Students assign numerical values to systems of living things in order to answer questions and raise questions for further investigation

Learning Intention:

- Develop mapping and recording skills (bird's-eye view mapping and tallying recording) and apply investigation methods to record living things and their habitat, within their own plot in the school grounds.

The lesson at a glance: This lesson is divided into two parts.

Part 1: Investigation Procedures – Focus on safety and protecting our school environment and living things "Code for Caring"

Part 2: School ground – Field Investigation

Students in small groups, observe a plot, collecting and recording data, the location and number of different living things. (bird's-eye view plot map & tallying)

Note: Each class in the cohort/school takes a different area and may later share findings.
Primary Connections "Schoolyard Safari" Unit can be incorporated for 'Mini Beasts' identification and knowledge https://www.primaryconnections.org.au/curriculum-resource/schoolyard-safari

Equipment/Resources

Book suggestion:
"Where the forest meets the sea"
Author - Jennie Baker

Link to Bird's eye view map of school
(i.e. google maps)

A3 Print out of bird's-eye view of school grounds

Hats & sunscreen (Part B)

Field Investigation Resource Box: measuring tape, meter ruler, perimeter markers (e.g. traffic cones) magnifying glasses, spoons, small containers, nets (catch and release), gloves

Camera/iPad – Record locations of plots and living things found

Equipment required for all lessons

Students: student workbooks (unlined), pencils, colours and rulers

Teachers: Board (IWB/whiteboard), and or butchers' paper for shared recording and pens

LESSON 3: Schoolground Investigation: Living Things and Places (Organisms and Habitats)

Part 1: Field Investigation Preparation Part 2: Field Investigation

(Approximate duration 120 minutes or 2 x 60 minute sessions)

Learning focus	Pedagogical stage	Lesson Outline *(NB: time allocations a guide only)*	Monitoring and supporting learning
Science: Investigation Procedures: establishing need for consistent methods (size of plot) and recording (what, where, why?) Protection – Code for Caring Needs of living things	***Orienting*** Establishing the need for consistent investigation procedures; safety and recording methods. i.e. 'Code for Caring'	**Establishing Student Prior Experience** *(5 minutes)* **(Whole Class)** What experiences of plant and animal care, and safety procedures have children had to allow a focus on a 'code for caring? What experiences have children had with investigation to enable an awareness of procedures? **Part A: Investigation Preparation** *(10 minutes)* Optional video or story book about caring for the environment (Suggestion – "Where the forest meets the sea" Jennie Baker) **Procedures Discussion (Whole class – teacher guided)** **Safety and Protection:** Protecting Our School Environment, Living Things and ourselves ❖ **What do we need to do to stay safe?** (Code for Caring) Teacher list & reinforce ❖ **What do we need to do to protect our living things?** List & reinforce that we avoid touching and disturbing living things – take photos/draw. ❖ **What do we need to remember when working outside?** Teacher list suggestions (school rules for movement, safety, as well as listen for animal sounds, stay within allocated area etc.)	What experiences of plant and animal care, and safety procedures have children had to allow a focus on a 'code for caring? What experiences have children had with investigation to enable an awareness of procedures? Do students demonstrate an awareness of the required safety considerations (self and living things)? Do children have a sense of the need for consistent procedures and thorough methods of recording? (plot size, drawings, tallying, labels etc.) What range of suggestions do students make for ***what*** is important to record and ***how*** to record? Can students come up with reasoned investigation locations considering habitat e.g. soil type, plants present, under rocks et

Mathematics: Bird's-eye view mapping, measurement, counting and tallying **Science:** Habitat and needs of living things identification Variation in habitats and living things **Mathematics** Measure (metres) and area; use grid, estimate distance and area	***Orienting*** Establishing a need for consistent recording methods and appropriate systems and practices. i.e. plot size, location, measurement and recording	NB Student safety: hats, gloves, not touching things that could hurt us e.g. spiders, sharp objects e.g. glass, etc. **Part B: Recording Procedures** *(15 minutes)* **Student identified and negotiated** ❖ ***Is it important to record what you find? Why?*** remember, compare, contrast, share with others ❖ ***What*** *is important* ***to record****?* *location details, habitat etc. (e.g. the type of ground, presence of nests, burrows, trees or log hollows; presence of water, shade) *types of animals/plants (named) *number of plants and animal ❖ ***How to represent location?*** (school map – habitat drawing, bird's-eye view) ❖ ***How to represent the animal/plant and the number found?*** (drawings, tallies) NB: Teacher may need to guide students towards tallying as appropriate and model benefits Teacher allocated small groups and areas Familiarize students with required resources (magnifying glasses, brushes, etc.) **OUTSIDE:** **School ground Investigation Preparation** *(30 minutes)* Whole class – initial tour of area to be investigated with safety and organism protection procedure considerations reinforced Students (groups) select the five best locations/habitats within the area to investigate, explaining why (OR the teacher can decide beforehand which areas will be investigated and lays out markers to specify the quadrants to be investigated – 4 markers, one on each corner). Whole class (groups) – teacher supported measurement of 5 (or teacher nominated number) 2m x 2m plots/quadrants	Do students recognise the need for consistent measure and methods (plot size and tallying) Do students identifying bird's eye view maps or plan maps as a means of recording location? Do students recognise the benefits of tallying in this investigation?

<table>
<tr><td colspan="4">At this point, the lesson could be broken up to complete the schoolground investigation (Part B) at another time or on another day.
Some teachers have also, at this point, incorporated the Primary Connections “Schoolyard Safari” to further developed student identification of ‘Mini-Beasts’ and their knowledge of invertebrates structure and function. https://www.primaryconnections.org.au/curriculum-resource/schoolyard-safari</td></tr>
<tr>
<td>Science:
Students investigate and record living things and their habitat within the familiar context of the schoolground

Stage 2 – Organisms and Places: Habitat
Exploring habitat, animal and plant diversity and animal and plant feature

Mathematics:
Creating and recording data methods (bird’s-eye view maps & tallying</td>
<td>Posing Representation Challenge
Students record and represent their findings of living things in a designated area (plot/quadrant)
i.e. bird’s-eye view mapping/drawing location, living things and tallying</td>
<td>Lesson 3 Part 2: Field Investigation
(45-50 minutes)
Living things in the schoolground
Students work in small groups, observing a plot and collecting and recording data, including location, the number of identified living things, their needs and interactions (food and shelter).

