WESTEM SHOWCASE

2021–2022 PROJECTS

TE HONONGA AKORANGA
COMET

Ministry for Pacific Peoples
Te Manatū mō ngā Iwi o te Moana-nui-ā-Kiwa

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INTRODUCTION

Kia ora and welcome to the WeSTEM Showcase for 2021–2022!

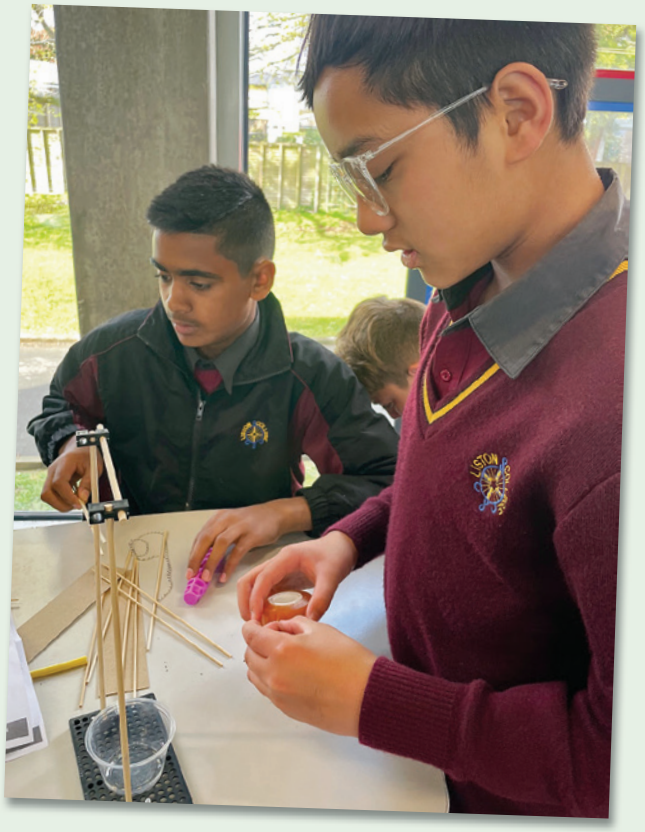
It has been an incredible period of STEM learning in west Auckland as we have watched WeSTEM grow from its initial pilot in 2021 through to a full programme in 2022, despite the ongoing challenges arising from a worldwide pandemic.

This showcase highlights the innovative and inspiring work of students across west Auckland. Many of our projects from this time feature a connection to te taiao (nature), reflecting the west Auckland spirit of caring for the local environment. Through this, our groups have contributed remarkably towards having a positive impact on their respective communities.

It has been especially exciting watching the collaborations grow between education partners, STEM experts and the community as the learning moves beyond the classroom. All the students involved should feed incredibly proud of what they have achieved.

We at Te Hononga Akoranga COMET are so excited to see the WeSTEM programme continue to grow and look forward to another year of STEM engagement in our community.

Dr Sneh Patel
WeSTEM Project Manager



PROJECT CRITERIA

PARTICIPATORY SCIENCE PROJECTS MUST BE:

EDUCATIONALLY VALUABLE

Offer enduring educational value and two–way learning opportunities for those involved

