Running a Zoo

Year 5-6 STEM Teaching Guide
Werribee Open Range Zoo

Zoos Victoria's STEM Design Challenge is a unique education program that helps students find solutions to complex problems by using their STEM knowledge and skills.

Running a Zoo is awesome, but it's not always easy. In this program at Werribee Open Range Zoo, students will be using STEM to solve a big challenge:

Managers need new ideas that help them continue to keep people safe and provide a fun experience for visitors.

This STEM Teaching Guide will help Year 5-6 students find solutions to this big and real-world challenge. They will develop their STEM skills and knowledge through an engineering framework called Design Thinking.

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Here's how the STEM Design Challenge works, using Design Thinking as a learning and teaching tool:

1 UNDERSTAND the challenge

Book an excursion to Werribee Zoo .
You will be given a special itinerary for your day, which includes a workshop with a STEM educator and a guide on how to find problems around the Zoo.

2 IDEATE possible solutions

Back at school, your students will brainstorm ideas and choose one to test.

Form teams of up to six students. Brainstorm a list of ideas that will solve one of the big challenges. Each team then needs to choose one idea to prototype and test.

3 PROTOTYPE an idea

Your students will bring their ideas to life.

Students may need to do further research. Then it is time to create a prototype of their idea using their STEM skills. They could use recycled materials from home, items from your art room or any technology available to build their prototype. See the FAQS on Page 3 to find out more about prototypes.

4 TEST & REFINE a prototype

Your students will share their prototypes with an audience to test and refine their ideas.

Your students can present their prototypes to their peers, another year level or an expert from outside your school.

You can also enter your students' prototypes in the STEM Design Challenge competition (optional).

Frequently Asked Questions

How do I fit Running a Zoo into my curriculum?

There are many ways to teach STEM. The STEM Design Challenge will help you use a transdisciplinary approach - students apply knowledge and skills from two or more learning areas by undertaking real-world problems or projects.

How long does the program run for?

You choose. Some teachers use this programas the centre of whole-term unit. Others use it as part of a special program that runs for 1-3 weeks. This Teaching Guide will help you walk your students through each stage of Design Thinking so you can move at your own pace.

What is a prototype? What have other schools done?

A prototype represents an idea. Prototypes can be 3D models that are 'tested and refined' by getting feedback from other people. Prototypes can also be in the form of something that can be physically tested.

Do I need special materials or a STEM lab for the prototypes?

Not at all. Just like people who work in STEM, students can use any of the materials available to them to create their prototype e.g. recycled materials from home, items from the art room, computers/technology.

How many prototypes should my class make?

If you want to participate in the STEM Design Challenge competition, you'll need to assign teams of up to **six students**.

This makes the Design Thinking and Project-Based Learning process easier to teach. If your students want to work on a whole-class prototype, split them into small groups to build the different parts.

What support is provided to help me teach this program?

This Teaching Guide has activities to help you teach each stage of Design Thinking. The Design Brief will kick off learning and outline expectations. The links on the Research page include videos and websites. Your Werribee Zoo educator will also be able answer student questions. You are also welcome to use the Judging Criteria as part of your assessment.

What are the links to the Victorian Curriculum?

Year 5-6 Business and Economics	**Identify types of resources (natural, human, capital) and explore the ways societies use them in order to satisfy the needs and wants of present and future generations (VCEBR003)** Students will learn about the needs and wants of different stakeholders of Werribee Zoo including managers, other staff, animals and visitors.
Year 5-6 Business and Economics	**Identify the reasons businesses exist and investigate the different ways they produce and distribute goods and services (VCEBB006)** Students will become familiar with the services that Werribee Zoo provides the community and the environment.
Year 5-6 Business and Economics	**Make decisions, identify appropriate actions by considering the advantages and disadvantages, and form conclusions concerning an economics or business issue or event (VCEBE010)** Students will use a Design Thinking process to weigh up decisions and create solutions for Werribee Zoo.
Year 5-6 Design and Technologies	**Generate, develop, and communicate design ideas and decisions using appropriate technical terms and graphical representation techniques (VCDSCD029)** Students will use Design Thinking to generate, grow and test their ideas for animal conservation.
Year 5-6 Critical and Creative Thinking	**Investigate a range of problem-solving strategies, including brainstorming, identifying, comparing and selecting options, and developing and testing hypotheses (VCCCTM020)** Students will learn how to use each stage of Design Thinking to develop their own creative solutions - Understand, Ideate, Prototype, Test and Refine.

About Design Thinking

Design Thinking is a framework used by an engineering framework that is used to bring an idea to life. The following pages contain ideas and activities on how to teach each stage of Design Thinking. Many thanks to the good folks at IDEO.org who provide a free online Design Kit. IDEO uses human-centered design to improve the lives of people living in poverty.