Students to record – Plot/Quadrant
❖ Where? – Location (draw, bird’s-eye view map, photos)
❖ Features (trees, water, next, leaves etc.) and conditions (weather)
❖ What? – Living things, their features (drawings, photographs) and behaviours and interactions (food and shelter)
❖ How many? Tallying and labelling

Teacher to circulate and provide assistance and feedback

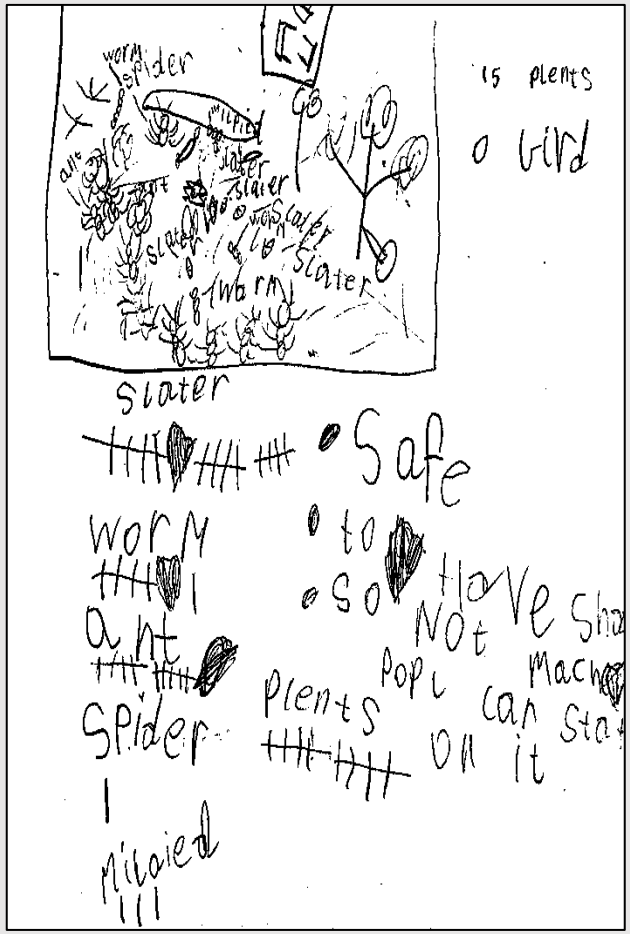
NB: Encouraged to focus on/notice the relationship between organisms (living things) and their habitat (home) with consideration of seasons.</td>
<td>Circulating and monitoring during investigation:

Are students representing their findings using locational drawings, bird’s-eye view maps, tally marks, drawing and labels?

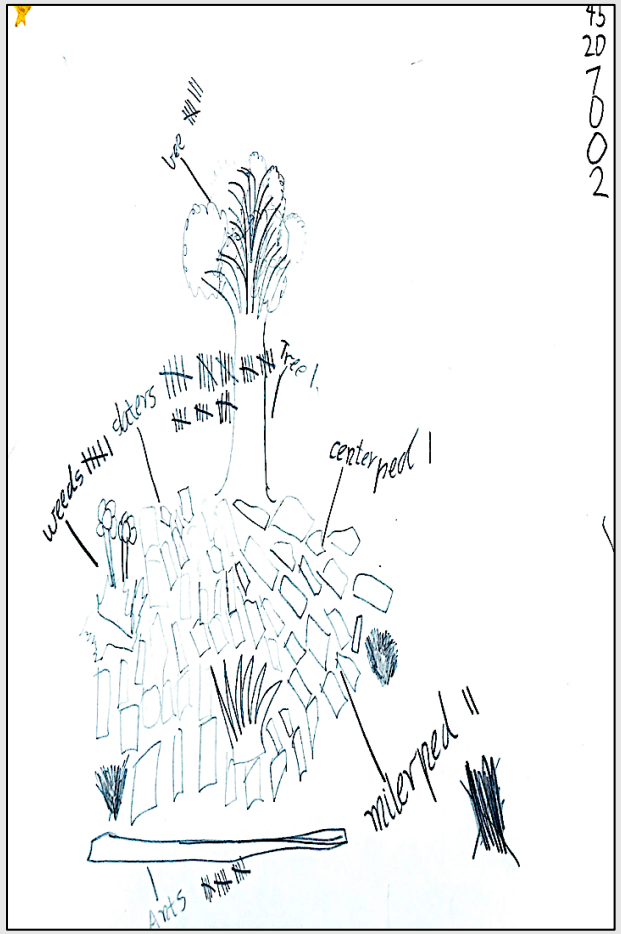
Are students organising their measures consistently and tallying systematically?

Are students recognising ‘habitats’ and recording the needs of living things (food and shelter)?</td>
</tr>
</table>

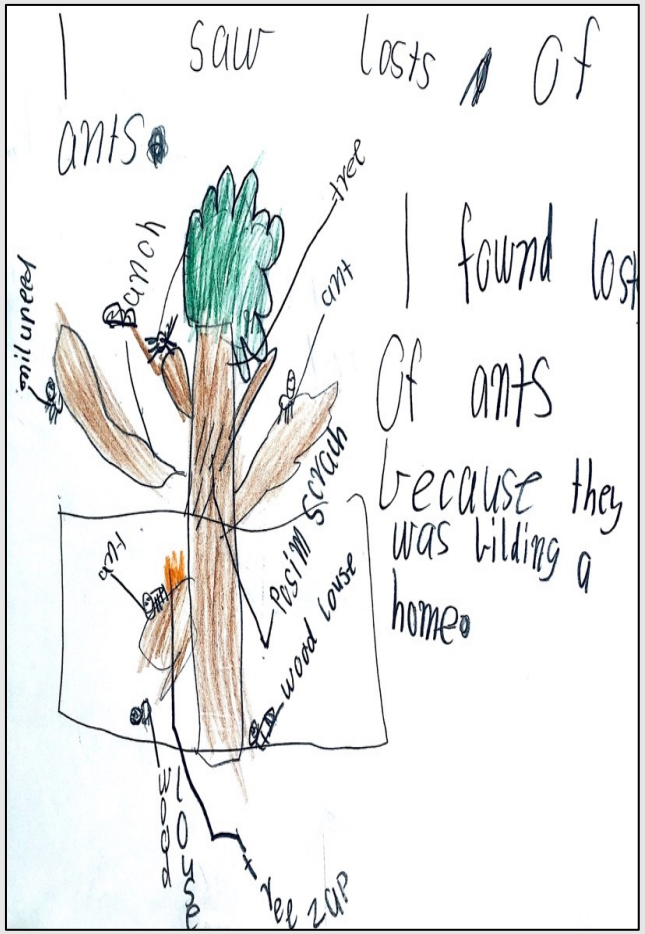
Samples of student work



Example 1: Tallying, mapping and labelling of living things found in the students plot



Example 2: Tallying, labelling and diagrammatic drawing of plot



Example 3: Making connections with habitat and needs 'building a home'

Science: VARIATION Method, location and habitat**s** and living things **Mathematics:** Location and spatial mapping; bird's-eye view mapping Data Recording; tallying	***Building consensus*** Students share and compare their different Habitat observations The teacher guides a consensus version of recording	**Return to Class** (10-15 minutes) **Observations/Data organising and sharing (own group)** Students complete their observation recordings; their drawings, bird's-eye view maps and tallying NB – Group conferencing - briefly discussing what they saw in their own small groups **Probing Question** ❖ *Did you find the same things? Why/why not?* Groups agree on the data - Plot groups compare their recordings and agree on the data (what was found, how many and where) from their investigation NB students counting in groups can count the same animal more than once – this could be discussed as part of deciding on process	**Variation** Do students come up with valid reasons why there is variation (in their recordings)? – For instance: a)Different areas within the plot b)Different living things recorded c)Method not consistent or accurate; reliable scientific method Do students recognise that inconsistent group/plot data may be the result of counting of the same animal more than once (as the animals move)?

