



**Prize Winner**

# **Citizen Science Primary**

**Heathfield Primary Year 3/4**

**Heathfield Primary School**



# Biophilic Design

## Introduction

Heathfield Primary School specialises in Science and the Adelaide Hills location of the school provides a unique opportunity to research, explore and discover within that ecosystem. Over the years students have worked with Landcare organisations with a focus on bushland management so when the opportunity arose to use their scientific skills to connect nature with learning, the students were eager to engage.

The students were partnered with Biophilic architect and university lecturer, Dr Shokry Abdelaal for a citizen science project to investigate the impact of biophilic design on learning and wellbeing.

The benefits of biophilic design have been extensively researched. Future Proofing Schools; Phase 1 Research Compilation is an Australian Research Council Linkage Project led by the University of Melbourne. It provides precise data on the positive impacts of natural ventilation, natural lighting, good acoustics and indoor air quality on both the staff and children. Providing spaces that are open and connected to the outdoors increases mental stimuli, energy and physical comfort levels and this, in turn, increases cognitive ability, attention and memory levels (O'Brien & Murray, 2007).

With a focus on Science as a human endeavour, particularly the use and influence of science students consider how people use scientific explanations to meet a need or solve a problem. Recent data has shown an increase in issues due to mental health and wellbeing impacting a student's ability to learn. Through a student lead science inquiry students contribute to the development of a solution. Whilst students will engage in learning about living things and their needs as well as properties of materials they will have an opportunity to apply this understanding to address an authentic issue. Whilst this report focusses on the science behind the project it is to be noted that these students also explored resilience, mental health and wellbeing as part of their learning in Health.

## Year 3 and 4 Biophilic Design of learning spaces, a citizen science inquiry.

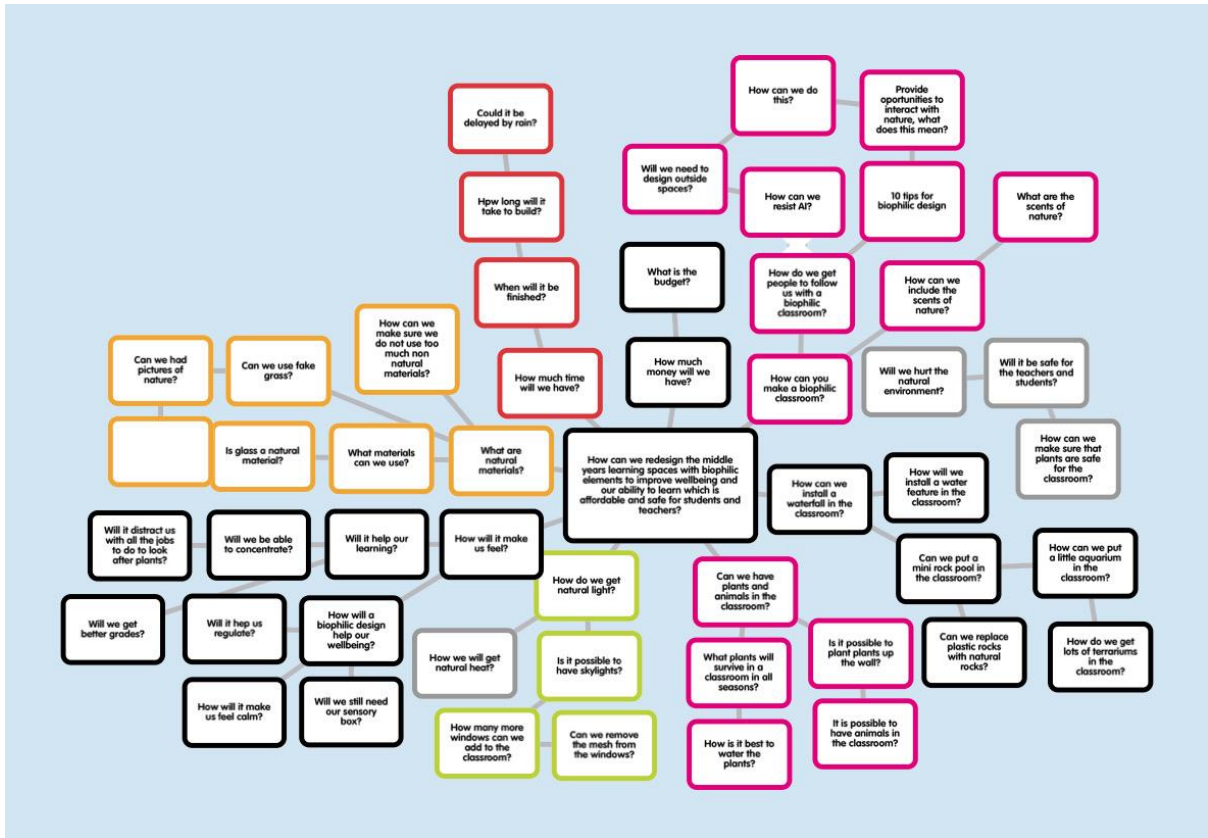
Using an engineering design process the students unpack the problem and develop a solution. The cogs will outline the process used during the citizen science inquiry.