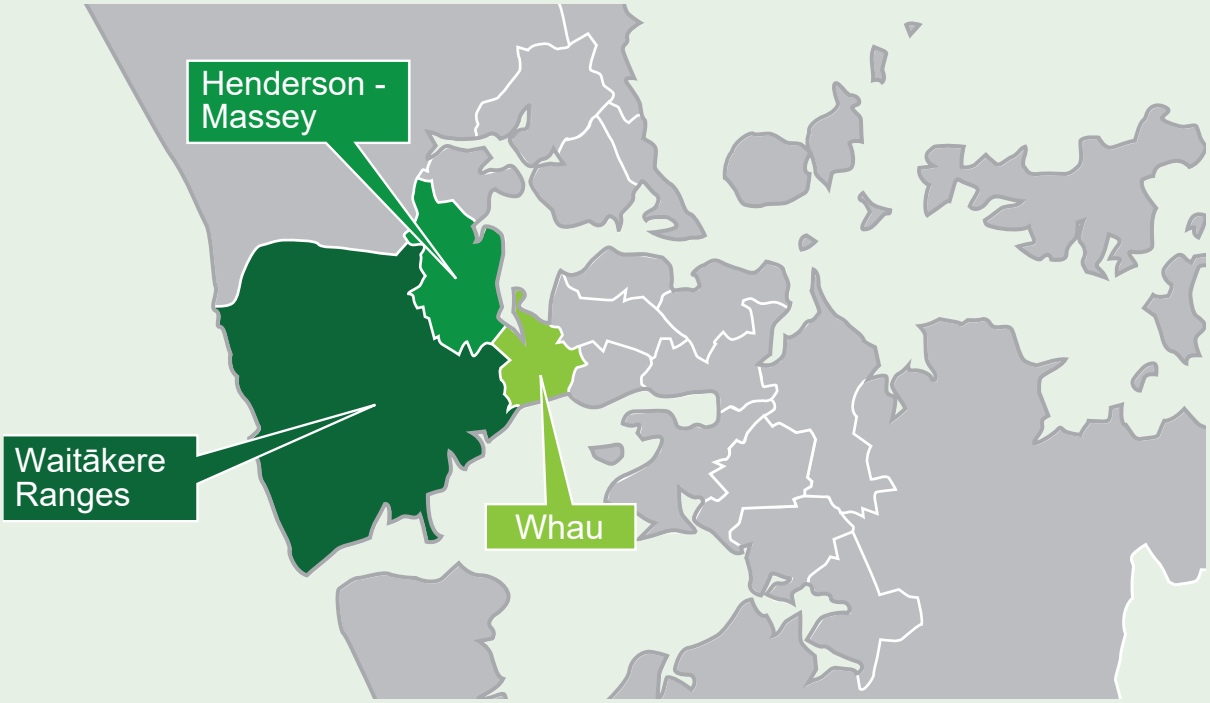
SCIENTIFICALLY ROBUST

Tackle a research problem in partnership with STEM experts, to generate new scientific and/or technological outputs

LOCALLY RELEVANT

Involve community members in research that is engaging, locally relevant and community driven

ELIGIBLE FUNDING AREAS IN AUCKLAND:



PROJECT DATA (2021–2022)

PROJECTS FUNDED

YOUNG PEOPLE ENGAGED

SCHOOLS INVOLVED

ORGANISATIONS INVOLVED

$86,000

IN FUNDING DISTRIBUTED

2021 PICO PROJECTS

SINA MA LE TUNA

LEATAATA O TUPULAGA OLE PASEFIKA

Inspired by the legend of* Sina ma le Tuna*, 35 tamaiti at Leataata Preschool in Massey studied the important role eels play in the ecosystem. They received guidance and support from Whitebait Connection, a conservation education programme funded by the Mountains to Sea Conservation Trust.

The project began with the children drawing pictures to show what they already knew about tuna (eels). Many of them drew long, snake-like creatures with a few eggs.

Next, Whitebait Connection ecologist Laura Torre guided the tamaiti through an exploration of eels, including their life cycle and optimal living conditions.

The children then visited their local awa to look for eels and to investigate the quality of the stream environment. This trip helped them understand the importance of keeping our waterways clean and healthy for the eels. To improve the living conditions for the eels they found, the tamaiti participated in a clean-up of the awa.

As the project wrapped up, the tamaiti took a trip to Auckland Zoo to see the eels there, presented their findings to their aiga and performed a school play based on the legend of *Sina ma le Tuna*, which explains the origins of the first coconut tree in the Pacific.

This being the first time the teachers had worked with an external science expert on a project, they valued Laura's expertise and her skill at communicating clearly with the children. They enjoyed the experience so much they would like to undertake more scientific enquiries.

The teachers also learnt new facts about eels and appreciated Laura's tips on how to conduct scientific research. They even created a story book about the project, which they shared with their local ECE network.

This project proved to be a simple yet effective way to integrate art and guided scientific enquiry with traditional knowledge, language and culture.

> ***"The kids were very excited about this project and shared their knowledge extensively with their parents."***
>
> **Leilua Suamasi, lead teacher**
> **Leataata Preschool**

ABOVE THE RIM

RANUI 135

Have you ever considered what it takes to get better at a sport? Can you train smarter to increase your strength and jump higher? Eighteen rangatahi from Ranui sought to answer these questions with a self-driven project designed around improving their basketball skills.

First, the rangatahi tested their athletic ability using equipment from the University of Auckland's School of Exercise Sciences. University lecturers Dr Rebecca Meiring and Dr Angus McMorland were on hand to provide guidance and expertise.

> ***The rangatahi created an environment for themselves that was fun, enabled them to explore new avenues and broke down the perception that science is daunting.***
>
> **Jordan Polima, project lead**
> **Ranui 135**

With the aim of improving their basketball skills, the students then developed a robust, six-week training programme targeting specific muscle groups. To test how well the programme worked, the students planned to have a control group complete a generic exercise regime for comparison purposes. This aspect of the project was not completed due to COVID-related complications.

The rangatahi enjoyed working with the two scientists, visiting the university exercise labs and learning about the different equipment and testing methods. The project opened their eyes to the science behind sport and the importance of understanding things like anatomy and physiology.

According to project lead Jordan Polima, the project experience also "*increased potential pathways for coaching, teaching and physiotherapy sporting avenues*" for the rangatahi.

Although COVID severely impacted the group's ability to complete their research, this project nevertheless demonstrates how STEM education can be paired with the interests of rangatahi to engage them in pathways they may not have considered previously.

2021

TE MĀRA RONGOĀ O ONEWHEROWHERO

KELSTON INTERMEDIATE SCHOOL

For centuries, Māori scientists have been using rongoā for their health and well-being. Many native plants are known to have medicinal properties, but it can be difficult to identify which plants are appropriate to use. Students from Kelston Intermediate School sought to find the answer while cultivating their māra rongoā (medicinal garden).

This project involved 30 students from the Towards Our Positive Success (TOPS) programme. These students were all keen to learn about gardening and horticulture in class.

The students worked with the local iwi, Te Kawerau ā Maki, and Sustainable Schools to research and place rongoā plants in their garden.

Each student was allocated a garden bed and given the responsibility of maintaining it. When the weather allowed, the students worked hands-on in their garden plots.

