STEM

Creating nesting boxes

Levels 3–4



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# Overview

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| --- | --- | --- |
| **Unit title:** Creating nesting boxes | **Level:** 3-4 This learning sequence focuses on Level 4. | **Time:** 8 x 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 holes and decreases in species numbers. 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?***Design and Technologies** Strand: Creating Designed Solutions

*Science* * Strand: Science Understanding (using Biological sciences content descriptions)

*Mathematics** Strand: Measurement and Geometry Sub-strand: 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 could be expanded to discuss broader ecological issues related to development by humans in wildlife corridors.**Practical considerations:**This project could be adapted to be delivered as a prototype design process to pitch to a client. Teachers are advised that it may not possible to create and install timber nesting boxes and it may be easier to focus on creating prototypes out of cardboard.Teachers may also consider using parents/local partners to prepare timber where possible and appropriate. |

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| **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)Select and use materials, components, tools and equipment using safe work practices to produce designed solutions(VCDSCD030)Evaluate design ideas, processes and solutions based on criteria for success developed with guidance and including care for the environment and communities(VCDSCD031)Plan a sequence of production steps when making designed solutions(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 considerationsStudents 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 compare the key stages in the life cycle of a plant and an animal and 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

Equipment and resources may vary depending on preferred design options selected.

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| **Equipment** | **Resources** |
| * Timber (hardwood, >15 mm thickness), ideally recycled (Note: treated pine is not suitable.)
* Saw/s, hole saws
* Nails and screws
* Glue
* Hammers
* Screwdrivers
* Measuring tools
* Drill and drill bits
* Leaves and branches
 | * Design criteria for success (Appendix 1)
* Student planning template (Appendix 2)
* Assessment rubric (Appendix 3)
* Self-evaluation checklist (Appendix 4)
* [FUSE resource FH227K](http://fuse.education.vic.gov.au/?FH227K) package of curated resources/information on lifecycles, habitats, habitat loss and nesting boxes for teachers and students
* Nesting box student presentation slides template with prompting questions/instructions ([FUSE resource package 8JSD44](http://fuse.education.vic.gov.au/?8JSD44))
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##

## Teacher instructions

Before the project, source and prepare the following resources:

* hardwood timber, minimum 15 mm thickness.
* print copies of Criteria for success (Appendix 1), student planning template (Appendix 2) and self-assessment (Appendix 4)
* examine instructional resources provided in the FUSE resource package FH227K to be used for student research
* 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 tools and links to resources that assist in identifying and mitigating against risk in schools.

In this activity, particular consideration should be given to the following:

* supervision of students using hammers, saws and 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

**Criteria for success:** List of requirements to determine success of solution

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

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

**Environment to thrive:** The location of an animal (or other living thing) lives in and provides what they need to survive

**Life cycle:** The series of events and changes an animal 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

# Additional resources/References

|  |  |  |
| --- | --- | --- |
| **Resource/*owner*** | **URL** | **Description** |
| Nesting boxes for local wildlife*Zoos Victoria: Act Wild* | <http://www.actwild.org.au/wp-content/uploads/2011/06/nestbox_guide.pdf>  | Basic instructions for construction and installation of nesting boxes for native animals. Includes suggested dimensions and installation positions |
| Nest boxes for native birds*birdlife Australia* | <http://www.birdlife.org.au/images/uploads/education_sheets/INFO-Nestboxes-nativebirds.pdf>  | Background information on nesting boxes for native Australian birds, including potential challenges. |

# Learning sequence

## Session 1

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| **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 |

### Activity

* 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 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 and 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 these 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.

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| ***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.*** |

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## Session 2

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| **Learning intention**: We will understand how loss of habitat and nesting sites can affect Australian animals | **Success criteria**: I can discuss why changes in habitat might affect an animal’s nesting site |

### Activity

* Review session one by reminding students of life cycles and the need for nesting hollows to raise young/babies.
* Ask students to think of five things in their home or room 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 ‘environments to thrive’ to students and discuss examples such as deserts, forest, urban, underwater. *Use visuals to support the discussion.* 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 room.

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| ***To stimulate discussion, show students examples of loss of environments in Australia due to land clearing, buildings/roads. Focus on local examples where possible.*** |

* Provide students with examples of Australian species that have been affected by environmental loss, for example the Leadbeater’s possum. Provide resources or research time for students to explore how the environment was (or is being) lost and the consequences on the animal.
* 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.

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| ***Record these in a class journal for reference in later sessions.*** |

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## Session 3

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| **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/can’t do when making our nesting boxes |

### Activity

* Review previous sessions by revising the term ‘environment to thrive’ and loss of environment and consequences.
* Explain to students that we will be trying to solve the problem of animals losing their environment/places to nest.
* Return to student brainstorming from session two*.*

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| ***If students have identified building a nesting box (or similar) highlight this and explain that they will be designing their own box for a chosen species. If not, support students in making this suggestion.*** |

* Display criteria for success for students. Guide students through criteria and key points for making their nesting boxes (Refer to Appendix 2).
* 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

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| **Learning intention:** We will be able to identify how different nesting box designs suit different animals, 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. |

### Activity

* Remind students of success criteria for the challenge from session three and display around the classroom.
* Explain to students that today they will be researching and creating possible designs and selecting a preferred option. They will also be making a plan of the steps they will need to follow to make their preferred option for a nesting box.
* Explain to students that two key parts of solving a problem are to break the problem into smaller parts and then think about the steps you will need to follow to do each part. Explain that today we will be practising these skills.

