**Quick Summary**

This unique program is part of the 2020 STEM Design Challenge. Year 9-10 students will help to solve two big STEM challenges:

* Scientists need new nest box designs to help Leadbeater’s Possums thrive in the wild
* Scientists need new nest box designs to help Swift Parrots thrive in the wild

This Teaching Guide includes activities that you can do with your students before, during and after your excursion. It will help to build foundational knowledge, ensure maximum benefit during the excursion and extend learning once back at school.

**What Students Will Learn**

* How Healesville Sanctuary uses STEM to help endangered animals thrive in the wild
* STEM skills such as scientific observation and Design Thinking
* How to express their ideas through Project Based Learning
* How to enhance their creative thinking skills

**Victorian Curriculum Links**

* Science – The values and needs of contemporary society can influence the focus of scientific research
* Science – Communicate scientific ideas and information for a particular purpose, including constructing evidence-based arguments and using appropriate scientific language, conventions and representations
* Design & Technologies – Apply design thinking, creativity, innovation and enterprise skills to develop, modify and communicate design ideas of increasing sophistication
* Critical & Creative Thinking – Investigate the kind of criteria that can be used to rationally evaluate the quality of ideas and proposals, including the qualities of viability and workability
* Personal & Social Capability – Evaluate own and others contribution to group tasks, critiquing roles including leadership and provide useful feedback to peers, evaluate task achievement and make recommendations for improvements in relation to team goals

**Learning Sequence**

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**Before Your Excursion**

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2. Video Research (p. 3)

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**During Your Excursion**

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**Design Thinking**

The process of Design Thinking is not linear. Students may need to return to different stages of the framework in order to deepen their learning or choose another idea to prototype.

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| --- | --- | --- | --- |
| **Understand**Be caring, ask questions and define the challenge | **Ideate**Imagine creative solutions to the challenge | **Prototype**Show your idea by using what’s available | **Test and Refine**Test, share, evaluate and improve your prototype |

Look for these logos in this Teaching Guide to identify each stage Design Thinking.

**Before Your Excursion**

**1. Design Brief**

**This activity will:** introduce your students to the Design Brief in the STEM student workbook. The Design Brief describes the user and the challenge that students will be solving. It outlines what students will be doing at every stage of Design Thinking.

**Preparation:**

* Download the Student Workbook at [www.zoo.org.au/education/excursions/saving-endangered-species-7-8-terms-1-2-2020/](http://www.zoo.org.au/education/excursions/saving-endangered-species-7-8-terms-1-2-2020/) (under ‘Program Resources’).
* Familiarise yourself with the Design Brief.
* Read the Judging Criteria if you would like students enter the STEM Design Challenge competition. You are welcome to use this criteria (or your own) as part of assessment.
* You will need share the Design Brief with your students, either printed or electronically.

**Instructions:**

1. Read through the Design Brief (Page 1 of the Student Workbook) with your students. Discuss the Understand stage of Design Thinking, which involves being caring, asking questions and defining the challenge.
2. Explain that the Ideate, Prototype and Test and Refine stages will occur back at school.
3. Read through the Judging Criteria if your students are entering the STEM Design Challenge competition. Or use this moment to discuss how students will be assessed.



**2. Video Research**

**This activity will:** start the Understand stage of the Design Brief by listening to the Zoos Victoria Fauna Podcast, ‘The Fairy Possum’ (24 minutes).

**Preparation**

Open these websites:

* ‘Zoos Victoria is Fighting Extinction’ video – [www.youtube.com/watch?v=qPrUvuKJs6E](http://www.youtube.com/watch?v=qPrUvuKJs6E)
* ‘The Fairy Possum’ Fauna Podcast – [www.zoo.org.au/education/fauna-podcast/](http://www.zoo.org.au/education/fauna-podcast/)

**Instructions:**

1. Watch the ‘Zoos Victoria is Fighting Extinction’ video.
2. Discuss with your students why it is important to help endangered animals to thrive in the wild.
3. Now listen to ‘The Fairy Possum’ Fauna Podcast (episode 7).
4. Write a list of what has been learnt so far about the Leadbeater’s Possum. You might like to record this as a class and build on throughout the unit.
5. Write a list of what questions still have about Leadbeater’s Possums and their nesting needs.
6. Pose the following questions to your students:
* What does a Threatened Species Scientist do?
* How do these scientists gather research?
* What challenges might scientists face when researching endangered animals?
* How can we find out this level of information about the Swift Parrot?
1. Remind students that they will continue to research the Leadbeater’s Possum and Swift Parrot during their excursion at Healesville Sanctuary.