On rainy days and during COVID lockdowns, the students took time to learn about plant biology as well as the medicinal properties and traditional uses of various plants.

To challenge the students, project lead John Hughes tasked them with identifying "unknown" plants he provided using the knowledge and skills they'd developed.

Once the students had identified a given plant, they produced signage to put in their garden plot to educate their peers on that plant's unique properties.

The school now plans to extend the work in the garden as part of a newly funded project focusing on fungi (see *Fungi for the Community* on page 21). Working with the Mushroom Smith, students will explore the different local fungi as they find ways to provide for their community.

BUG AND INSECT SANCTUARY

GLEN EDEN PRIMARY SCHOOL

Twenty-four tamariki from Glen Eden Primary School became budding entomologists as they developed a 'bug hotel' to promote biodiversity in the school garden.

To start their project, the Year 2 students conducted a pre-project survey of the insects in the school garden. While they found plenty of worms in the compost bin and snails among the māra kai, they struggled to find any butterflies.

The tamariki followed up on their garden survey with an investigation into the environments in which particular insects prefer to live. This knowledge helped them to ensure their sanctuary design included a comfortable place for every insect.

> ***"The students were all so enthusiastic and engaged at every step of the way. They loved finding all the different things that existed in our garden, and it changed the way that they interacted with the space."***
>
> **Nicole Tamepo, lead teacher**
> **Glen Eden Primary School**

To complete the project, the tamaraki built a 'bug hotel' that connected all the elements of their learning to bring thriving wildlife into the garden space.

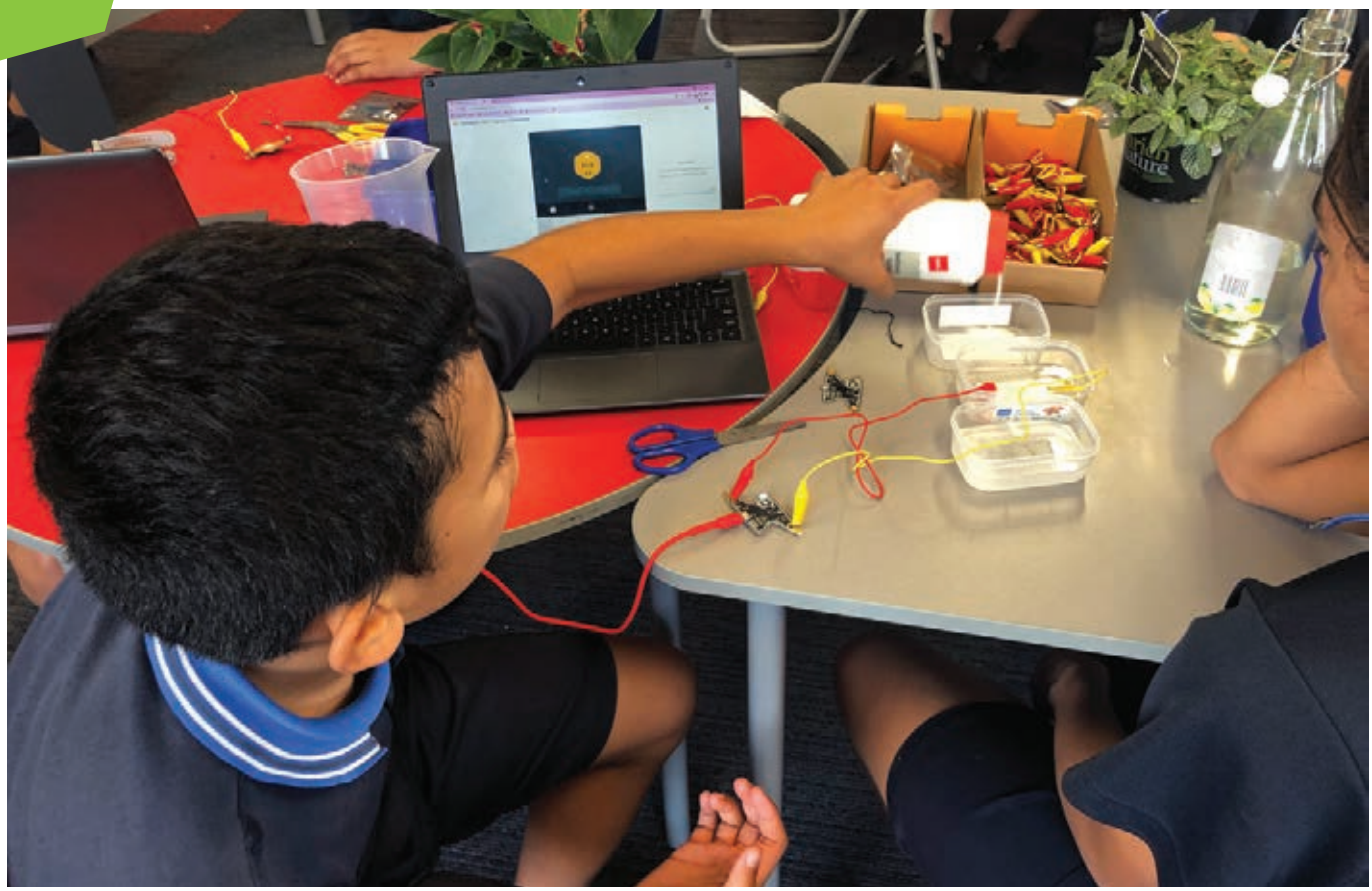
The children also produced infographics and posted them around the garden to educate their peers about the various species they could find in the sanctuary.