LESSON 4: What living things did we find in the schoolground? Sharing the findings

Ecosystems: Organism's needs and interactions

(Approximate duration 90 minutes)

Learning focus:

Science ideas and practices

- Students review, sort and represent their observations and communicate their observations, findings with others
- Reinforce understanding and recognition of living things and non-living things
- Recognise that living things live in different places where their basic needs; including food, water and shelter

Mathematics ideas and practices

- Spatial mapping: Bird's-eye view mapping of where living things might be in the school grounds

Learning Intention:

- Develop mapping and recording skills (bird's-eye view mapping and tallying recording) and apply investigation methods to record living things and their habitat, within their own plot in the school grounds.

Equipment/Resources

Interactive Whiteboard (IWB) or Projector
Link to Bird's eye view map of school
(i.e. google maps)

*A3 Print out of bird's-eye view of school grounds

Group Photos – from investigation (printed)
Student drawings and notes (previous lesson)

Equipment required for all lessons
Students: student workbooks (unlined), pencils, colours and rulers

Teachers: Board (IWB/whiteboard), and or butchers' paper for shared recording and pens

The lesson at a glance:

Students identify, on a bird's eye view map of the school grounds, the location of their group plots.
Whole class discussion/ exploration based on the findings of their group schoolground living things investigation plots. Students share their group findings with the whole class to generate a plot data display.

Lesson Preparation: Groups need to have consolidated their data, their recordings of 'what they found' from the previous lesson, before proceeding.

LESSON 4: What living things did we find in the schoolground? Sharing the findings (Ecosystems - organisms needs and interaction)

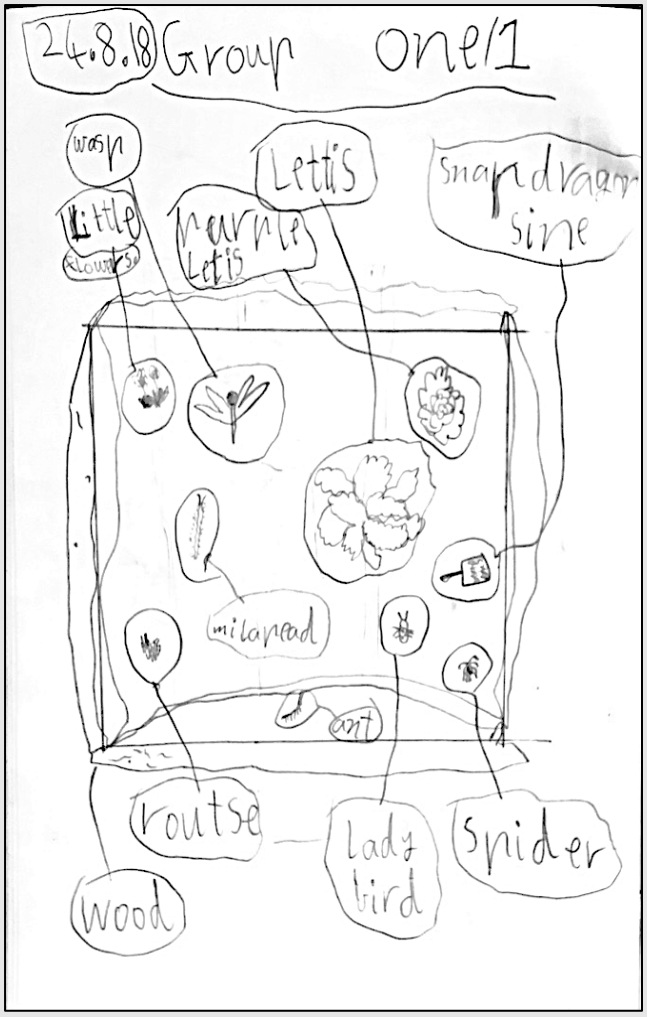
(Approximate duration 90 minutes)

Learning focus	Pedagogical stage	Lesson Outline *(NB: time allocations a guide only)*	Monitoring and supporting learning
Mathematics: Spatial mapping and reading: bird's-eye view mapping, measurement, counting and tallying	***Orienting*** Establishing group agreement on 'what and how many living things were found in each plot/quadrant and the need for consistent recording methods, systems and practices. i.e. measurement and recording	**Whole Class: Locating Group Plots** *(10 minutes)* **Where did you investigate? Where was your plot?** **(A3 Printout/IWB Image of schoolgrounds)** Each group locates and marks, on the schoolyard map, the location of their group plot. (teacher prompting questions and support may be required) **Schoolground Investigation Findings – Sharing** *(5 minutes)* **(Plot group – then Whole Class)** Students compare their findings with their predictions and finalise their 'agreed plot data' as discussed in the previous lesson. (students refer to their books) **Probing Questions** ❖ *Did you find your predicted living things? How many? Age/Size?* ❖ *Did you find your predicted living things where you thought you would?*	What reasons do students identify for differences in data? (i.e. location, method) NB: Students may suggest that they're counted more than once, as the animals move Are students able to locate their plot location on a bird's eye view map of the whole school grounds?
Science: Habitat conditions and interactions and how they meet plant/animal's needs	***Orienting*** Establishing habitat conditions that support living things (feed and shelter)	**Habitat and Interactions:** Draw attention to feeding relationships and shelter relationships (e.g. seed and bird, spider and web) **Small Group Discussion** *(5 minutes)* **Suggested probing questions** ❖ *Why do you think your living things live where they do?* ❖ *How did the conditions of the area /habitat support them living there?* ❖ *Did the living things (organisms) interact in any way*? (e.g. bees pollinating) ❖ *How did what you observed in your plot (living and non-living things) interact or influence each other?*	Do students recognise the needs of living things and how they interact in their plots?

