STEM

Creating nesting boxes

Levels 3–4



**Disclaimer:** It is the responsibility of the school to ensure that duty of care is exercised in relation to the health and safety of all students undertaking activities. In this unit of work, particular consideration should be given to ensuring adequate supervision of any students working with tools.

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Overview

**Unit of work:** Creating nesting boxes

**Levels:** 3–4

 This learning sequence focuses on Level 4.

**Approximate time:** 8 × 1 hour sessions

Native birds and mammals need hollows in old trees for nesting. Environmental loss reduces the number of nesting holes for these animals, leading to increased competition for nesting holes and a decrease in the population of individual species. In extreme situations, this may lead to species becoming endangered or extinct.

What can we do to address this problem?

**What makes this unit have a STEM focus?**

This unit of work incorporates content from:

* *Science* – Science Understanding, Biological sciences
* *Design and Technologies* – Creating Designed Solutions
* *Mathematics* – Measurement and Geometry, Using units of measurement.

This learning sequence builds on the assumption that students have been explicitly taught the Science Inquiry Skills and can apply their understandings.

**Advice and considerations:**

* This unit of work could be expanded to discuss broader ecological issues related to development by humans in wildlife corridors.
* If it is not possible to create and install timber nesting boxes, students could focus on creating prototypes (for example, out of cardboard) to be pitched to a ‘client’.
* Consider using parents or local partners to prepare timber where possible and where appropriate.

|  |  |  |  |
| --- | --- | --- | --- |
| **Learning Area** | **Design and Technologies**  | **Science** | **Mathematics** |
| **Levels**  | 3–4 | 3–4 | 4 |
| **Strand** | Technologies Contexts | Creating Designed Solutions | Science Understanding | Measurement and Geometry |
| **Sub-strand** | Materials and technologies specialisations | Investigating Producing Evaluating Planning and managing  | Biological sciences | Using units of measurement |
| **Content Descriptions** | Investigate the suitability of materials, systems, components, tools and equipment for a range of purposes [(VCDSTC027)](http://victoriancurriculum.vcaa.vic.edu.au/Curriculum/ContentDescription/VCDSTC027) | Critique needs or opportunities for designing and explore and test a variety of materials, components, tools and equipment and the techniques needed to create designed solutions ([VCDSCD028](http://victoriancurriculum.vcaa.vic.edu.au/Curriculum/ContentDescription/VCDSCD028))Select and use materials, components, tools and equipment using safe work practices to produce designed solutions ([VCDSCD030](http://victoriancurriculum.vcaa.vic.edu.au/Curriculum/ContentDescription/VCDSCD030))Evaluate design ideas, processes and solutions based on criteria for success developed with guidance and including care for the environment and communities ([VCDSCD031](http://victoriancurriculum.vcaa.vic.edu.au/Curriculum/ContentDescription/VCDSCD031))Plan a sequence of production steps when making designed solutions ([VCDSCD032](http://victoriancurriculum.vcaa.vic.edu.au/Curriculum/ContentDescription/VCDSCD032)) | Different living things have different life cycles and depend on each other and the environment to survive [(VCSSU058)](http://victoriancurriculum.vcaa.vic.edu.au/Curriculum/ContentDescription/VCSSU058)  | Use scaled instruments to measure and compare lengths, masses, capacities and temperatures [(VCMMG165)](http://victoriancurriculum.vcaa.vic.edu.au/Curriculum/ContentDescription/VCMMG165)  |
| **Achievement Standards***The extracts identify the parts of the Achievement Standards addressed in this learning sequence* | Students … explain needs or opportunities and evaluate ideas and designed solutions against identified criteria for success, including sustainability considerations … Students plan and sequence major steps in design and production. They identify appropriate technologies and techniques and demonstrate safe work practices when creating designed solutions.  | Students ... describe relationships that assist the survival of living things. They … relate life cycles to growth and survival. | Students use scaled instruments to measure length, angle, area, mass, capacity and temperature of shapes and objects. |

Equipment and resources

The equipment and resources required may vary depending on the design options selected.