For lead teacher Nicole Tamepo, it was inspiring to see her class take ownership of the school garden and feel responsible for it.

Nicole adds that the students' enthusiasm for the project not only transferred into their work around the bug hotel but also into their writing, maths, research and data collection work.

She is pleased that the school now has a "*special and intentional*" space where tamariki can learn about insects.


BUG HOTEL



KIWRIOUS ABOUT PLANTS

KIWRIOUS LTD + PARAKAI SCHOOL

Fifty-seven students from Parakai School used sensor technologies to investigate native New Zealand plants and their unique properties.

With support from technology education provider Kiwrious Ltd, the students investigated how variables such as light, humidity and temperature can impact plant growth. Their research focused on native plants with traditional medicinal uses, such as kawakawa, ngaio, pōhutakawa and tītoki.

Working in small groups, the students discussed how to test a chosen variable to determine its effects on seed germination and optimal plant growth. Each group presented their plan to another group as part of an experimental design sharing lesson.

Next, the students used the Kiwrious sensors to conduct experiments and learn how to make scientific measurements. They also learnt how their experiments correlated to the traditional uses of the native plants they studied.

For instance, Māori traditionally used crushed ngaio leaves as mosquito and sandfly repellent. The students learnt that this was because crushing the leaves releases volatile organic compounds (VOCs) into the air. They were able to measure the concentration of VOCs released using their sensors.

Unfortunately, a COVID lockdown disrupted the next stage of the project, which would have involved the students germinating seeds in a variety of conditions around their classroom.

Despite this setback, the participants nevertheless gained valuable knowledge about native plants and sensor technologies. The school also continues to have access to the Kiwirious platform for future learning.

2022 PICO PROJECTS

EXPLORING FUNGI ROLES

SUMMERLAND PRIMARY SCHOOL

Aotearoa is home to over seven thousand species of native fungi. An exploration of this plant kingdom was the driving force behind the research enquiry led by 57 tamariki at Summerland Primary School.

Working closely with mycologist Dr Chris Smith, the students began by conducting an audit of the fungi species currently inhabiting the school grounds.

Next, the students learnt about the various types of mushrooms and fungi that grow in their local area. They also worked actively with their whānau to investigate the fungi growing in their own backyards.

With Dr Smith's guidance, the students studied the optimal conditions fungi need to thrive, as well as how to transplant and propogate them.

Dr Smith also showed the students different ways to prepare and cook mushrooms, going so far as to convince one student with an initial distaste for edible fungi to admit that oyster mushrooms were *"actually quite tasty."*

The investigation of fungi drew the students' attention to aspergillosis, a dangerous fungus mould that wiped out 10% of Aotearoa's kākāpō population in 2019. This pushed some of the tamariki into action. Hosting a sausage sizzle at school, they raised $150 to aid in the recovery of the endangered species.

Due to the students' young age, art evaluations were used to determine the project's outcomes. Through various art and question prompts, it became evident that many of the tamariki had gained new knowledge of fungi biology and ecology, as well as an increased interest in exploring nature through a scientific lens. (For more on the art evaluation process, see page 22.)

Lead teacher Amanda Signal found that the project was *"hugely helpful in showing students how learning scientific concepts can be both practical and fun."*

SPHERO BOLT PROJECT

TIRIMOANA PRIMARY SCHOOL

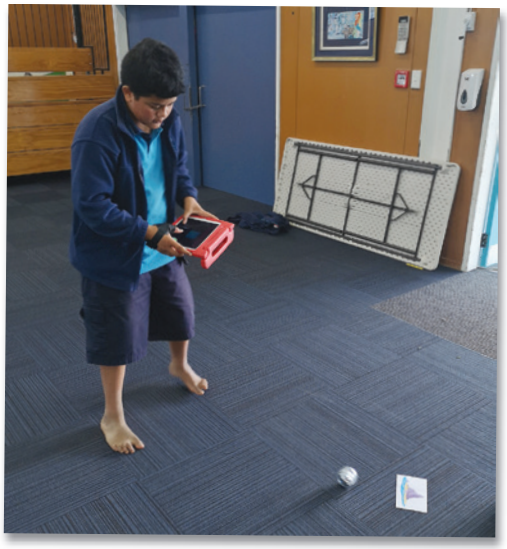
Tirimoana School implemented a tuakana-teina approach to their STEM project, which involved the use of Sphero robots to teach coding and robotics.

With guidance from STEM experts Ron Amosa from Amazon Web Services and Grace Thompson from the University of Auckland's School of Computer Sciences, the young Pasifika leaders in Years 5–6 learnt to code and control the Sphero robots.

These older ākonga passed on what they learnt about coding to their peers in Years 3 and 4, reinforcing the tuakana-teina relationship in their learning. Working as role models, the older students were able to teach the younger ones in a way that was relatable and simple to understand. As the project continued, the students began to take ownership of their own learning.

The school intends to continue this learning into 2023, with a plan for the teachers to develop skills in computational thinking. The teachers will then work with the Pasifika student leads to continue to develop the programme for ongoing learning throughout the year.

