

## Science and Technology Stage 3 & Stage 4 Learning Sequence

### How can we promote natural behaviour in zoo-based animals?

#### Learning sequence description

Students will be defining the problem they are trying to solve and then identify the species that they will be designing enrichment for. They will then research the selected species to build a deeper understanding of their natural behaviours and physiology when developing their enrichment. Undertaking further research about the animals, their adaptations and existing enrichment designs before designing a device will support students in creating an innovation and original idea that will encourage natural behaviour and enhance mental and physical behaviour in Zoo-based animals.

### Syllabus outcomes and content

#### Stage 3:

**ST3-1WS-S** – plans and conducts scientific investigations to answer testable questions, and collects and summarises data to communicate conclusion

- present data as evidence in developing explanations
- communicate ideas, explanations and processes, using scientific representations including multimodal form

**ST3-4LW-S** – examines how the environment affects the growth, survival and adaptation of living things

- describe adaptations as existing structures or behaviours that enable living things to survive in their environment
- describe the structural and/or behavioural features of some native Australian animals and plants and why they are considered to be adaptations

#### Stage 3 (New Syllabus):

**ST3-DDT-01** Uses design processes to create, evaluate and modify designed solutions

- Develop design ideas to build a prototype using design criteria
- Test, evaluate and modify the prototype to meet the design criteria

**ST3-SCI-01** uses evidence to explain how scientific knowledge can be used to develop sustainable practices

- Observe behavioural and structural adaptations of plants and animals, and suggest how these may help them survive in their environment

**Stage 4:****SC4-WS-07 – Working Scientifically Problem-Solving**

- identifies problem-solving strategies and proposes solution

**C4-CLS-01- Cells and Classification**

- Describes the unique features of cells in living things and how structural features can be used to classify organisms

**TE4-PPM-01- Engineering technologies and systems**

- Applies processes in the planning management and production of projects

## **Suggested incursions or excursions to compliment this unit:**

- Adaptations in a Changing World at Taronga Zoo
- Adaptations in a Changing World Incursion via Taronga Zoomobile
- Enrichment Design Incursion via Taronga Zoomobile

# Identify & Define: Adaptations

Students are learning to:

- identify examples of structural and behavioural adaptations in selected animals.
- describe how adaptations support the animal's ability to survive and thrive in their specific environments.

Lesson	Learning experience	Differentiation strategies and/or adjustments	Resources
1	<p><b>What is an adaptation?</b></p> <p><u>Whole class:</u></p> <ul style="list-style-type: none"> <li>- Zoom In Activity (use resource 1 to support questioning techniques to encourage thinking routines with students)</li> <li>- Discuss what all living things need to survive (<i>food, water, shelter, protection, sunlight, and oxygen</i>)</li> </ul> <p><u>In Groups:</u></p> <ul style="list-style-type: none"> <li>- Provide each group with an image of an animal from a range of different environments (<i>print these prior to the lesson</i>). Have students write down the environment that this animal can be found in.</li> <li>- Have students create a mind map about how this animal is able to survive and thrive within its habitat.</li> </ul> <p><u>Whole class:</u></p> <ul style="list-style-type: none"> <li>- Let students present their ideas and thoughts to the class and as they do, use the '<i>what makes you say that</i>' thinking routine to support them in building on their explanations (<i>resource 2</i>)</li> <li>- Define the word adaptation:  <b>Britannica-</b> Adaptation, in biology, the process by which a species becomes fitted to its environment; it is the result of natural selection's acting upon heritable variation over several generations.</li> </ul> <p>Adaptations are remarkable features that have evolved in animals over millions of years to help them thrive in their environment.</p>		<p>Resource 1 – PowerPoint with Zoom in activity and animal images (<i>resource attached</i>)</p> <p>Resource 2 – <a href="#">What makes you say that thinking routine</a></p> <p><b>Reminder: Don't forget to book your excursion for Adaptations in a Changing World at Taronga or Incursion with Taronga Zoomobile!</b></p>

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2	<p><b>Types of adaptations – structural adaptations.</b></p> <p><u>Whole Class:</u></p> <ul style="list-style-type: none"> <li>- Prior to the watching the video (<i>resource 3</i>) have students write down 3 things that they wonder about the adaptations of an owl (<i>resource 4</i>).</li> <li>- As they watch the video have students record what they see and think about the structural adaptations.</li> <li>- After the video, have students reflect on what they wondered prior to watching the video and write down any answers that they discovered from the information. Then have them write down 3 more questions that they wonder after watching the video.</li> <li>- Discuss the term <b>structural adaptations</b> and have the class define this term.</li> </ul> <p><u>In Groups:</u></p> <ul style="list-style-type: none"> <li>- Using the animals from last lesson, have students create a mind map of as many structural adaptations as they can on their animal. (<i>resource 1</i>)</li> <li>- Have them explain how the structural adaptations support the animal to be able to thrive in their environments.</li> </ul> <p><i>Teacher notes:</i>  A <b>structural adaptation</b> is a physical feature that supports a species ability to survive.  For example, a Lesser Sooty Owl has large feet and sharp talons. One of their toes can turn to face forwards or backwards.  As a bird of prey, these physical features help make this species a supreme predator and they use them to hunt prey species to get plenty of food. If you compare their feet to a bird in the school playground like a Noisy Miner or Cockatoo who doesn't need to hunt animals to survive, they are very different.</p>		<p>Resource 3 – Super Hero Owl Video:  <a href="https://bcove.video/3Ut4nVD">https://bcove.video/3Ut4nVD</a></p> <p>Resource 4: See, think, wonder thinking routine (<i>worksheet attached</i>)</p>
3	<p><b>Types of adaptations - Behavioural adaptations</b></p> <p><u>Whole Class:</u></p> <ul style="list-style-type: none"> <li>- As students watch the video have them work through the name, describe and function thinking routine activity (<i>resource 5 &amp; 6</i>).</li> </ul>		<p>Resource 5 – Aquatic Animal Adaptations:  <a href="https://bcove.video/3WuTWUe">https://bcove.video/3WuTWUe</a></p>