* timber (hardwood, >15 mm thickness), ideally recycled (Note: Treated pine is not suitable.)
* cardboard
* plastics, such as ice-cream containers, milk bottles or juice bottles
* saw(s), hole saws
* nails and screws
* glue
* hammers
* screwdrivers
* measuring tools
* drill and drill bits
* leaves and branches
* suggested criteria for success ([Appendix 1](#Appendix1))
* student planning template ([Appendix 2](#Appendix2))
* assessment rubric and probing questions ([Appendix 3](#Appendix3))
* student self-evaluation template ([Appendix 4](#Appendix4))
* package of curated resources/information for teachers and students on life cycles, habitats, habitat loss and nesting boxes ([FUSE resource package FH227K – http://fuse.education.vic.gov.au/?FH227K](http://fuse.education.vic.gov.au/?FH227K))
* nesting box student presentation slides template, with prompt questions and instructions ([FUSE resource package 8JSD44 – http://fuse.education.vic.gov.au/?8JSD44](http://fuse.education.vic.gov.au/?8JSD44))

Preparation

Before starting the unit of work:

* source hardwood timber, greater than 15 mm thickness, if wooden boxes are going to be developed
* print copies of the suggested criteria for success ([Appendix 1](#Appendix1)), the student planning template ([Appendix 2](#Appendix2)) and the student self-evaluation template ([Appendix 4](#Appendix4))
* examine the information and resources provided in the [FUSE resource package FH227K](https://fuse.education.vic.gov.au/ResourcePackage/ByPin?pin=FH227K) to be used for student research
* source and prepare example designs for specific local or regional species (see additional resources below for examples).

Occupational Health and Safety

Teachers should be familiar with the Victorian Department of Education and Training [Risk Management](http://www.education.vic.gov.au/school/principals/spag/governance/pages/risk.aspx) policy and references that provide resources to assist in identifying and mitigating against risk in schools.

In this activity, particular consideration should be given to:

* supervision of students using hammers, saws, nails or screws
* risk of injury due to splinters from timber.

Key concepts and vocabulary

**Animal:** A living thing that can move around and react to stimuli

**Characteristic:** An attribute of a material, usually detected using human senses, such as its texture or colour; for example, the characteristics of corrugated cardboard can be detected by sight and touch

**Criteria for success:** A list of requirements that can be used to determine/judge the success of a designed solution

**Design:** Plan something with a specific purpose in mind

**Environment:** All the surroundings in a location, including living and non-living things

**Environment to thrive:** The environment that an animal (or other living thing) lives in that provides what it needs to survive and reproduce

**Evaluate:** Decide how well a solution meets the criteria for success

**Life cycle:** The series of events and changes an animal (or other living thing) passes through in its life

**Measure:** Find the size of an object or the amount of something

**Nesting box:** An artificial structure provided to an animal for shelter and rearing young

**Solution:** A way to address a problem, need, situation or challenge

Learning sequence

## Session 1

**Learning intention:**

We will understand the life cycles and nesting sites of different animals, such as mammals and birds.

**Success criteria:**

I can identify the stages of an animal's life cycle and what kind of nest it prefers.

* Begin by asking students how animals begin their lives, diagnosing their current understanding of life cycles. Document their ideas either on a whiteboard or in a class journal (for example, in a hard-copy class journal or in a class blog using software such as [Global2](http://global2.vic.edu.au/) or [Padlet](https://padlet.com/)).
* Introduce the term ‘life cycle’ and discuss with students what it might mean, discussing ‘life’ and ‘cycle’ separately as needed.
* Provide students examples of different life cycles of native animals, including mammals, birds and fish. Discuss the progression/stages they can see. Identify similarities and differences.
* Ask students what they think an animal would need to support its young and introduce the idea of a nesting hollow. Explain to students that nesting hollows form naturally over time, taking up to 100 years to form. Show students examples for different species and discuss with them the key features of each.
* Ensure students understand the key point that many Australian animals (300 or more species) depend on nesting hollows for shelter and breeding and that this is a key relationship in their life cycle.

##

## Session 2

**Learning intention:**

We will understand how loss of environments and nesting sites can affect Australian animals.

**Success criteria:**

I can discuss why changes in environments might affect an animal’s nesting site.