### Our big question:

How can we redesign the middle years learning spaces with biophilic elements to improve our wellbeing and ability to learn which is affordable and safe for students and teachers?

### Our guiding questions:





Class brainstorm 'Poplet'



### Success Criteria and Limitations

is it possible to design a biophilic building with not much money?

Success criteria	Limitations
<ul style="list-style-type: none"> <li>1. water</li> <li>2. trees</li> <li>3. plants</li> <li>4. patterns</li> <li>5. soil</li> <li>6. greenery</li> </ul>	
<ul style="list-style-type: none"> <li>• Biophilic elements</li> <li>• natural light &amp; greenery</li> <li>• wood</li> <li>• living things</li> <li>• water</li> <li>• soil</li> <li>• plants</li> <li>• patterns</li> <li>• Learning space</li> </ul>	<ul style="list-style-type: none"> <li>• Space</li> <li>• Small budget</li> <li>• limited funds</li> <li>• time frame</li> <li>• only types of materials</li> <li>• safety</li> </ul>

natural elements  
small budget

is it possible to design a biophilic classrooms  
small budget up to \$10,000 to \$50,000 and use recycled materials.

Success criteria	Limitation
<ul style="list-style-type: none"> <li>• Biophilic elements</li> <li>• Plants</li> <li>• Natural materials</li> <li>• heat</li> <li>• water</li> <li>• light</li> <li>• Sustainability</li> </ul>	<ul style="list-style-type: none"> <li>• Space</li> <li>• Small budget</li> <li>• limited materials</li> <li>• Time</li> <li>• Seasons</li> <li>• not too much safety</li> <li>• water</li> <li>• Sustainability</li> </ul>

## Research

To better understand Biophilic Design students were partnered with biophilic architect Dr Shokry Abdelaal.

### *Dr Shokry Abdelaal biography*

Sustainable Construction / Construction Technology professional with a PhD degree in Architecture since 2009. Over 20 years experience in Academic Teaching / Architectural Design, with exposure to Architecture / Urban Planning and four years of project management experience. Academic appointments include teaching and research in Architecture and Design in three continents. Currently, I work as an Online Course Facilitator in the Construction Management program, which is owned by the STEM unit at the University of South Australia. Earlier I used to work as a Visiting Researcher at the University of Adelaide, School of Architecture and Built Environment and a casual lecturer at the school of Nature and Built Environment at the University of South Australia. Also, I conducted extensive industry-based research in the area of sustainable architecture and environmental psychology. Also, I was involved in developing some nationally significant medical and higher education projects in roles as Architect, Senior Designer and Manager at a market-leading firm between 2003 and 2011. Recently, I approached the vast world of life-long online education. I enjoyed the experience of developing and delivering interactive and digitally enriched and architecture-related courses in the program of construction management at UniSA Online.