> ***"The older students embraced the opportunity to work with the younger ones. They found it fascinating to watch the progression of knowledge and development of confidence amongst their younger peers."***
>
> **Wendy Lidell, lead teacher**
> **Tirimoana Primary School**



KITCHEN CHEMISTRY

KELSTON GIRLS' COLLEGE

It might not seem obvious, but a lot of maths and chemistry goes into baking the perfect chocolate cake. That's what the junior students at Kelston Girls' College discovered while investigating the every day chemistry processes that occur during cooking.

This transdisciplinary project integrated English and chemistry topics to inspire students through fun, hands-on experiments that also helped them develop their numeracy, literacy and scientific skills.

Throughout the project, the students focused on Pacific food and preparation (e.g. fa'ausi). This showcased different cooking techniques and chemistry processes.

To add to their understanding, the rangatahi received a visit from Amy Maslen-Miller, who discussed her PhD research on the revitalisation of traditional Samoan diets.

The students also took a field trip to Massey University's School of Food and Advanced Technology, where they received a tour from senior lecturer Dr Tony Mutukumira.

A final experiment involved testing different chocolates to determine which one created the best ganache.

To understand the highly technical aspects of cooking with chocolate, the students studied the chemistry behind the emulsion and how the fats and oils impact the texture of ganache. They then visited the Kitchen Collective in Glendene for a practical lesson on tempering chocolate with chocolatier Tom Hilton from Ao Cacao.

> ***"Chemistry can seem a bit dry and abstract, but the process of learning the science, doing the hands-on experience, and writing up the formula makes everything tie together, and you can see that little light bulb go off."***
>
> **Rebecca McGrath, lead teacher**
> **Kelston Girls' College**

Scan this code to watch the project video.

2022 SCIENCE IN ACTION PROJECTS

REGENERATIVE GARDEN DESIGNS

MATIPO PRIMARY SCHOOL

Students at Matipo Primary School undertook a design challenge to convert old, unused spaces at their school into green play spaces using their maths, biology and horticulture skills.

This multi-faceted project focused first on a large, overgrown space outside the school office. Led by garden-to-table specialist Hollie Colegate, participants brainstormed how best to utilise this unused space, eventually settling on an edible food forest.

> ***"The project has opened our community's eyes to more sustainable ways of planting and gardening. It has also provided an example of the amazing, mutually beneficial relationships between plant species and invertebrates."***
>
> **Hollie Colegate, project lead**
> **Matipo Primary School**

Next, the students investigated ideal growing conditions for fruit trees and determined which companion plants would help their garden flourish best. They learnt about optimal sun, wind and shade amounts, and they also considered the plants' water needs, soil acidity, size and compatibility. They rounded this part of the project off by designing an irrigation system to sustain the garden over summer.

Following the planting of this edible forest, the students turned their attention to an old shipping container on the school grounds. Their initial plans involved a play space with a living roof and walls, but when concerns were raised about roof access, they opted for a shaded pergola instead. They also decided to make the space a "chill out" zone.

By working with local scientists and community partners such as mycologist Dr Chris Smith and Lila Kuka from Te Wai o Pareira / Rivercare Group, students gained a greater appreciation for environmental science and the engineering design process.

For the teachers, the ultimate reward was seeing the participants' learning develop into practical new education and recreation spaces that Matipo students can enjoy for years to come.

MAKE ME A MATHS GENIUS

Matipo Primary School also started a WeSTEM Pico Project in 2022. Designed for students who were less confident and less engaged in maths, this project moved away from standard maths teaching methods and instead applied mathematical principals to real life scenarios, making the learning more relevant to the students.

Lucie Cheeseman from Maths Matters was heavily involved in the implementation of this project, working closely with the teachers at the school to ensure best outcomes were met.

Due to a delay in the delivery of required resources and a late start to the project, the students will continue this learning into 2023.

LICHENS AS BIO-INDICATORS OF AIR QUALITY

AVONDALE COLLEGE

Sixty senior students at Avondale College embarked on a project to investigate how lichen can be used as an indicator of air quality in urban areas.

In this project, students engaged with the full scientific process of collecting, characterising and analysing samples before publishing their findings.

As part of this process, they collected lichen samples from around the school grounds and the nearby industrial area as well as from Huia Domain in the Waitākere Ranges. They then compared the various samples.

Numerous science experts came to the table. Dr Adam Martin and Dr Rose Turnbull from GNS Science taught the students how to use X-ray fluorescence to identify inorganic elements present in the samples, while Dr Joel Rindelaub from the University of Auckland assisted with the analysis of the samples' organic components.

Students learnt about the various inorganic elements that could be identified in the lichen, and how this differs between industrial, urban and rural areas. For example, lichen near a petrol station has high levels of cadmium from the cars, while lichen near the school fields has high levels of copper from fertilisers.

Perhaps the most fascinating find was curiously high levels of pyrene in the samples taken from around the school. After some investigation into the cause of this, the students were told the story of a fire that burned down a third of the school in 1990. This demonstrates how lichen can act as a source of local history, holding on to information from over thirty years ago.

The next stage of the project was to introduce a citizen science element, allowing the general community and public to be involved. The first step towards this was a community evening that Avondale College hosted to share their results with the public.