* Review Session 1 by reminding students of life cycles and the need for nesting hollows to raise young/babies.
* Ask students to name five things in their home or bedroom that they think they need to survive. Ask them to imagine trying to manage/live without one or more of those things.
* Introduce the definition of the term ‘environment to thrive’ to students and discuss examples such as the greater bilby’s desert environment and the orangutan’s rainforest environment. Use visuals to support the discussion (see [FUSE resource package FH227K](https://fuse.education.vic.gov.au/ResourcePackage/ByPin?pin=FH227K)). Help students identify why an animal might need a certain environment to thrive.
* Ask students what they think might happen to an animal if it lost its environment. Make the link to what might happen to them if they lost their bedroom.
* To stimulate discussion, show students examples of loss of environments in Australia due to land clearing for buildings and roads. Focus on local examples where possible.
* Provide students with examples of Australian species that have been affected by environmental loss, for example, Leadbeater’s possum. Provide resources or research time for students to explore how the environment was (or is) being lost and the consequences on particular animal species.
* Frame a question similar to ‘How can we help animals that have lost their nesting hollows?’ Ask students to brainstorm possible solutions to this problem. Record these solutions in a class journal for reference in later sessions.

##

## Session 3

**Learning intention:**

We will understand the requirements for our nesting box project.

**Success criteria**:

I can explain what we are trying to achieve and what we can and can’t do when making our nesting boxes.

* Review previous sessions by revising the term ‘environment to thrive’, as well as the loss of environments and the consequences of this.
* Explain to students that we will be trying to solve the problem of animals losing their environment/places to nest.
* Return to the student brainstorming from Session 2*.* If students have identified building a nesting box (or similar), highlight this and explain that they will be designing their own box for one specific species. If not, support students in making this suggestion.
* Display the suggested criteria for success for students (see [Appendix 1](#Appendix1)). Guide students through the criteria and key points for making their nesting boxes.
* Allow students to ask any clarifying questions they have about the design criteria and constraints in general.
* Record key ideas/wonderings for the challenge (for example, in a class journal).

## Session 4

**Learning intention:**

We will be able to identify how different nesting box designs suit different animals, and we will choose a design and create a plan to build it.

**Success criteria:**

I can identify key features of a nesting box for a certain species.

I can make a plan of the key steps we will need to follow to build our design.

* Remind students of the criteria for success for the challenge from Session 3 and display the criteria around the classroom.
* Explain to students that today they will be researching and creating possible designs in small teams and selecting their team’s preferred option. They will also be making a plan of the steps they will need to follow to make their preferred nesting box option.
* Explain to students that two key parts of solving a problem are breaking the problem into smaller parts and then thinking about the steps you will need to follow to do each part. Explain that today the students will be practising these skills.
* Provide students with examples of nesting boxes for different native mammal and bird species, with a focus on those that have experienced loss of environment, or allow research time.
* Discuss with students what they notice about the boxes, looking for similarities and differences. Ask students why the nesting boxes may be different sometimes.
* Direct students (in small teams) to choose a species of animal that they would like to help with a nesting box.
* Each student can work to design their team’s nesting box based on their animal’s features, or they could follow a provided design if more support is needed.
* Provide one planning template ([Appendix 2](#Appendix2)) for each team, and then ask each team to determine which nesting box design they prefer. Support students to outline a broad plan of the stages for building their team’s preferred design option, including identifying key design features and materials needed Students can begin sketching or drawing ideas of the team’s preferred option at this time.

## Session 5

**Learning intention:**

We will be able to choose and test materials and use scaled tools to accurately measure materials from our team’s design.

**Success criteria for students:**

I can decide which materials are best suited to my team’s design.

I can use scaled tools to accurately measure characteristics of materials.

* Revise Session 4 with students, reminding them of the need to break down a problem/challenge and make a plan to solve it.
* Ask students if all the nesting boxes should be the same size, and ask for reasons why or why not. Discuss with students different methods for finding out the size of objects or parts of their nesting box.
* Provide various tools for students to explore. Explain to students that using specific measuring tools such as rulers, tape measures and measuring scales lets us know exactly how long, wide or heavy things are.
* Explicitly teach students to start all measurements from zero. Teach them to line up a ruler or tape measure and count along the scale of the tool to find the measurement.
* Allow time for students to explore the various tools provided.
* Ask students what they think their nesting box could be made out of. Encourage students to consider the needs of the animal, such as warmth and space, and the effects of weather. Students can research this as needed or be provided with information. Support students to develop workable solutions as needed.
* Ask students to identify what units of measurements would be appropriate for measuring materials for their nesting box.
* Ask students to measure out specific sizes of their suggested materials (for example, wood, cardboard, plastic) and then cut out the materials and test their suitability. Discuss with students whether they think these materials would be suitable or not. Explain to students that this is part of the process of ‘prototyping’ and evaluating in design. Explain that evaluating is deciding how well a solution works or solves a problem or how suited something is to a task. There is an opportunity to assess students’ use of scaled instruments here.
* Direct students to include suggested materials in their planning template, along with a detailed sketch of their design.