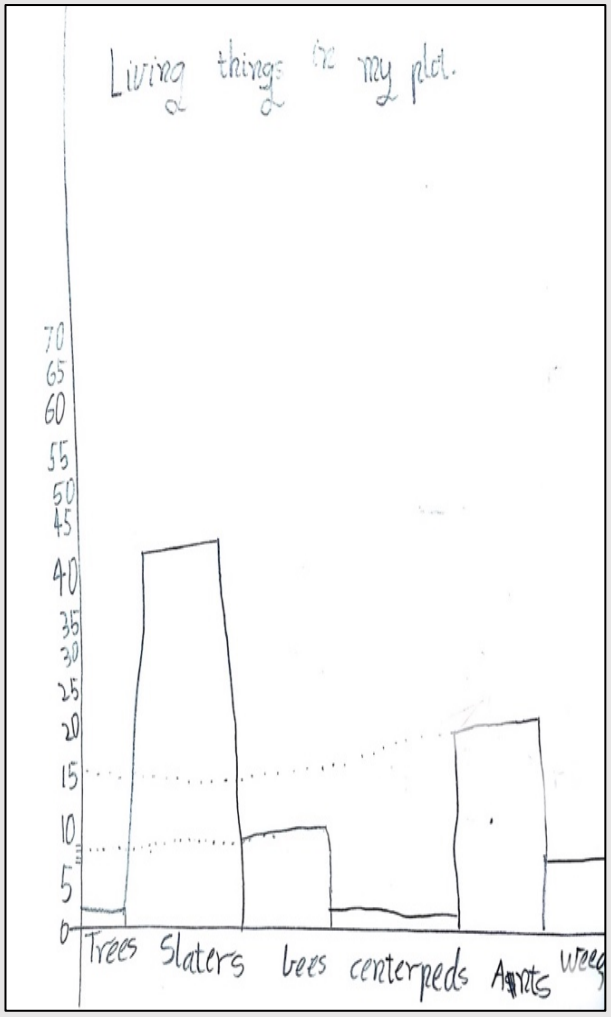
Science: Organisms Interactions Ecosystem Diversity **Stage 3** Organism's Needs: Ecosystem – Relating organisms need to habitat	***Orienting*** Developing understanding of the effects of conditions and actions on living things	**Whole class discussion – Commonalities** *(10 minutes)* Feeding relationships and shelter relationships Probing Questions ❖ *What are these relationships?* ❖ *Were there similarities? Commonalities?* ❖ *Were there similarities? Commonalities?* (feeding and shelter relationships) List student ideas on the board student ideas on the board NB: Draw students attention, through their examples, to the understanding that *all living things do have shared needs* (feeding and shelter relationships) **Feeding Relationships** -Different types of feeding relationships (living and living interactions e.g. seed and bird and non-living and living interactions e.g. biscuit and ant) **Shelter Relationships** - Ways shelter is achieved (e.g. non-living and living interactions e.g. spider web under a seat and living and living – slug in a log) **Discuss specific locations** in the schoolground in discussion commonly found living things in all the different areas/plots/quadrants. ❖ *How were these needs met in specific school areas where they were found? Commonalities? Variance?* **Teacher note - Introduce and model the terms** "ecosystem" - system of living and non-living things interacting and functioning together. "diversity'– number of different living things	How do students analyse and interpret numerical data to discuss habitats in terms of animals' needs? Do students recognise living things, their needs and interactions within their plots (Food and shelter)?

Science: VARIATION Representing location, habitat**s** and living things **Mathematics:** Data representation: Location and spatial mapping; bird's-eye view mapping; tables and graphing	***Posing Representational Challenge*** Students are challenged to collate their group agreed data into a clear representation of what and how many living things were found. (The aim is to move students towards seeing the power of bar graphs to represent data clearly)	**Representing Plot Data – The number of each living thing.** **Whole class brief discussion** *(5 minutes)* Data representation and organization ❖ *How could you represent how many different living things were found to share with the whole class?* Discuss student ideas/suggestions (methods of representation- bird's-eye view map, graph (bar graph) table) **Individual/Small Groups** *(15 minutes)* Students collate their findings from in the field into a clear representation Students invent representations/displays that allow for comparison – tabulating tables, graphs and location	What different 'ways. Of showing' do the students identify? What different ways have students represented the data? (bar graphs, diagrams, bird's-eye view maps etc.) What different aspects of the student findings are represented? (e.g. numbers, location, variation, needs)
Mathematics: Developing bar graph skills. Working towards agreement on effective data representation, spatial mapping, bird's-eye view map and data characteristics	***Building consensus*** Students share and compare their data and plot representations. The teacher guides a consensus version of recording. (bar graphs and bird's-eye view mapping of locations within plots)	**Group Feedback, Analysis and Reflection** *(10 minutes)* Class identification of attributes of data representations that are easy to understand NB: moving towards bar graphs Student compare and collaborate individual/group findings and share their 'way of representing'. (graphs, maps, etc.) Encourage students to make meaning from others representations and discuss what makes some representations effective? **Review purposefully selected student examples** (clear and accurate representations – bar graph and bird's-eye view plot) **Teacher Note:** Select student representations that demonstrate clear data utilising bar graph attributes. To support student understanding of bar graphs, from student work and through guided questions, move to co-construct the data as a bar graph,	How do students compare and analyse different representations? Do they make meaning from others representations? Do they identify what is shown/not shown confidently? Do students identify that as bar graph is an effective way of representing the data?

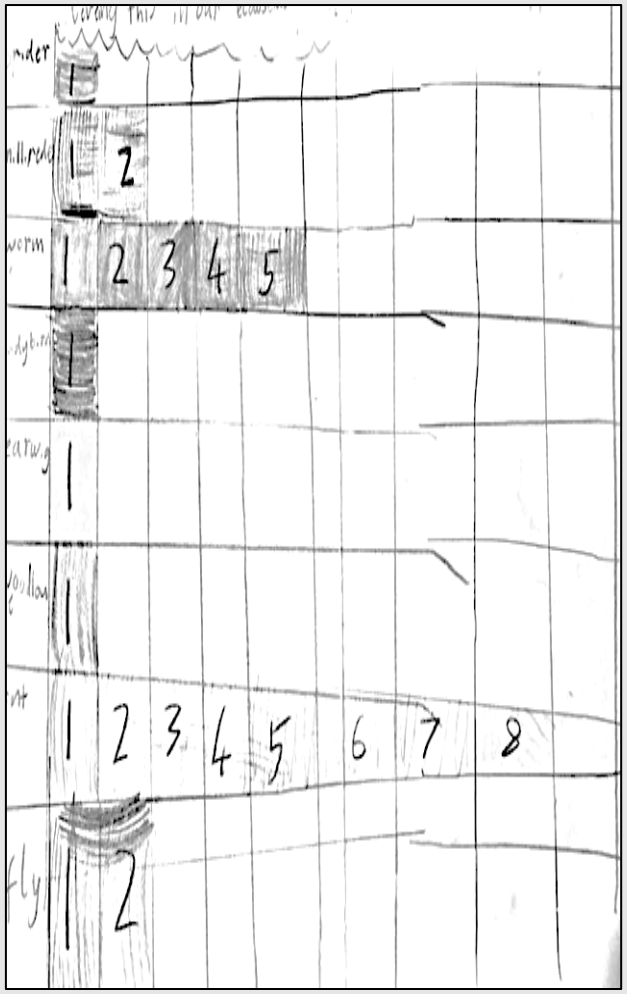
Samples of student work



Example 1: Student group-constructed map of plot



Example 2: Vertical bar graph with scale in 5's



Example 3: Horizontal bar chart with grid to show frequencies

LESSON 5: Comparative Analysis – Making Connections and Supporting Diversity

(Approximate duration 90 minutes)

Learning focus:

Science ideas and practices

- Students review, sort and represent their observations and communicate their observations, findings with others
- Reinforce understanding and recognition of living things and non-living things
- Recognise that living things live in different places where their basic needs; including food, water and shelter

Mathematics ideas and practices

- Spatial mapping: Bird's-eye view mapping of where living things might be in the school grounds
- Develop graphing methods for representing data

Learning intention:

- Construct graphs to compare living things across plots and interpret differences in terms of the needs for survival.
- Analyse and compare different locations 'ecosystems' and findings to make connections with the needs and interactions of living things.

Equipment/Resources

Interactive Whiteboard (IWB) or Projector
Link to Bird's eye view map of school
(i.e. google maps)

A3 Print out of bird's-eye view of school grounds

Group Photos – from investigation (printed)
Student drawings and notes (previous lesson)

Equipment required for all lessons
Students: student workbooks (unlined), pencils, colours and rulers

Teachers: Board (IWB/whiteboard), and or butchers' paper for shared recording and pens

The lesson at a glance:

Students generate a of whole class data display, from the group plot data and discuss in groups and as a class the distribution of animals/living things across habitats and reasons for this.