Students worked in groups to answer the questions from the brainstorm pictured above. These were grouped according to topic to facilitate the research (colour coded). As scientists, students looked at work that had been already done by scientists in biophilic design but had questions remaining to ask the expert, Dr. Shokry.

Dr. Shokry came to school and presented to the students. Students then were given a chance to ask questions and clarify understanding. Shokry also spoke about the importance of direction in relation to the sun for natural light and the concept of space.



Eliza asks Dr. Shokry to clarify the learning areas to be redesigned



Dr Shokry helps the students understand length using Ashley as an example.

Through the research Archie, Remy and Oliver discovered principles of biophilic design and presented them to the class. The principles below added to the success criteria for the project.

“During our research into Biophilic design we found out that there are some things we need to think about when we are doing our design.”

1. Natural lighting
2. Greenery
3. Visuals of nature
4. Water elements
5. Opportunities to interact with nature
6. The scents of nature
7. Natural materials
8. Natural heating and cooling

Archie, Remy and Oliver

After researching natural materials online, students investigated properties of materials through a hands on experiment, ‘Mr Bean’s new shoe’, examining choice of materials to fit a purpose. Students also developed a range of scientific vocabulary to describe the properties of materials.

Science understanding for chemistry - Natural and processed materials have a range of physical properties that can influence their use. Students group materials into either natural or processed materials, and explain how the properties of materials determine their use. For example, when choosing building materials, wood is a natural material which is strong and can be cut, whereas concrete is a processed material which is also strong but can be moulded.





'We chose cardboard for most of the shoe because it is stiff and holds together. We put cloth on the inside so that it is soft for your foot. We also put cloth on the outside so that it was colourful. We used pipe cleaners because they can twist and hold the shoe together.'

Asher and Jack



Herbie, Jarvis and Anthony with their shoe design.

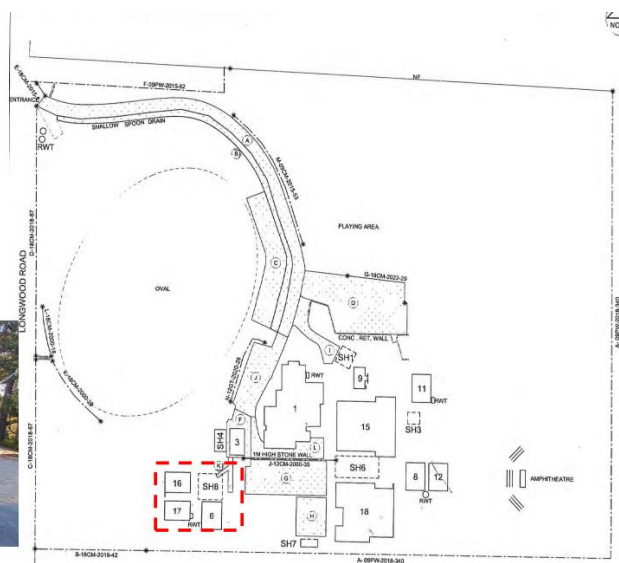


Tilly, Autumn and Sofia with their shoe design.