## Session 6

**Learning intention:**

We will be able to use our plan to build a nesting box.

**Success criteria:**

I can follow our plan to create a nesting box.

* Revise Session 5 by reminding students of methods and tools for measuring the size of objects/materials. Explain that they will be continuing to practise this skill today, as they build.
* Direct students to review their plan and identify what stage they are at. Ask students to identify what they need to do next. Explain they need to be sure about how they will make their box before they start. Support all teams to be ready to start constructing their nesting boxes.
* Provide students with equipment and tools to construct their nesting boxes.
* Discuss safety precautions for equipment, materials and tools. Explicitly show students how to safely use each tool and explore the possible hazards when using each tool. It may be useful to have additional staff or supervision to assist groups during construction.
* Store nesting boxes in a safe place in the classroom.

## Session 7

**Learning intention:**

We will be able to use criteria to evaluate our nesting box designs.

**Success criteria:**

I can use provided criteria to measure success.

* Remind students of the meaning of ‘evaluate’. Explain that to evaluate is to decide how successful or effective their work is.
* Explain to students that they will be using thecriteria for success from Session 3to decide how successful their nesting box design and build is.
* Provide students with a self-assessment checklist to assess their own work ([Appendix 4](#Appendix4)).
* Step students through how to evaluate their designs using the template provided.
* Allow students time to assess and evaluate their designs, completing the checklist.
* Monitor and support groups as needed.
* Ask students to share their evaluations with the class or another team.

## Session 8

**Learning intention:**

We will be able to communicate to others our designs and work.

**Success criteria:**

I can explain the process we followed in making our nesting box.

I can explain the key features of our nesting box.

* Explain to students that to finish their challenge they will be communicating/
demonstrating their final products and what they have learnt throughout the challenge. Students should create some form of communication piece (ideally multi-modal) that explains their aim, design and evaluation, as well as what they have learnt about Science, Mathematics, and Design and Technologies along the way.
* Explain to students that they will be making a three- to four-minute piece in a format of their choosing. Alternatively, the teacher could choose a format based on student need. Google Slides and PowerPoint are useful tools, as it is easy to incorporate multi-modal texts in them. Teachers could provide students with the nesting box student presentation slides template ([FUSE resource package 8JSD44](https://fuse.education.vic.gov.au/Resource/ByPin?pin=8JSD44)) to support students, as needed.
* Discuss with students different possible ways to communicate information, using examples such as a presentation, podcast or class talk. Guide students to identify features of these formats.
* Provide resources such as paper and digital devices such as iPads or laptops, and provide time for students to create their communication piece.
* Ask all students to present their piece to the class. This process could be as informal (quick presentations to the class) or formal (parent expo) as desired.

Assessment strategies

* Developmental rubric for all strands explicitly taught and suggested probing questions ([Appendix 3](#Appendix3))
* Student self-evaluation ([Appendix 4](#Appendix4)), related to the criteria for success

Additional resources

**Resource and owner:** [Nest boxes for local wildlife (PDF, 235MB)](http://www.actwild.org.au/wp-content/uploads/2011/06/nestbox_guide.pdf), Zoos Victoria:
Act Wild

**Description:** Basic instructions for construction and installation of nesting boxes for native animals. Includes suggested dimensions and placement.

**Resource and owner:** [Nest boxes for native birds (PDF, 520MB)](http://www.birdlife.org.au/images/uploads/education_sheets/INFO-Nestboxes-nativebirds.pdf), BirdLife Australia

**Description:** Background information on nesting boxes for native Australian birds, including potential challenges.

Appendix 1: Suggested criteria for success

* Design of nesting box must be tailored to a specific species and
stage of the life cycle.
	+ Evidence shown in design features, size and materials used.
* Nesting box must keep the animal fully dry and protected from
the weather.
* Nesting box must have three small (10 mm) drainage holes.
* Nesting box must be made from material(s) appropriate for the
chosen species.
* Design must include a way for the nesting box to be attached
to a tree.