Find out more at www.designkit.org.

1 UNDERSTAND the challenge

Bring your students to Werribee Zoo to undertake research.

You will be given a special itinerary for your day, which includes a workshop with a STEM educator and a guide on how to conduct research in the Zoo.

Here are some activities to help you teach the 'Understand' stage of Design Thinking:

Read the Design Brief

+ Engineers and designers use a 'Design Brief' to guide the design process. We've create a brief *(see page 6)* to help your class with their projects.

Look at the Judging Criteria or Co-Create Assessment

+ If your students would like to enter the STEM Design Challenge competition, read through the Judging Criteria *(see page 8)*. This Criteria can also be used part of your assessment. Alternatively, you could co-create an assessment rubric together with your students so that everyone understands what is expected.

+ You might like to set up a way for students to record their learning journey e.g. learning journal, video, exercise book

Research

+ Before or after your excursion, decide on the student teams. If you want to enter the STEM Design Challenge competition, you will need to have teams of up to **six students**.

+ Encourage students to find their 'why'. Why do they think this problem will be interesting to solve? How might solving this problem help them? Help animals? Help Zoos Victoria?

+ Use the Research Guide *(see page 9)* to help your students develop their understanding of endangered animals.

We recommend you wait until your Werribee Zoo visit before students choose which challenge they want to focus on.

Running a Zoo - Design Brief

1 UNDERSTAND the challenge.

The users for this Design Challenge are the managers of Werribee Open Range Zoo
- **Managers need new ideas that help them continue to keep people safe and provide a fun experience for visitors.**

Running a zoo is incredible, but it's not always easy! There is a lot to balance - the health of animals, the wellbeing of staff, conservation action and the experience for visitors. Managers are always searching for creative ideas that ensure that the Zoo succeeds in its goals.

In this Design Challenge, you will be both problem finding and problem solving. You will focus on improving the experience of visitors or finding better ways to keep visitors and staff safe while at the Zoo.

2 IDEATE possible solutions

Once you've chosen one of the challenges from the list above and done some research, it's time to think of solutions. Imagine and brainstorm your ideas. Choose one that you'd like to prototype and test.

3 PROTOTYPE an idea

Choose one of your ideas and create a prototype.
A prototype allows you to show your idea to other people. Your prototype can be a 3D model or diorama, or you can make a prototype that can be tested in a real-life situation.

4 TEST & REFINE a prototype

Test your prototype by explaining it to other people. You can show other students, parents or local experts like council park workers, scientists or even veterinarians.

Your audience should provide feedback so you can improve your prototype.
You might also be able to test your prototype in a real-life situation.

About the Competition

You are also welcome to enter Zoos Victoria's STEM Design Challenge competition.
To enter, teams of up to six students need to submit a video of 2 minutes or less that explains their prototype and their learning. Check out Zoos Victoria's website for the details.

Thanks for helping to solve the challenge of saving endangered animals!

Running a Zoo - Research Guide

While at the Zoo

Step 1. Practice quiet scientific observation skills to gather information about what is working and what is not working.

Step 2. Share what people already know and what they saw.

Step 3. 'Understand' discussion questions:
• What is the 'visitor experience'? Hint: design of space, signs, interactivity
• How are animals being kept safe? Hint: fences, locks, gates, barriers, water
• How are people being kept safe? Hint: fences, locks, gates, signs, paths, safety uniforms
• What is working?
• What could be improved/added?
• What else do we need to know to solve problems in this space?

Online Research About the Zoo

Here are some online resources to help with your research:

Websites
Zoos Victoria - Werribee Zoo Open Range Zoo
www.zoo.org.au/werribee/

Zoos Victoria - About Us (scroll down the page for Mission, Vision and reports)
https://www.zoo.org.au/about-us/

Zoos Victoria YouTube Videos
Werribee Open Range Zoo Highlights - https://youtu.be/vS5du_kqT_A

African Wild Dogs move in at Werribee Open Range Zoo - https://youtu.be/0wAcq8Dw-vg

New Home for the Plains Wanderer - https://youtu.be/KBdOjpSzEX4

Orange-bellied Parrots Call Werribee Home - https://youtu.be/hscUeh9x2Wk

Toddler Thursdays at Werribee Zoo - https://youtu.be/CRnYPuISRpO

Slumber Safari - https://youtu.be/5Zs14mawX4U

Running a Zoo - Judging Criteria

This judging criteria will be used for the STEM Design Challenge compeition.