**3. Plan Your Visit**

**This activity will:** help your group prepare for your excursion to Healesville Sanctuary.

**Preparation:**
Open your excursion confirmation email from Zoos Victoria to find out your workshop time/s.

**Instructions:**

1. Open the Sanctuary map – [www.zoo.org.au/healesville/healesville-sanctuary-map/](http://www.zoo.org.au/healesville/healesville-sanctuary-map/)
2. Use the map to look at where different animals are located and discuss what you will be doing at the Sanctuary.
3. You may like to ask students questions like, “What will you need to find out?” and “What are you most looking forward to?”

**Teaching Tip:** Discuss with your students what may be the best way for them to collect evidence and research whilst at the Sanctuary. They may want to write notes, draw pictures, take photos or record short videos. This is also a good time to discuss what students will need to bring for a great excursion e.g. appropriate clothing, rubbish-free lunch

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******During Your Excursion**

**1. Possum Watching**

**This activity will:** equip students with knowledge about the Leadbeater’s Possum as part of the Understand stage of the Design Brief.

**Preparation:** Use your Sanctuary map to navigate your walk to the ‘Animals of the Night’ area.

**Instructions:**

1. Before you enter ‘Animals of the Night’, ask students their tips for observing nocturnal animals in their habitat e.g. moving quietly and slowly, not using flash photography
2. Discuss how to use scientific observation skills to find out about the Leadbeater’s Possum:
	* What the possum looks like
	* How the possum moves
	* Different features of the possum’s habitat
	* How the environment affects the survival of a Leadbeater’s Possum
	* The possum’s behaviours
	* Any signage that talks about possums
3. Ask students to quietly gather at the Leadbeater’s Possum habitat and begin to observe the space. You might like to set a timer on your phone, just like a scientist would, so that everyone is watching at the same time.
4. Ask students to share what they saw with the person next to them.
5. Ask students to explain how their observations helped them to understand the challenge of building a possum nest box.

**Teaching Tip:** Leadbeater’s Possums have similar behaviours to Sugar Gliders. If you cannot see any Leadbeater’s Possums, repeat this activity at the Sugar Glider habitat, which is also in the Animals of the Night.

**2. Parrot Watching**

**This activity will:** build student knowledge about the Swift Parrot as part of the Understand stage of the Design Brief.

**Preparation:** Use your Sanctuary map to navigate your walk to the ‘Land of the Parrots’ area.

**Instructions:**

1. Before you enter ‘Land of the Parrots’, ask students their tips for observing birds in their natural habitat e.g. moving quietly and slowly, not using close-up photography
2. Discuss how to use scientific observation skills to find out about different parrots:
* How a parrot moves
* Features of a parrot’s habitat
* Parrot behaviours
* Any signage that talks about parrots
1. Walk in to ‘Land of Parrots’ and ask students to begin to observe the space. You might like to set a timer on your phone, just like a scientist would, so that everyone is watching at the same time.
2. Ask students to share what they saw with the person next to them.
3. Discuss as a group what you currently know about the difference between the parrots you saw and the Swift Parrot you are focusing on.
4. Ask students to explain how their observations helped them to understand the challenge of building a Swift Parrot nest box.

**Teaching Tip:** If you come across volunteers working in ‘Land of Parrots’, encourage your students to ask lots of questions about parrots. The volunteers are a wealth of knowledge!



**3. Hollow Spotto**

**This activity will:** help students learn more about tree hollows.

**Instructions:**

Healesville Sanctuary is the home to old trees. Old trees are important because they provide hollows, which are homes to wildlife. Small hollows (for animals like possums) take about 100 years to form. Medium hollows (for animals like parrots) take around 200 years to form.

As you walk the paths of Healesville Sanctuary, encourage your students to look up at the trees and see what hollows they can spot.

**Teaching Tip:** You will see nesting boxes as you walk around the Sanctuary. Stop and look at their design and where they are positioned. Your students might like to guess who lives in them.

****Healesville Sanctuary acknowledges the Traditional Custodians of the land on which we live and work, and pay our respects to Elders both past and present.

**After Your Excursion**

**1. 100 in 10**

**This activity will:** help students brainstorm their ideas for solving the big challenges.

**You will need:**

* The Design Brief (in the Student Workbook)
* Pens or textas
* Something for small groups to write their ideas on e.g. large piece of paper, whiteboard
* A stopwatch or timer

**Instructions:**

1. Look at the Design Brief and ask students to decide which challenge they would like to work on i.e. a nest box for a Leadbeater’s Possum or a next box for a Swift Parrot
2. Divide students into small teams, based on their animal choice. This will be the team they will work with on their prototype. If you are entering the STEM Design Thinking Challenge competition, limit each group to a maximum of six students.
3. Tell students that the goal of this activity is to come up with lots of ideas that will solve the big challenge. There will be time at the end to discuss each idea. For now, they will have 10 minutes to write down as many ideas as possible 🡺 100 ideas is the goal.
4. As a class, set some rules to guide the brainstorm. Everyone should feel like they can share their idea openly, there are no bad ideas, one idea at a time and use “and” to build on ideas.
5. Pass out the pens and paper/whiteboards.
6. Ask each team to work out how they will record their idea (e.g. everyone writing, one person to scribe) and set the timer to 10 minutes.
7. Give warnings when the timer goes past 8 minutes and 9 minutes. Encourage students to write all their ideas down, even the ones that include big dreaming.
8. When the timer reaches 10 minutes, ask students to stop writing and count up how many ideas they thought of.