Appendix 2: Student planning template

**Planning how to build the nesting box**

|  |
| --- |
| What is the problem we are trying to solve? |
|  |
| Why is this a problem that needs to be solved? |
|  |

|  |
| --- |
| What are the **big stages** we will need to work through to make our nesting box?*For example: We will need to draw a clear design ...***Stage 1:****Stage 2:****Stage 3:****Stage 4:** |

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| For each stage, what are the smaller steps we will need to complete?

|  |  |
| --- | --- |
| **Stage 1** | **Stage 2** |
| Step 1:Step 2:Step 3: | Step 1:Step 2:Step 3: |
| **Stage 3** | **Stage 4** |
| Step 1:Step 2:Step 3: | Step 1:Step 2:Step 3: |

Tick these off as you finish them. |
| **Nesting box design** |
| **Key design features** | **Materials needed** |

Appendix 3: Assessment rubric and probing questions

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Learning area** | **Sub-strand** | **Working towards Level 4** | **Level 4** | **Exceeding Level 4** |
| **Science – Science Understanding** | **Biological sciences** | No evidence | I can identify what a nesting box is for | I can discuss if a nesting box is suitable for a certain animal | I can describe where in an animal’s life cycle a nesting box is needed | I can explain why an animal needs a nesting box with specific features |
| **Design and Technologies – Creating Designed Solutions** | **Investigating** | No evidence | I can distinguish between solutions and problems | I can explore a provided solution | I can list potential solutions to a problem | I can compare different solutions to a problem |
| **Producing** | No evidence |  | I can use provided tools safely when supported | I can follow safety rules and procedures for provided tools | I can explain the reason for having and following safety rules and procedures |
| **Evaluating** | No evidence | I can decide if I am finished or not | I can decide if my solution fits the aim of the challenge | I can use provided criteria to measure success | I can choose appropriate criteria to measure success from a range of options |
| **Planning and managing** | No evidence |  | I can follow a provided plan | I can list the steps I need to follow to complete my project | I can create a plan that includes the resources and processes that I will use |
| **Mathematics – Measurement and Geometry** | **Using scaled instruments** | No evidence | I can make measurements using informal units | I can compare and order materials based on their size | I can use scaled tools to accurately measure materials | I can use tools and calculations to find the area and/or volume of the nesting box |

|  |  |  |
| --- | --- | --- |
| **Learning area** | **Sub-strand** | **Suggested probing questions** |
| **Science – Science Understanding** | **Biological sciences** | What is a nesting box?What is environmental loss?Why does loss of environment affect native animals? | What is a life cycle?Why might an animal need a nesting box?Why does [animal] need [feature] in their nesting box? |
| **Design and Technologies – Creating Designed Solutions** | **Investigating** | Is this a problem or solution?Can you compare [solution A] with [solution B]? | What are different ways that we could solve this problem? |
| **Producing** | What are the safety rules when using \_\_\_\_\_? | Why do we need [rule] when using [item]? |
| **Evaluating** | Are you finished?How closely does your nesting box match the design brief?How could you improve your design? | How well does your design meet your aims?What are the strengths and weaknesses of your design? |
| **Planning and managing** | What steps will you need to follow? Why?What will you need to do to complete your plan? | How did you break down the problem? |
| **Mathematics –Measurement and Geometry** | **Using scaled instruments** | Can you show me how to use the ruler?How do you know how big \_\_\_\_ is? | Can you order these pieces/items by size?How would you work out the area or volume of your nesting box? |

Appendix 4: Student self-evaluation

Answer these questions about how well your group completed the challenge and the nesting box you produced.

|  |  |
| --- | --- |
| **Question** | **Answer** |
| Did your group finish your nesting box in time? If not, why not? |  |
| Did your group make a plan for the project? |  |
| Did your group follow your plan for the project? If your group did not follow your plan, why not? If they did, what helped them to do this? |  |
| Did your group finish your nesting box in the time allocated? If not, why not? |  |
| Did your group follow all safety rules? |  |
| How well did your group work together? | [ ] Needs lots of improvement[ ] Needs some improvement[ ] OK[ ] Well[ ] Really well |
| Why did you choose this rating? |  |
| Did your nesting box meet all of the criteria for success? If not, which ones were not met and why were they not met? |  |
| How did you judge if the nesting box is suitable for your species and if it would keep the animal fully dry and protected? |  |
| How could your nesting box be improved next time? |  |