Making Connections and Inferences: Students ask questions of and explore aspects of the data on living things – distribution, diversity, needs for survival and interactions.

Preparation: Whole class data recordings of what was found in each plot needs to be consolidated and shared from the previous lesson, before proceeding.

LESSON 5: Where and why did we find living things in different habitats? Looking deeper into the data – Comparative Analysis Making Connections and Supporting Diversity Ecosystems - organisms needs and interactions

(Approximate duration 60 minutes)

Learning focus	Pedagogical stage	Lesson outline *(NB: time allocations a guide only)*	Monitoring and supporting learning
Science: Habitat Ecosystem Variation Diversity **Mathematics:** Co-constructed class tabulated data, measurement, counting and tallying	***Orienting & Posing Representation challenge:*** Establishing class data 'what and how many living things were found in each plot/quadrant and the need for	**Sharing: Plot data to construct a Whole Class Data Set** **Group map of plots – then Whole Class** *(20 minutes)* Each group shares their visual representation and adds to a whole class data set with consideration to why they found what they did **Probing Questions** How could we record all of the plot data in one display? (Table) Class co-constructed data table. (see example below) Each plot group adds their data (tally marks) to the whole class data set (table) **Whole class data review** *(5 minutes)* **Probing Questions** How many different living things are found throughout the school (diversity). Where in the schoolground (which plot) is the most variation in living things found? (Diversity) ❖ Why? Can we/do we influence that?	What reasons do students identify for differences in data between the plots? (i.e. location, method) Do students accurately share the number and range of living things found in their plot? Do students recognise living things, their needs and interactions across different plots (Food and shelter)? How do students analyse and interpret numerical data to discuss habitats in terms of animals' needs?

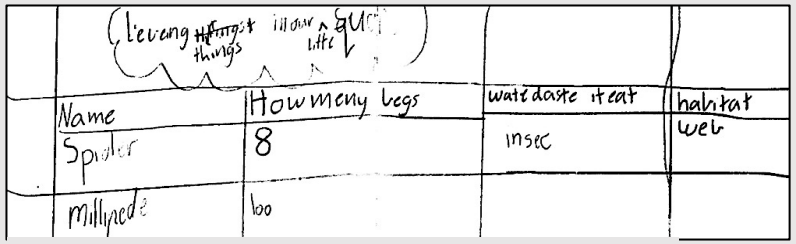
Example of Whole Class Data Set/Display: Teacher guided, whole class generated plot, data set. Different colour coding represents the different plot findings (IWB)

	spiders	snap dragon plant	wasp	ant	beetle	millipede	bird	broccoli	lettuce	flowers	bee	roots	woodlouse	grass	worms	slugs	earwig	asparagus fern	tree
Group 1	1	1	1	3	1	1	4	3	5	2	0	10	0	N	0	0	0	0	0
Group 2	3	0	0	3	0	2	0	0	0	0	2	1	1	Y	0	0	0	7	1
Group 3	1	0	0	1	0	0	16	0	0	0	0	2	1	Y	7	1	0	0	1
Group 4	0	0	0	2	0	0	7	0	0	0	2	0	0	Y	2	1	2	0	1

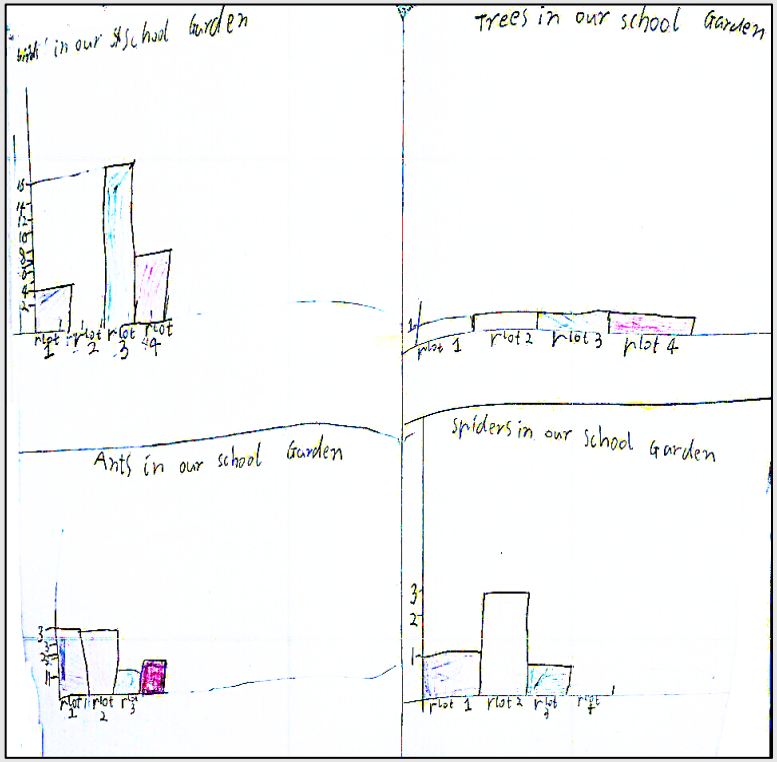
Y = Yes
N = No

Science: Habitat Ecosystem Identifying patterns Diversity Variation	***Building consensus*** Students review the data to form agreed generalisations about diversity, i.e. which plots have the most variety of living things and why (making connections with needs; shelter, food and interactions)	**Small Group Discussion** *(5 minutes)* **Suggested probing questions** ❖ *Why do you think your living things live where they do?* ❖ *How did the conditions of the area /habitat support them living there?* ❖ *Did the living things (organisms) interact in any way?* (e.g. bees pollinating) ❖ *How did what you observed in your plot (living and non-living things) interact or influence each other?*	Do students recognise diversity and variation between the different plots? What justifications to students make for the variation in living things and diversity of living things found in different locations.
Mathematics: Collating data Graph design Bird's eye view maps **Science:** Analysing patterns of living things and making inferences. Habitat Ecosystem Variation Diversity	***Posing Representational Challenge and applying conceptual understanding*** Students are challenged to collate the whole class data into a clear representation of chosen living things and locations (bar graphs, bird's-eye view maps, diagrams)	**Making Connections - "Did You Know Report"** **Individual/Small groups** *(30 minutes)* **Task:** Show what lives in this habitat and why? Encourage students to include a variety of representations (diagrams, maps, graphs etc.) Student choose individual living things to analyse patterns of living/interaction and behaviour within the schoolground. **Teacher Note**: Individual/group responses can be compiled to form a 'Field Guide" Booklet of the schoolgrounds OR a Wall Display	What representation decisions and justifications do students make? Is data and location accurately displayed? What inferences and/or generalisations do students make about where, why and frequency of different living things in the school grounds? Do students demonstrate understanding of diversity and variation?