**Teaching Tip:** When students are brainstorming, it is best for a teacher to step back and not participate. Pauses in conversation often lead to new and creative thinking.

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**2. Choose Your Idea**

**This activity will:** help your students choose an idea to prototype and test as a team. It is the final part of Ideate in the Design Brief. This activity helps students identify patterns and themes.



**You will need:**

* The idea lists that teams created during the ‘100 Ideas in 10 Minutes’ activity
* A device/computer with Internet access to do a fast check of each idea

**Instructions:**

1. Ask each team to look at their list of ideas.
2. Each team chooses their ‘Top 5’ ideas – the ones they like or find most interesting.
3. Look at the ‘Top 5 ideas’ more closely. Are the ideas similar?
Do they have things in common? Is there a way to mash ideas together to improve an idea?
4. What might students have to think about during decision-making? e.g. timelines, materials available, personal strengths of each team member
5. Ask each team to decide on one idea that everyone wants to prototype and test.
6. Do a fast check on the Internet. Has someone already thought of this idea? Did it work? Can it be improved?
7. Finish by explaining that designers have a growth mindset. Teams might have to return to their ideas list if the first idea they choose does not work out. Ask students to keep their list somewhere safe in case they need to look at it again.

**Teaching Tip:** Give students time decide on an idea. They will develop their interpersonal skills and learn how to make team decisions. If they are stuck, encourage them to be curious about one idea, knowing that they may have to return to their list to try another.

**3. Prototype**

**This activity will:** help your students complete the Prototype stage of the Design Brief. A prototype is a visual representation of an idea, using the materials and technologies available.

**Preparation:** You may need to support students with identifying what materials they will use to build their prototype. It is recommended they use recycled materials where possible. Encourage students to return to the Design Brief when needed.

**Teaching Tips:**

* Ask students to focus on the challenge they have selected, the user (Dan the scientist) and the functionality of their idea. They can return to the Design Brief and their research when needed.
* It might be useful to set deadlines to help teams stay on track.
* Encourage ‘quick fails’ where students try different ideas and quickly assess if the idea will work. This might include sketching out their idea to think it through.
* If entering the STEM Design Challenge competition, use the Judging Criteria to help students assess and reflect on this stage of Design Thinking as they go.

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**4. Test**

**This activity will:** enable students to test and share their prototype.

**Preparation:** You may need to think through what audience you would like students to get feedback from e.g. other students, a vet, animal expert, Biodiversity Officer from your local council/shire

**Instructions – Presentation:**

Student teams will need to practice how they will present their prototype to others. They might do a speech, a performance, animation or create interesting signage as part of a showcase. If teams want to enter the STEM Design Challenge competition, they will need to create a video of 2 minutes or less (refer to the Judging Criteria for more information) and upload it at [www.zoo.org.au/education/enter-the-stem-design-challenge/](http://www.zoo.org.au/education/enter-the-stem-design-challenge/)

**Instructions – Workable Model:**

If student teams have created a prototype that is a workable model, they may be able to test its design features. For example:

* Test whether the a Swift Parrot or Leadbeater’s Possum will be able to
fit through the entrance to the nest box
* Test the air circulation of the nest box by placing a small bowl of
boiling water inside and seeing where the steam goes
* Test whether the nest box can withstand the weight of a small branch
being dropped on it

**5. Refine**

**This activity will:** enable students to evaluate and improve their prototype.

**Instructions – Refine:**

Once students have received feedback, it is ideal to give them some time to refine their design. This stage of Design Thinking shows students that the engineering process does not stop after they have presented an idea. Designs are modified over time so that a better solution can be reached.

1. As teams to share what they learnt during the ‘Test’ activity. They may like to synthesise their thinking by writing reflections on pieces of paper and then group by common themes.
2. Encourage each team to brainstorm how their prototype could be changed.
3. If time, student teams could physically adjust their prototype.

**Teaching Tip:** Remind students that Design Thinking is a process for testing and learning, not for getting to the ultimate solution the first time. At Zoos Victoria, people use Design Thinking regularly to test new solution ideas and work out all the kinks.

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**Thanks for participating in Zoos Victoria’s STEM Design Challenge. Together, we are creating a world that is rich in wildlife and providing young people with an education worth having.**

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