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	<ul style="list-style-type: none"> <li>- After the video, have students share behavioural adaptations that they are able to identify from the aquatic animals that they learnt about in the video. Provide students an opportunity to also discuss how these behavioural adaptations support the animal's ability to thrive in their aquatic environment.</li> <li>- Discuss the term <b>behavioural adaptations</b> and have the class define this term.</li> </ul> <p><u>In Groups:</u></p> <ul style="list-style-type: none"> <li>- Using the animals from last lesson, have students create a mind map of as many behavioural adaptations as they can on their animal. (<i>resource 1</i>)</li> <li>- Have them explain how the behaviour adaptations support the animal to be able to thrive in their habitat.</li> </ul> <p><i>Teacher Notes:</i>  A <b>behavioural adaptation</b> is an action that a species does, usually in response to something, that improves survival.</p> <p>For example, a Short-beaked Echidna has sharp quills all over its body. While these quills are an impressive physical feature that supports their survival in several ways, when an echidna feels threatened by another animal they quickly hunch over their body and dig to grip to the ground as tightly as they can, which makes the quills stand up and protects the softer vulnerable parts of their body. This action is something all echidnas do and keeps them safer from larger predators like foxes, dogs, and eagles.</p>		Resource 6: Name, describe, function thinking routine ( <i>worksheet attached</i> )
4	<p><b>Enrichment In Zoos: Defining the question.</b></p> <p><b>How can we promote Natural behaviours in Zoo-based animals?</b></p> <p>In pairs:</p> <ul style="list-style-type: none"> <li>- Have students define what they think these different types of enrichment are and give an example of each: sensory, cognitive, food-based, environmental/structural, and social. Show students the Enrichment Diversity web to build upon what they already might know about each aspect of enrichment for animals (<i>resource 7</i>).</li> </ul>	Provide students with the dingo for the Enrichment design planner	Resource 7: <a href="#">Enrichment Diversity Web</a>  Resource 8- Animal Enrichment- <a href="https://www.youtube.com/watch?v=3f7epBbV9QE">https://www.youtube.com/watch?v=3f7epBbV9QE</a>

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	<ul style="list-style-type: none"> <li>- Have students brainstorm what they think enrichment looks like in a Zoo based environment and explain why it might be important for Zoo animals.</li> </ul> <p>Whole Class:</p> <ul style="list-style-type: none"> <li>- Watch the video on Enrichment and have students record down 3 new things that they learnt about enrichment from this video (<i>resource 8</i>).</li> <li>- Watch two or three clips of enrichment given to animals at the Zoo (<i>resource 9</i>) and get students to complete resource 10 while they are watching.</li> <li>- Using the images from resource 1, have students complete the enrichment design planner (<i>resource 11</i>) to plan purposeful enrichment for the animal.</li> </ul> <p><i>Teacher Notes:</i></p> <p><b>Enrichment Design Planner (resource 11)</b></p> <p>For this activity, students need to start broad by thinking about all the behaviours an animal exhibits. Then selecting one specific behaviour and considering all the contexts in the wild we might see that behaviour occur. For example, in a dingo a behaviour we might see is scratching. The contexts that drive that behaviour might be scratching up dirt in the ground, scratching at a hollow log to break it apart, scratching up leaf litter for a place to rest. Then students need to consider what object could be used for the animal to replicate these behaviours.</p> <p><b>Sensory enrichment-</b> This enrichment focusses on the stimulation of the animal's senses (e.g. Mirrors, noisemakers, perfumes, scratch poles). Can be divided into 4 subcategories (visual, olfactory, auditory, and tactile).</p> <p><b>Food-based-</b> The manipulation of food or the method of providing food (e.g. Scatterfeed, frozen food, hidden food, hanging food). Focuses on the food presentation and making feeding more challenging for the animal.</p> <p><b>Environmental/Structural enrichment-</b> An alteration of the physical elements of the exhibit and the main goal is to stimulate exploratory behaviours (e.g. Water element, substrates, climbing structure, gradients)</p> <p><b>Cognitive Enrichment-</b> This is seen as cognitive and mental stimulation that</p>		<p>Resource 9 - Different Zoo based animal enrichment-</p> <p><a href="#">Penguin Enrichment</a></p> <p><a href="#">Tiger enrichment</a></p> <p><a href="#">Dingo Enrichment</a></p> <p><a href="#">Giraffe Enrichment</a></p> <p><a href="#">Rhino Enrichment</a></p> <p>Resource 10 – Parts, purposes, and complexities thinking routine (<i>worksheet attached</i>)</p> <p>Resource 11- Enrichment Design Planner (<i>worksheet attached</i>)</p>