A summary of the techniques that were used to sample the lichen was provided to inform the public, followed by a summary of the results and outcomes by the teachers and students.

Scan the QR codes below to see the data for yourself.

sampling location map *raw data and graphs* *presentation*

PROJECT STEM RENEWABLES

LISTON COLLEGE

The Liston College Enviro Group have been working on their school garden since 2018. Last year, they started thinking about more energy efficient ways to water the garden as part of a plan to expand the space. Out of this grew the plan for their STEM Renewables project.

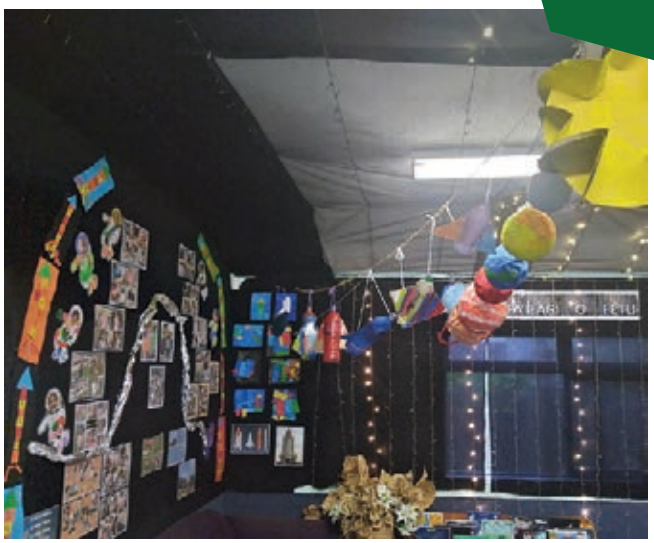
The garden sits on the other side of the Liston College carpark from the school buildings. The students realised that collecting water from the school roof and pumping it around the carpark to the garden would use large amounts of electricity.

To save the school money, the students opted to find a renewable energy source to power their watering system. Under the guidance of MOTAT science educator Damon Kahi, the students eventually settled on solar panels.

The whole school participated in the design of the watering system. Maths and physics were a heavy focus as the students needed to consider the distance the water had to travel, the pressure necessary to pump the water to its destination and the volume of tank storage needed to ensure the garden received enough water to survive over the summer.

The efforts the students put into Project STEM Renewables resulted in the design and installation of a solar-powered water pump system on the school grounds. The system uses dual pumps to ensure adequate water flow and reduce noise.

Lead teacher Tony Worth says the project resulted in the students gaining "*confidence in things they thought impossible,*" essentially giving a half-acre of wasted space a renewed, sustainable purpose. It also succeeded in increasing awareness of STEM opportunities amongst the school's Pasifika students and their families.



TAFĀ'ILAGI O FETŪ – EXPLORING ASTRONOMY

SAASIA INC

Following a successful astronomy project with Curious Minds in 2021, SAASIA expanded their inquiry-based learning approach into west Auckland with Lupesina Aoga Amata and Aoga Amata PIC Avondale.

This enquiry had a strong Pasifika focus from the start with the tamaiti studying how Samoans traditionally interpreted astronomical phenomena to influence their daily activities.

Talanoa also featured heavily, with community members sharing stories, myths and songs about Samoans using observations of the sky to tell the time, predict weather events and identify the best time to harvest crops.

The children also visited the Stardome Observatory to learn about planets, stars and the phases of the moon. This science learning was extended with a visit from Dr Niven Brown, an astronomer from the Auckland Astronomical Society. Dr Brown brought a large reflecting telescope that the children used to observe the sun and the moon. They also made their own observations using telescopes and binoculars purchased with their WeSTEM funding.

To help consolidate the learning, the tamaiti learnt songs and dances that they performed for their families, including the legend of *Tala ' I Le Mavaega A Sina*, which tells the story of Sina's promise to create the moon. The teachers hope to create a digital version of this story in the future so they can continue to share their knowledge with the wider public.

They also created artwork, including papier-mâché planets to transform their classroom into an astronomical space. (For more about the art evaluation process, see page 22.)

WATER FOR THE GARDEN

TE ATATŪ INTERMEDIATE SCHOOL

Forty-one students at Te Atatū Intermediate School sought to reinvigorate their school garden through an investigation into the importance of water in a garden.

The project started in the classroom, with the students researching different types of water (e.g. rain water, tap water, salt water, etc). They also studied how different variables — such as pH levels, temperature and salinity — can affect the water to make it more or less suitable for growing plants. This research served to emphasise just how important water is for sustaining plant life.

Next, Dr Kathy Waghorn from AUT's School of Future Environments guided the students through planning and designing an architecturally sound garden. From there, the students got to work creating a tidy space in which their vegetables could grow and installing a new water tank and irrigation system to help sustain their plants.

The installation of the watering system was just the start of a longer term project for the school. Over the course of 2023, the students will put their knowledge into action, discovering what fruits and vegetables grow throughout the year and which conditions are necessary for the plants to survive.

For this next stage of the project, the school is partnering with local community gardener Matua Hone Pene, who will work with the students to investigate ways in which they can improve their harvest so they can provide food for the community.