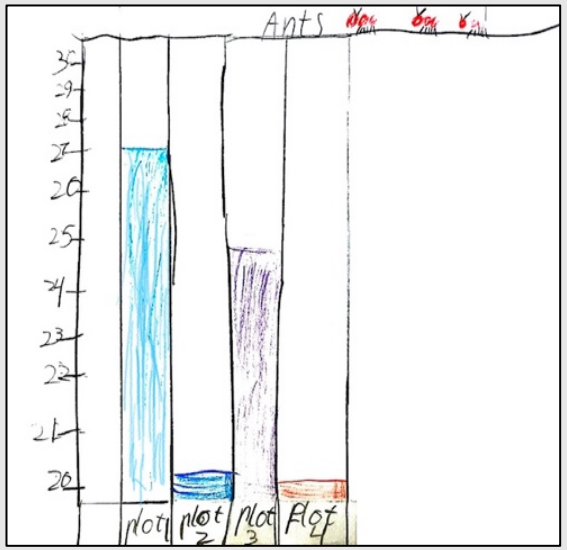
Samples of student work (different classes)



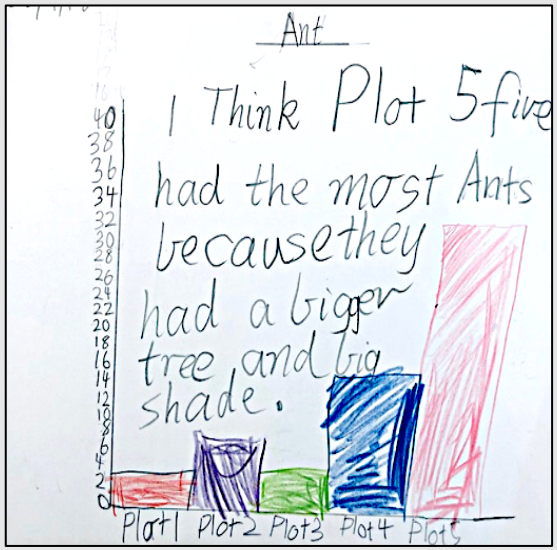
Example 1: Table of living things found, the number found and identified needs, food and shelter.



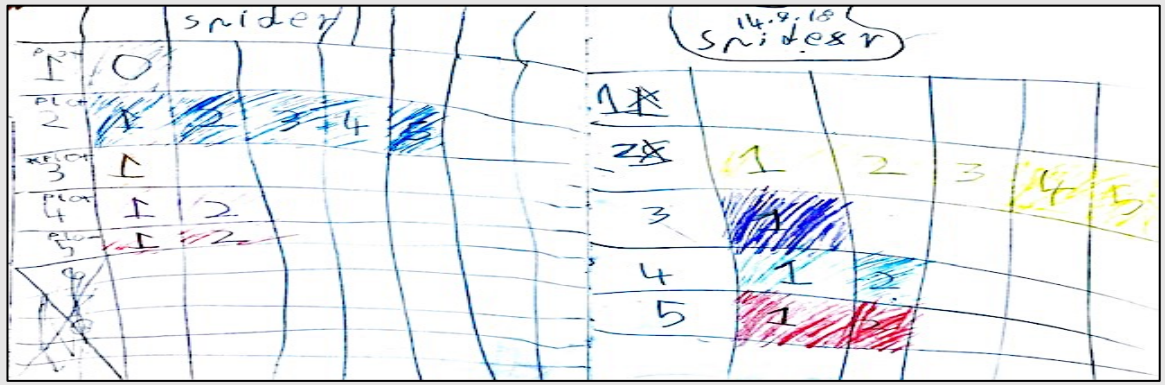
Example 2: Student vertical bar graphs comparing the distribution of different living things across the plots.



Example 3: Vertical bar graph representation of ants found in the different plots.



Example 4: Bar graph representing, and comparing, the number of Ants in all of the plots investigated. Student reasoning why there were more in Plot 5, making connections to needs, shelter.



Example 5: Bar chart representation of spiders found, with colour coding of the different plots

LESSON 6: Communicating the findings and making inferences– Sharing research and understanding

(Approximate duration: 60 minutes)

Curriculum focus:

Science ideas and practices

- Students review, sort and represent their observations and communicate their observations, findings with others
- Reinforce understanding and recognition of living things and non-living things
- Recognise that living things live in different places where their basic needs; including food, water and shelter

Mathematics ideas and practices

- Spatial mapping: Bird's-eye view mapping of where living things are located in the school grounds
- Identify patterns in the numerical data and the features of plots
- Data modelling to identify patterns in living things across habitats
- Mapping distribution of living things

Learning intention:

- Share, interpret and compare living things across plots and interpret differences in terms of the needs for survival.
- Analyse and compare different locations 'ecosystems' and findings to make connections with the needs and interactions of living things.

Equipment/Resources

Link to bird's-eye view map of school
(i.e. google maps)

A3 Print out of bird's-eye view of school grounds

Group Photos – from investigation (printed)
Student drawings and notes (previous lesson)

Display paper, cardboard, glue

Equipment required for all lessons
Students: student workbooks (unlined), pencils, colours and rulers

Teachers: Board (IWB/whiteboard), and or butchers' paper for shared recording and pens

Post Sequence Assessment Task (Appendix 2)

The lesson at a glance:

Students communicate their findings, sharing information across the classes. Students making inferences about the distribution of living things and connections between the where and why? Demonstrating the connection between diversity, distribution, habitat and the needs of living things.

LESSON 6: Communicating the findings and making inferences; sharing research and understanding

(Approximate duration 60 minutes)

Learning focus	Pedagogical stage	Lesson outline *(NB: time allocations a guide only)*	Monitoring and supporting learning
Science: Communicate observations and make inferences -Habitat Ecosystem Variation Diversity **Mathematics:** Student- generated data and location displays (graphs, bird's-eye view maps, diagram)	***Building Consensus*** Students refine and consolidate the representations and understanding in their own/group displays of findings, representation of chosen living things and locations (bar graphs, bird's-eye view maps, diagrams)	**Refining written reports "Did you know** (20-30 minutes) **Display - what lives where and why?** **Individuals/groups finalise their 'Did you know report'** Student chosen individual living things data and report, including diagrams and visual representations e.g. map, graphs etc. Consideration of patterns of living/interaction and behaviour within the schoolground.	What representation decisions do students make? Do students accurately share the number, range and location of their living things found across the plots? Do students recognise and report clearly patterns of living things, diversity and variation between the different plots.
Science: Present and communicate understanding and observations Diversity Variation Habitat Ecosystems **Mathematics:** Present and communicate findings tables column graphs labelled diagrams simple reports Attempt to explain why different areas(plots) yield different living things (sampling)	***Building consensus and applying conceptual understanding*** Students share their findings across the plots, considering variation and diversity (making connections with needs; shelter, food and interactions and location similarities/differences	**Sharing and Communicating Reports** (30+ minutes) **Living things in our Schoolyard "Did you know – Display"** Displays are shared across classes or within the class Displays demonstrate the distribution of animals/living things across habitats and reasons for variation. **Students/Groups present their displays/reports and contribute/add to the class Field Guide/Wall Display** **Probing Questions for reporting** ❖ *Why do you think your living things live where they do?* ❖ *How did the conditions of the area /habitat support them living there?* ❖ *Are there patterns in where they were found?* ❖ *Where else in the schoolgrounds (not already investigated) could they be found?* **Post Sequence Assessment Task (Appendix 2)**	What inferences and/or generalisations do students make about patterns; where, why and frequency of different living things in the school grounds? What justifications to students make for the variation in living things, diversity and conditions in different locations. What questions are raised for further investigation and/or deeper understanding? Do students make generalisations or raise questions about diversity and conservation? (extension and enrichment)

Samples of student work: Class displays

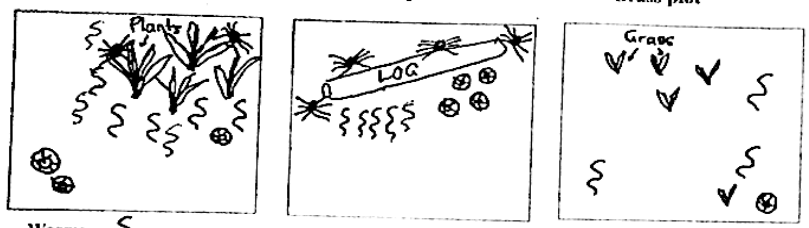
Examples of class combined reports - Group displays of plot data and findings including graphs, plan and bird's eye view maps and photos.