Plan

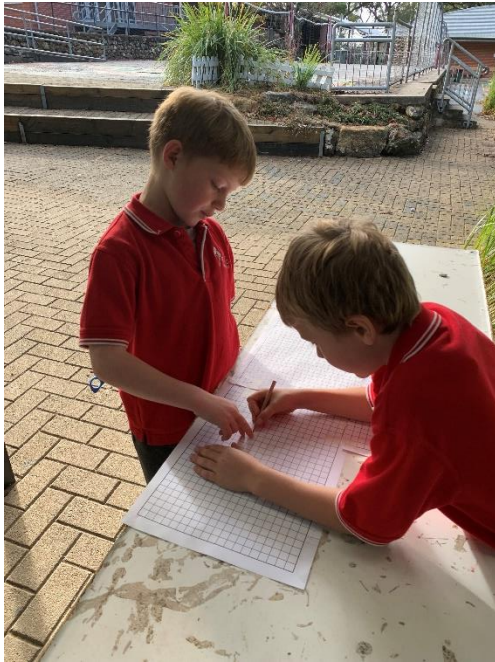


**PROJECT AREA**  
Buildings 6+16+ 17 +SHB

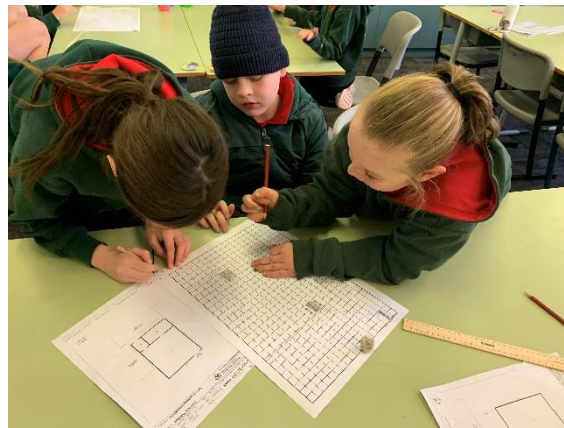


With questions answered and a greater understanding of biophilic design students started to plan a design for the 4 learning areas.

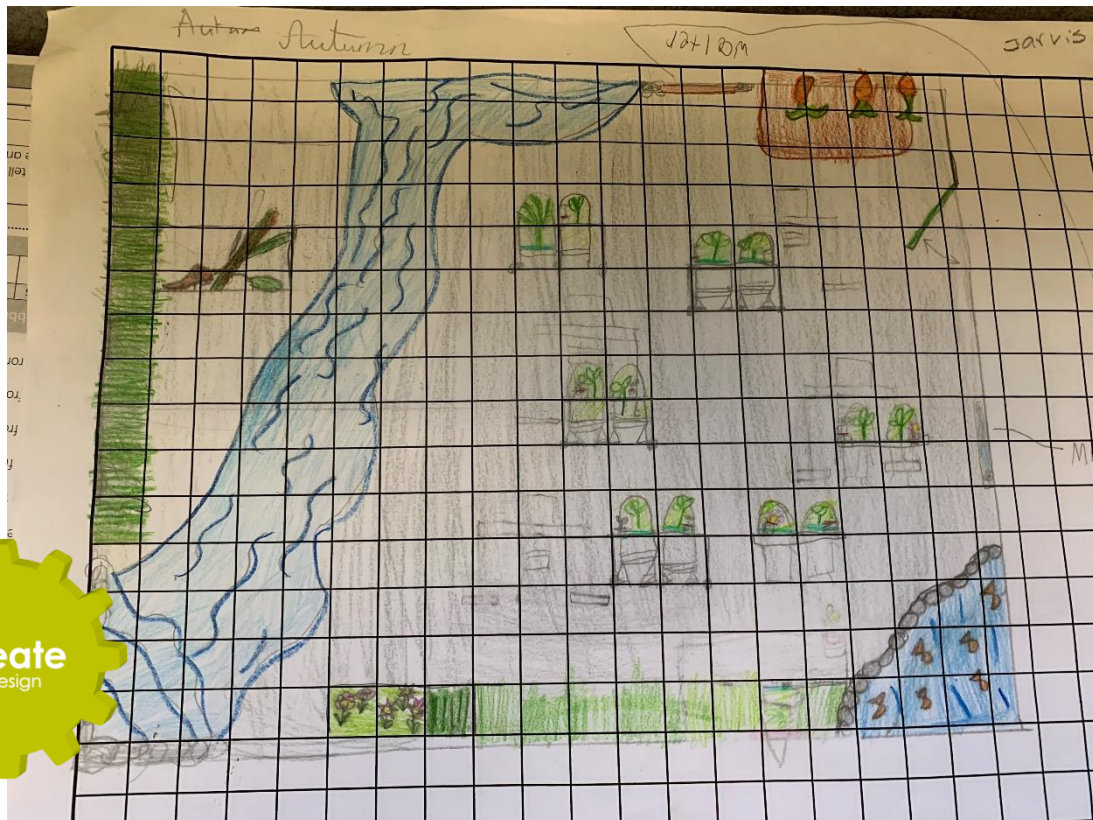
This was not challenging in terms of selecting appropriate materials and understanding the needs of each space however converting those ideas to a scale drawing took a great deal of learning about measurement, scale and space. Whilst students grasp some of these concepts working with Dr. Shokry applying this was challenging. Students developed their plan over several weeks consistently revising and redesigning their plan.