> ***"This project has changed the students' understanding and perception of STEM through their teaching partners and exciting experiments, as well as through starting something from scratch and seeing how it can develop into something tangible."***
>
> **Amber Aratema, lead teacher**
> **Te Atatū Intermediate School**

2023 PROJECTS

FUNGI FOR THE COMMUNITY
THE MUSHROOM SMITH

Following a successful partnership with Summerland Primary School last year, west Auckland's resident mycologist, Dr Chris Smith, is continuing to grow a love of fungi with Kelston Intermediate School, Saint Dominic's College and Waitākere College.

Students at these schools will study different aspects of the fungi plant kingdom, employing a Tuakana–Teina approach that will see them collaborate and share their learnings with the wider community.

MEASURING MAURI – WETLANDS AND WATER
MATUKU LINK + HENDERSON NORTH SCHOOL

Set in the backdrop of the Matuku Reserve wetlands, this project will see students from Henderson North School work with the Matuku Link conservation team to undertake an investigation into the importance of wetlands and streams for human health.

The project will have a strong a focus on stream quality and biodiversity monitoring, which the students will use to compare the wetlands with their local stream.

TE WAIORA O TE AWA
MPHS COMMUNITY TRUST

MPHS will undertake a research project on the health of their local Opanuku and Oratia awa. They will investigate the water quality and see how recent flood events have affected stream modifications, bank stability and erosion. They will also investigate the effect this will have on the biodiversity of the two awa.

ADOPT AN ECOSYSTEM
SAASIA INC

Tamaiti at two west Auckland aoga amata will conduct a scientific enquiry into the biological processes that take place inside an ecosystem.

Featuring a partnership between Rosebank Early Childhood Centre, Taulapapa Leata Su'a Aoga Amata and the Auckland Teaching Gardens, the children will learn how to create and sustain an ecosystem by building terrariums in the classroom. Over time, they will monitor the growth of living species inside this small environment.

TE MOHIO KI REIRA KO RUTHERFORD COLLEGE
RUTHERFORD COLLEGE

In collaboration with Te Pūnaha Matatini, rangatahi in Te Atatū Peninsula will embark on an exploration of what it means to be a student at Rutherford College as experienced through cutting-edge technology.

Senior students involved in an internship programme will create a VR experience of the school to help alleviate anxieties for new students and whānau.

The enviro group will undertake a further exploration of the health and biodiversity of the local Pixie stream, accessing new technology that can complement traditional tools used in stream monitoring.

LICHEN AS BIO-INDICATORS OF AIR QUALITY (EXTENSION)
GREEN BAY HIGH SCHOOL

Building on Avondale College's successful experiment on how lichen can tell a story of the local environment (see page 18), students at Green Bay High School will extend this study in their local area.

This project extension will continue the ongoing collaboration with scientists at GNS Science in Dunedin, which will see three Year 12 project leaders visit the science lab to conduct the analysis of lichen themselves. These project leads will then employ a Tuakana-Teina approach and share their learnings with students across three Year 11 classes.

PUTTING THE ART INTO STEAM

Curating data analytics to fit participants' skills and abilities is critical for ensuring accurate, effective and efficient data collection. Here, Dr Rajshree Krishnan explains how Te Hononga Akoranga COMET uses visual evaluation as a method of engaging with and learning from our project participants.

In a bid to continually improve and grow our data collection and assessment process, we explored using visual assessments with our younger participants to gauge both their learning and the overall success of their project. We not only learnt that the students increased their understanding of the topics they explored but also that art is an excellent way for students to communicate their understanding.

Visual assessment, or visual evaluation, is the process of using drawings to assess learning outcomes and retention of information.[1] This process involves the use of visual aids — such as drawings, diagrams or charts — to evaluate learning outcomes and assess the effectiveness of teaching methods or educational interventions.

There is also a large body of research that supports the use of drawing as part of learning science.[2–5] Advocates argue that integrating art into STEM subjects helps students understand the inter-relatedness of everything they learn and promotes creativity and collaboration.[4]

The arts also play a role in the development of reading, imagination, creativity and more. Integrating art makes STEM subjects more engaging and accessible. Art can help students visualise complex concepts and retain information more effectively. It can also break down cultural barriers and facilitate conversation. For example, SAASIA used art as a tool to teach STEM concepts in their *Tafā'ilagi o Fetū* project (page 19), where the whole classroom ended up decorated with students' artwork related to the stars and planets.

We documented the benefits of employing art in visual assessments in two of our projects: *Sina ma le Tuna* (page 6) and *Exploring Fungi Roles* (page 12). In both instances, we first asked the students (aged 3–11) to draw on their existing knowledge and understanding about a certain topic — in this case, eels or fungi. As the projects concluded, we hoped to see an increase in the students' knowledge and understanding of their topic. To that end, we asked them to draw those concepts and ideas again.

In some cases, the students were presented with their original drawings and tasked with reflecting on and discussing how their two drawings differed and what new information they had gained during the project.