Examples of Year 1 Student Responses: Post Sequence Assessment Task

Investigating the schoolyard

A grade 1 class explore their schoolground looking for animals in different places.
Their drawings show where they found worms, spiders and slaters in three different plots.

Garden plot **Dry mulch plot** **Grass plot**

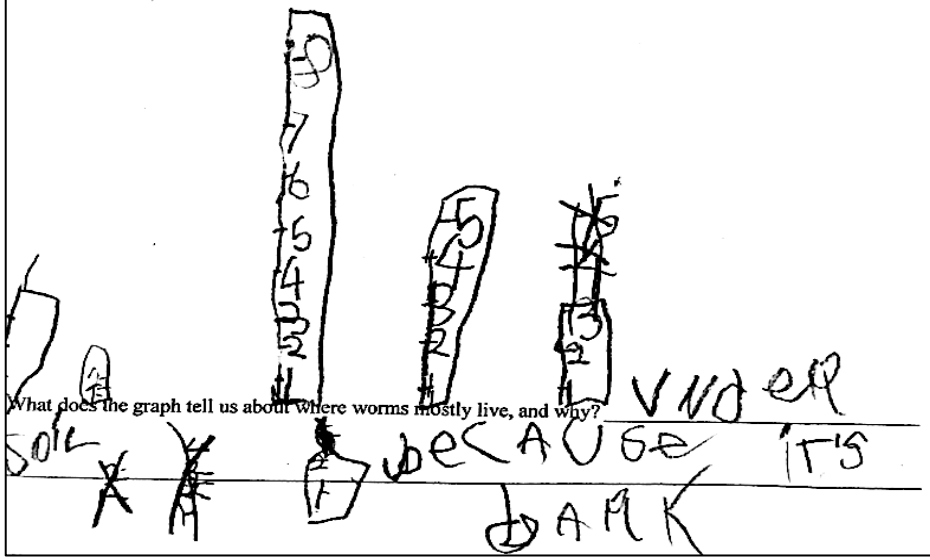


Worms
Spiders
Slaters

In which plot are most spiders found? DRY MULCH PLOT

Why do you think more spiders are found there? because there are 4 spiders in the PLOT

Draw a graph showing the worms in each plot.

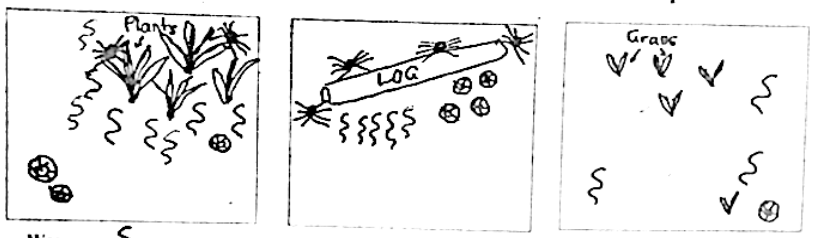


What does the graph tell us about where worms mostly live, and why? under soil because it's dark

Investigating the schoolyard

A grade 1 class explore their schoolground looking for animals in different places.
Their drawings show where they found worms, spiders and slaters in three different plots.

Garden plot **Dry mulch plot** **Grass plot**

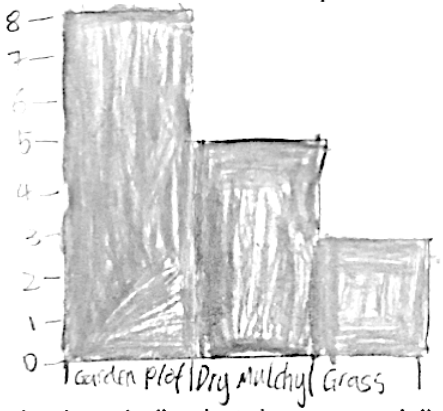


Worms
Spiders
Slaters

In which plot are most spiders found? Dry mulch plot

Why do you think more spiders are found there? Becase they're most webs in some logs.

Draw a graph showing the worms in each plot.



What does the graph tell us about where worms mostly live, and why? Most worms live in Graden plot Because there is Plants and Plants have soil.

Appendix 1

Teacher Notes

Criteria for Living Things - Differentiating living and non-living things

Movement – Living things change their position in their environment to obtain essential requirements such as water, air and food as well as to protect themselves, or locate a mate. Most animals are mobile and move their whole body from place to place (e.g. by swimming, walking or flying). Plants are slower and more limited in their movement. These movements can be subtle as in a flower moving to face the sun.

Reproduction – Living things create similar organisms to themselves to survive through time.

Sensitivity/Responsiveness – It is important that living things can sense and respond to changing factors in their environment. Information taken in through the senses is processed to provide a response, which helps it to survive. Plants sense and respond to light, water and gravity.

Growth – Over a period of time, living things make new cellular materials and become larger and more complex. Growth involves both an increase in size and repair of damaged parts. Damaged parts of both animals and plants can also be repaired by new growth. Living things use some of the energy released from their food for growing and food materials are incorporated into new parts or increased size.

Respiration/Breathing – In the cells of living things, respiration is the process by which energy is released from food. Oxygen is usually required to do this and carbon dioxide and water are produced. All living things carry out respiration all the time. If a living thing stops respiring it is no longer alive. Respiration should not be confused with breathing. The function of respiration is to release energy from food for use by the organism. ***This process usually requires oxygen, but not always***. Plants differ from animals by being able to produce their own food using it later as an energy source.

Élimination – Life functions create wastes that must be removed from the organism. All living things get rid of the waste materials produced from living processes. Both animals and plants give off carbon dioxide as a waste material from respiration. Plants give off waste oxygen from photosynthesis.
In humans, excreted material is contained in the liquid known as urine. Other waste products include carbon dioxide (removed via the lungs), excess salts and water (removed through the skin and the kidneys), and unused waste food (removed as feces). Excess heat is also continuously lost from the body through the skin.

Nutrition/ Food – In all living things, there is a continual need for the nutrients that are required for growth as well as energy. Plants make their food from carbon dioxide and water, using energy from sunlight, in the process known as photosynthesis. Animals get their food by eating plants or other animals.

Adapt – Living things have the ability to adapt to their environment.

Cells – All living things have cells.

Criteria of living things: Alternate Conceptions

Students often have difficulty characterising things as living or non-living.
They may describe anything that moves as alive. They also may not understand the cycle of life (birth, growth, death) and may therefore classify as non-living anything that has died.