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	<p>requires problem-solving of different levels of complexity (e.g. Novel item, puzzle feeder, novel object, bags)</p> <p><b>Social Enrichment</b>-This form of enrichment is focussed on organising interactions between animals or human-animal. (e.g. Training, mixed-exhibits, conspecific)</p>		

## Research & Plan

Students are learning to:

- Research an animal's needs and adaptations.
- Design an enrichment object for an animals.

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5	<p><b>Research animals at the Zoo</b></p> <p>Individually:</p> <ul style="list-style-type: none"> <li>- Select an animal at Taronga that you would like to learn more about or select an animal from the enrichment competition.</li> <li>- Research the habitat, diet, structural and behavioural adaptations of this animal (<i>resource 12</i>).</li> <li>- Research any enrichment that has been used for this animal in a zoo-based environment (<i>resource 12</i>).</li> <li>- Research the animal's exhibit at the Zoo (<i>resource 12</i>).</li> </ul>	<p>Provide students with animals to research to support their understanding. Some ideas include (echidna, meerkat, sun bear)</p>	<p>Resource 12 - Research template (<i>worksheet attached</i>)</p>
6	<p><b>Design an enrichment prototype</b></p> <p>Individually:</p> <ul style="list-style-type: none"> <li>- Complete the enrichment design planner on your selected animal. This will assist to narrow down the behaviour that you are trying to</li> </ul>		<p>Resource 11- Enrichment design planner (<i>worksheet attached</i>)</p> <p>Resource 13 – Design Brief</p> <p>Online design apps:  <a href="https://sketch.io/sketchpad/">https://sketch.io/sketchpad/</a></p>

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	<p>have the animal exhibit through the enrichment object (<i>resource 11</i>).</p> <ul style="list-style-type: none"> <li>- Fill in the design brief prior to completing the sketches of your design. After completing the sketches ensure that you label the plans with the resources that will be used to build the object (<i>resource 13</i>) <ul style="list-style-type: none"> <li>▪ Designs can be done on technology (sketchpad, tinkercad, Leocad)</li> </ul> </li> <li>- Ensure that the enrichment object can be placed in and removed from the animal's exhibit.</li> <li>- Follow the safety guidelines to ensure the animals safety and dignity &amp; respect of the animal is maintained (<i>resource 14</i>)</li> </ul> <p>Whole Class:</p> <p>'Speedback Session'- A Rotational Feedback Activity (<i>resource 15</i>): This activity will require the class to be split in half. Half of the class will stay with their enrichment design at a station to deliver a short 1-minute pitch to the other half of the class who will walk around the room to provide feedback.</p> <p>In the 1-minute pitch students share their design with peers and explain what they have created and why. After the 1-minute pitch, the student who has listened offers 2 stars and a wish (2 things that have been done well and 1 suggestion that you might like to change). Do this rotation 3-4 times before swapping the other half of the class over to then be the ones who share their one-minute pitch.</p> <p>At the end of this activity, students will have received positive feedback from their peers and some feedback with ideas that they might like to consider. Students need to read through the feedback and apply AT LEAST two of the changes to their design.</p> <p>Individually:</p> <ul style="list-style-type: none"> <li>- Implement at least two ideas that were provided from the roundtable feedback session</li> </ul>		<p><a href="https://www.tinkercad.com/">https://www.tinkercad.com/</a> <a href="https://www.leocad.org/">https://www.leocad.org/</a></p> <p>Resource 14- Enrichment safety checklist (these can vary animal to animal, so this is a general one)- (<i>worksheet attached</i>)</p> <p>Resource 15- Speedback (<i>worksheet attached</i>)</p>

## Produce & Implement

Students are learning to:

- Build an enrichment object that can be placed in and removed from the animal's exhibit
- Follow a safety checklist to ensure the needs of the animals are met

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7	<p><b>Bring the plan to life!</b></p> <p>Individually:</p> <ul style="list-style-type: none"> <li>- Begin the build of the prototype (This may take up to one-two weeks to construct this using the correct materials)</li> </ul>	The materials used can be adjusted to suit the needs of the individual students	
8	<p><b>Enrichment Pitch</b></p> <p>Individually:</p> <ul style="list-style-type: none"> <li>- Develop a pitch to the class as to why your enrichment object is the best design and most effective in promoting natural behaviours in the Zoo-based animals (<i>Resource 13</i>).</li> </ul>		Resource 13- Design Brief ( <i>worksheet attached</i> )

### Reflection and evaluation

These simple questions may help you reflect on your students' learning and plan for next steps.

What worked well and why?

What didn't work and why?

What might I do differently next time?

What are the next steps for student learning based on the evidence gathered?