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| ***Provide students with examples (or allow research time) of nesting boxes for different native mammal and bird species, with a focus on those which have experienced loss of environment.***  |

* 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.
* Students can work to design their own nesting box based on their animal’s features or follow a provided design where more support is needed.

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| ***Provide teams with planning template (Appendix 2) and support students to outline a broad plan of the stages for building their preferred design option. Students can begin sketching/drawing ideas at this time.*** |

## Session 5

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| **Learning intention:** We will be able to choose and test materials and use tools to accurately measure materials from our designs | **Success criteria for students:** I can decide which materials are best suited to my design I can use scaled tools to accurately measure basic properties of materials |

### Activity

* Revise session four 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, including reasons why. Discuss with students different methods for finding out the size of objects/parts of their nesting box.
* Explain to students that using specific measuring tools, such as rulers, tape measures and scales lets us know exactly how long, wide or heavy things are.

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| ***Explicitly teach students to start measurements from zero, lining up the tool and to 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, space, etc. and the effects of weather. Students can research this as needed or be provided with information.

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| ***Support students to develop workable solutions as needed.*** |

* Ask students to identify what units of measurements would be appropriate.
* Ask students to measure out specific sizes of their suggested materials (for example, wood, cardboard, plastic) and cut out to test their properties and suitability. Discuss with students if they think this material 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.
* Direct students to include suggested materials in their planning template, along with a careful sketch of their design

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| ***There is a potential opportunity to assess use of scaled instruments.*** |

## Session 6

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| **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 |

### Activity

* 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.

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| ***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 as needed for equipment, materials and tools

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| ***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 assisting groups during construction where possible.*** |

* Store nesting boxes in a safe place in the classroom.

## Session 7

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| **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 |

### Activity

* Remind students of the meaning of ‘evaluate’.
* Explain that to evaluate is to decide how successful or effective your work was.
* Explain to students that they will be using the *criteria for success* to decide how successful their nesting box design and build was (based on the initial instructions).

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| ***Provide students with template to assess their work (Appendix 4).******Step students through how to evaluate their designs/use the template provided.******Allow students time to assess and evaluate their designs, completing checklist/template. Monitor and support groups as needed.*** |

* Ask students to share their evaluations with the class/another group.

## Session 8

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| **Learning intention:** We will be able to communicate our designs and work to others | **Success criteria for students:** I can explain the process we followed in making our nesting box I can explain the key features of our nesting box |

### Activity

* Explain to students that to finish their challenge, they will be communicating/demonstrating their final products and what they have learned throughout the challenge.

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| ***Students should be creating some form of communication piece (ideally multi-modal) that explains their aim, their design and evaluation, as well as what they have learned about Science, Maths 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, teacher could choose a format dependent on student need. Google Slides/PowerPoint is a useful tool as it is easy to incorporate multi-modal texts).

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| ***Teachers could provide students with Nesting box student presentation slides template to support students as needed.*** |

* Discuss possible ways to communicate information with students, using examples such as, a presentation, podcast, talk, etc. Guide students to identify features of these formats.
* Provide resources such as paper, digital devices such as iPads or laptop etc. and time for students to create their communication piece.

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| ***Ask all students to present their piece to the class. This process could be as informal (a quick presentation to the class) or formal (for example, parent expo) as desired.*** |

# Assessment strategies

* Use of developmental rubric for all strands explicitly taught and suggested probing questions (see below)
* Student self-assessment/evaluation (related to criteria for success)

# Appendix 1: Suggested success criteria

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

# Appendix 2: Student planning template

**Nesting box plan**

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

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| 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...*1. **Stage 1:**
2. **Stage 2:**
3. **Stage 3:**
4. **Stage 4:**
 |

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

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| --- | --- |
| **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

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| --- | --- | --- | --- | --- |
| **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 Technology –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 basic properties of materials | I can use tools and calculations to find the area and/or volume of our nesting box |

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| **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 [Sol. A] with [Sol. 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 each question to decide how well your group completed the nesting box challenge

|  |  |
| --- | --- |
| **Question** | **Answer** |
| Did your group finish your nesting box in time? | [ ] **Yes/**[ ] **No** |
| Did your nesting box meet all of the criteria for success? | [ ] **Yes/**[ ] **No** |
| How do you know if you met the criteria or not? |  |
| Did your group **make a plan** for the project? | [ ] **Yes/**[ ] **No** |
| Did your group **follow your plan** for the project? | [ ] **Yes/**[ ] **No** |
| Why or why not? |  |
| Did your group follow all safety rules? | [ ] **Yes/**[ ] **No** |
| How well did your group work together? | [ ] Needs lots of improvement[ ] Needs some improvement[ ] Ok[ ] Well[ ] Really well |
| Why did you choose this rating? |  |
| How could your nesting box be improved for next time? |  |