Remind students that:

- in science a '**living thing" is different from 'alive'.**
  Living thing is used to describe anything that **is** or **has ever been alive**
  (e.g. dog, flower, seed or a log)

- **non-living** is used to describe anything that **is not now** nor **has ever been alive** (e.g. rock, mountain, glass, watch)

- all living things grow, breathe, reproduce, excrete, respond to stimuli, and have similar basic needs like nourishment.

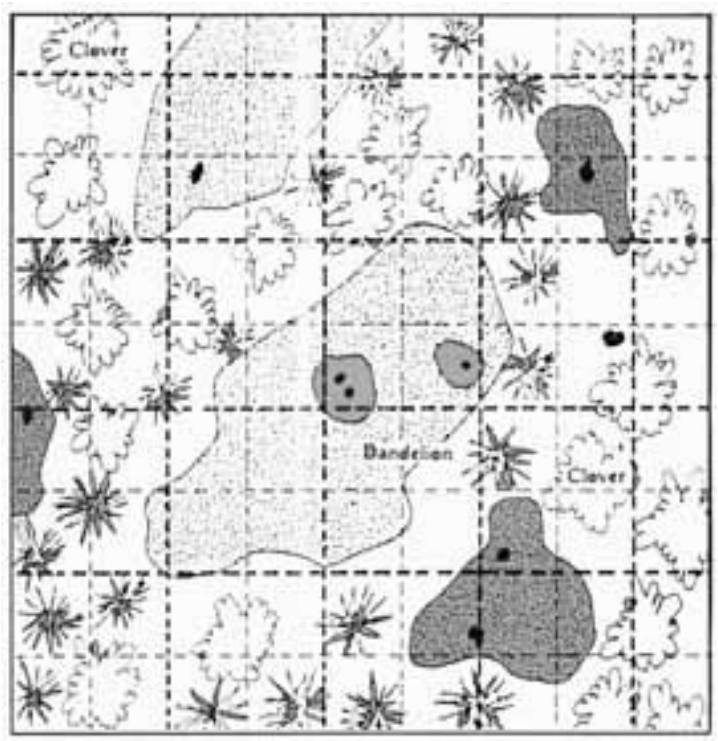
- Humans (and many other animals) breathing is the way in which we get air into and out of our lungs, and so get oxygen into the body and remove carbon dioxide. (Many bacteria also do not require oxygen). Students may say that plants 'breath' however they do not 'breath' as humans do (i.e. respiration -taken in carbon dioxide and release oxygen).

- Students often believe that cars are a 'living thing' as they move. However, they don't demonstrate or exhibit the other characteristics of living things (e.g. grow, reproduce, and respond to stimuli). Students may argue they do get nourishment and energy (petrol) and they do respond to stimuli)

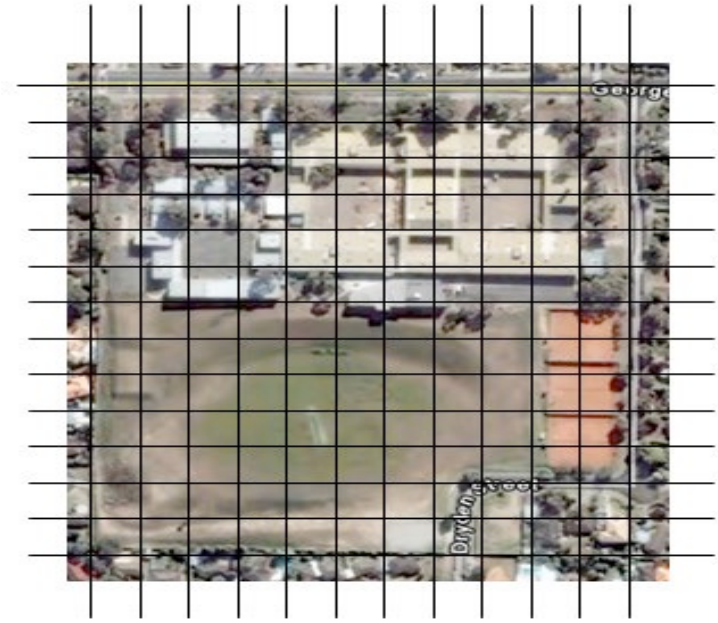
- **Fire is not a living thing**. It does move, grows, requires oxygen and produce more fires; however, it does not pass on DNA/genetic information to offspring, reproduce. It is a form of energy. It does not have cells or a measurable mass/weight.

This list of information is adopted from Australian Science Teachers Association, Education Services Australia 2013)

Living things in the schoolground: What are they? Where do they live? Mapping the schoolground and Investigation Preparation



Aerial view and representations of mapping with quadrants/grids and scaffolding



Images from https://ypte.org.uk/factsheets/using-a-quadrant/placing-the-quadrant-in-position

Appendix 2

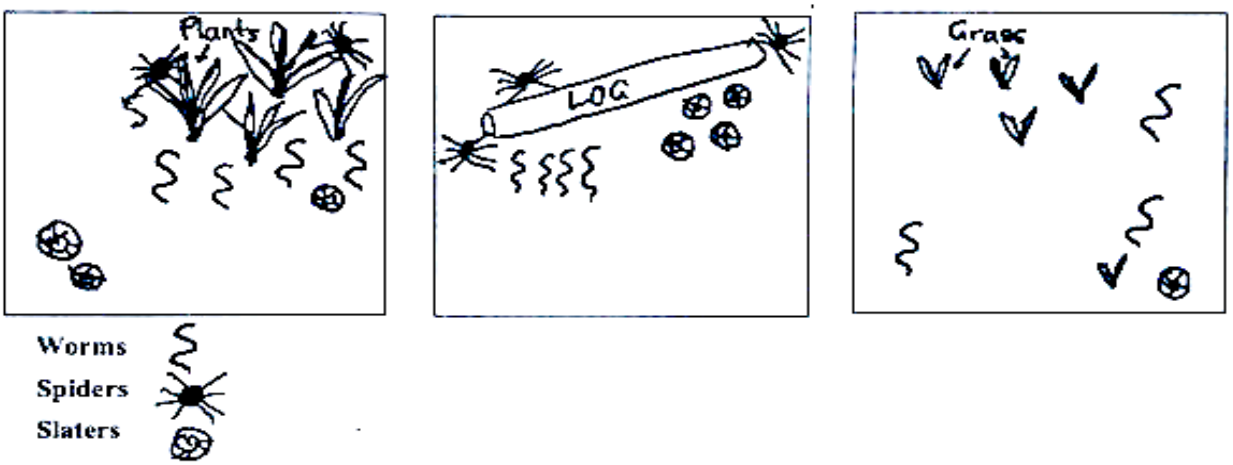
Post Sequence Assessment Task

Investigating the schoolyard **Name:**_____

A grade 1 class explore their schoolground looking for animals in different places.

Their drawings show where they found worms, spiders and slaters in three different plots.

Garden plot **Dry mulch plot** **Grass plot**



In which plot are most spiders found?

_____

Why do you think more spiders are found there?

_____

_____

Draw a graph showing the worms in each plot.

What does the graph tell us about where worms mostly live, and why?

_____