Daniel and Herbie use grid paper to be able to scale their design appropriately.



Eliza, Harley and Tilly use the school building diagrams to ensure their design has the correct dimensions.







Students' scaled and dimensioned drawings







### Critique

Dr Shokry returned to the classroom to talk to the students about their designs. Using the success criteria and limitations established by the students. Dr. Shokry gave the students feedback for improvement. Feedback can be difficult for students to take on as they are so invested in their solutions, however students listened to Shokry's suggestions and recorded improvements to be made.



### Redesign

Students redesigned their solutions and used their 2D design to guide their 3 dimensional modelling in Minecraft.

The students have created movies of their online Minecraft collaboration.

[https://youtu.be/hcbCmapj\\_jo](https://youtu.be/hcbCmapj_jo)

<https://youtu.be/4uY86jcSGDk>



In the videos you can see that students have incorporated biophilic elements but further to this they have thought about the needs of the living things including food, shelter and light. The materials they have used have been thoroughly considered and you will see lots of wood and rammed earth as well as recycled materials for sustainability.

Whilst the students did not quite complete their Minecraft 3D design by the time this project report had to be submitted they will do by the end of the term and then they will invite Dr. Shokry back to school to present their designs back to him. They will also write a persuasive piece and present to the school principal next term.



### Reflections

Eliza

Our design is very full, we have skylights and natural air-conditioning. We also have plants everywhere. We have fish tanks which are very nice. There is a lot of stuff in the classroom but it would be a nice place to have a class. I think it would feel calm but interesting because there would be a lot to look at. I really liked working as a team together to create ideas with each other. We had lots of choices to make but we also had to think about what we needed and what was the biophilic elements.

Jarvis

The special features of our design are the fishpond and a pet rabbit. I think it would feel calm listening to the water in the classroom when you are doing your learning. It was really good to be able to work together on Minecraft to be able to show the designs. We all had a part and added it to the design in Minecraft.

Remy

Our design has a strawberry farm. When I was doing research I found out all of the things you need to make your design biophilic. We have put all of these things in our design. We shared this with the class. It helped them too. My favourite part was that I enjoyed the fact that you can use Minecraft as a tool to learn about biophilic design.

Anthony

In our design we have changed the roof, we have put glass to let the natural light into the classroom. It looks cool and it is natural light. We have used natural materials like wood. We have strawberries to grow fresh fruit. So we can do gardening in the classroom. The learning environment would be pretty nice because you would have the noise of the guinea pigs? I'm not sure the little animal noises. I really enjoyed working out how long with the building was and all that sort of stuff with the dimensions in the space and the design doing the design. We have strawberries to grow fresh fruit. So we can do gardening in the classroom.

#### Further direction and questions

We would like to make the biophilic changes in the classrooms and then find out if that makes a difference to health and wellbeing. We think we know a lot about what Biophilic design is and how you can use natural materials in the right purpose but what difference will it make to our learning? We are still wondering this. We do think that the process has been really fun and we have spent lots of time learning about this in Biology as well. We worked like scientists together to solve the problem. Working together on Minecraft to design the classroom was very different and we were really focussed on this. We would like to continue this project for the rest of the year.

Frankie and Toby