Judging Criteria	1 Point	2 Points	3 Points	4 Points
1. UNDERSTAND What is the challenge and who is the user?	Neither the challenge nor the user was described.	The challenge *or* the needs of the user was described.	Both the challenge and the needs of the user were described.	The challenge and the needs of the user were described, including personal insights that showed deep thinking.
2. IDEATE What were your ideas and how did you decide which one to prototype?	The process of ideation was not described.	Limited description of the process of ideation.	The process of ideation was described, along with a few ideas.	The process of ideation was described, including how a decision was reached on what idea to prototype.
3. PROTOTYPE How did you create your prototype and how will it help the user solve the challenge?	The prototype was not complete.	The process of creating the prototype *or* how it works was described.	Both the process of creating the prototype and how it works was described.	Both the process of creating the prototype and how how it works was described in detail e.g. material, safety
4. TEST AND REFINE How did you test your prototype and what modifications did/could you make?	No testing or refining of prototype was described.	The testing *or* the refinement of the prototype was described.	Both the testing and the refinement of the prototype was desribed.	Both the testing and the refinement of the prototype was described, including detailed description of modifications.

5. BONUS POINTS will be given for the following:
- Description of how STEM knowledge and skills were applied
- Demonstration of creative thinking
- Demonstration of team work
- Suitability of prototype for the user
- Sustainability of materials used

2 IDEATE possible solutions

Your students will generate a list of solutions and choose one to test.

Your students now need to brainstorm a list of ideas that will solve one of the big challenges. They will then choose one of their ideas to prototype and test.

Here are some activities to help you teach the Ideate stage of Design Thinking:

Brainstorm and Generate Ideas

1 Everyone should feel like they can share their idea openly.

2 Come up with wild ideas that don't factor in any limitations.

3 Get creative brains going through drawing and post-it notes.

4 Go for quantity – the goal isn't a perfect idea, it's lots of ideas to choose from!

+ Brainstorm – www.designkit.org/methods/1

+ Download Your Learning – www.designkit.org/methods/12

+ How Might We – www.designkit.org/methods/3

Decide on an Idea

Groups decide which idea has the greatest potential in the time-frame they have available to create their prototype:

+ Gut Check – www.designkit.org/methods/42

+ Find Themes – www.designkit.org/methods/5

+ Bundle Your Ideas – www.designkit.org/methods/30

+ Top Five – www.designkit.org/methods/15

Design the Prototypes

+ Groups could do a rough sketch/design of their prototype before they start building. They could use storyboards, models, sketched designs or scrappy mock-ups.

+ Students should seek feedback from other groups during this stage.

3 PROTOTYPE an idea

Your students will generate a list of solutions and choose one to test.

A prototype represents an idea. For example, a 3D model can show an idea and be 'tested and refined' by getting feedback from other people. A prototype can also be in the form of something that can be physically tested.

Here are some activities to help you teach the Prototype stage of Design Thinking:

Plan a Road Map

Once they've chosen an idea to prototype our students may need to do further research. They may also like to plan out their design and how they'll stay on track:

+ Plan a Roadmap – www.designkit.org/methods/7

Create the Prototypes

Ask students to focus on the challenge, the user and the functionality of their idea:

+ Your school's art room may have some supplies to help with this process.

+ Use recycled materials from home or from a company like Reverse Art Truck.

+ Encourage 'quick fails' where students try different ideas and quickly assess if the idea will work.

Decide on a Presentation

Students can practice how they will present their prototype to others. They might do a speech, a performance, animation or create interesting signage.

If they want to enter the STEM Design Challenge competition, they need to create a video of 2 minutes or less (refer to the Judging Criteria for more information).

+ Choose a Pilot to practice on – www.designkit.org/methods/8

4 TEST AND REFINE a prototype

Your students will share their prototypes with an audience to test and refine their ideas.

Your students can present their prototypes to their peers, another year level or an expert from outside your school. They can also submit a video entry into Zoos Victoria's STEM Design Challenge competition.

Here are some activities to help you teach the Test and Refine stage of Design Thinking:

Present the Prototypes

+ Students should share their prototype to explain how it would work. They might do a speech, a presentation, a performance or create interesting signage.

They may also consider creating a video for the STEM Design Competition. See the Judging Criteria on Page 8.

Get Feedback

+ Students should receive feedback about their prototype from their audience.
This will allow them to expand their design and their thinking.

+ Get Feedback – www.designkit.org/methods/57

Refine the Design

+ 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 doesn't stop after they've presented an idea. Designs get modified over time so that a better solution can be reached.

+ Integrate Feedback and Iterate – www.designkit.org/methods/4

Thanks for participating in Zoos Victoria's STEM Design Challenge.

**For more information visit
www.zoo.org.au/education/**