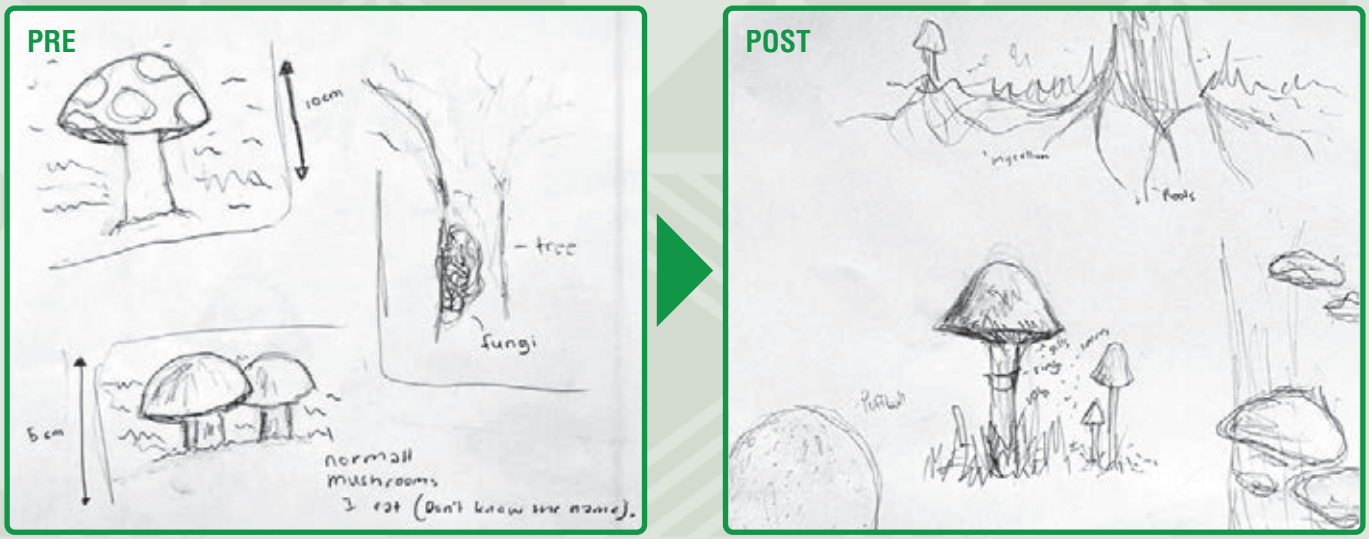
In other cases, groups of students were presented with their original drawings and asked more complex questions to demonstrate new knowledge through dialogue and more detailed second drawings.

SINA MA LE TUNA

"Tuna live with other animals in the water. Tuna like to eat bread."

"Tuna live next to rocks in the water and eat worms and seaweed."

EXPLORING FUNGI ROLES



"There are many types of mushrooms."

"Fungi share resources underground and also [with] trees."

The growth in the students' understanding of their topics was unmistakable.

Most students showed an increase in knowledge and built on their previous drawings. Some found their previous drawings amusing and showed pride in their newly gained confidence and understanding of their research topics.

For example, with the *Sina ma le Tuna* project, which looked at the ecosystem and habitat of tuna (eels), students went from describing the eels as "slimy" and "black" to detailing the eels' life cycle, from how they lay millions of eggs to how one can differentiate between a male and a female.

Additionally, with the *Exploring Fungi Roles* project, students noted five facts they knew about fungi at the start of the project and then again at the end. The students' post-project drawings increased in detail and their facts were more elaborate as well as more accurate.

We also noted the use of scientific vocabulary in many post-project drawings. In addition, we found that giving students the opportunity to express their learnings creatively hinted at the areas of learning they found most fascinating, engaging or enjoyable, which can provide teachers with valuable feedback for future teaching.

Data from the art evaluations complemented other evidence collected in the form of questionnaires, final accountability reports (from project leads) and observations.

Through these methods, we concluded that WeSTEM is achieving its desired outcomes in providing exciting and effective STEM learning opportunities for students as well as equipping teachers with more methods for teaching and evaluating STEM in their classrooms.

Contact the STEM team to find out more about how Te Hononga Akoranga COMET can support you with evaluating the effectiveness of your STEM engagement initiative.

References

[1]Evans, W. & Reilly, J. (1996). Drawings as a Method of Program Evaluation and Communication with School-Age Children, Journal of Extension, 34 (6).

[2]Ainsworth, S., Prain, V., & Tytler, R. (2011). Drawing to learn in science. Science, 333(6046), 1096-1097.

[3]Heideman PD, Flores KA, Sevier LM, Trouton KE. Effectiveness and Adoption of a Drawing-to-Learn Study Tool for Recall and Problem Solving: Minute Sketches with Folded Lists. CBE Life Sci Educ. 2017 Summer;16(2):ar28. doi: 10.1187/cbe.16-03-0116. PMID: 28495932; PMCID: PMC5459246.

[4]M.M. Hardiman et al. The effects of arts-integrated instruction on memory for science content. Trends in Neuroscience and Education. Vol. 14, March 2019, p. 25. doi: 10.1016/j.tine.2019.02.002.

[5]Powers, A. (2020). Why Art Is Vital To The Study Of Science, Forbes. Retrieved from: https://www.forbes.com/sites/annapowers/2020/07/31/why-art-is-vital-to-the-study-of-science/?sh=22e4665342eb in May 2023.

[6]Using Art to Teach Science , University of Texas Arlington, 2018. Retrieved from https://academicpartnerships.uta.edu/articles/education/art-to-teach-science.aspx on May 2023.

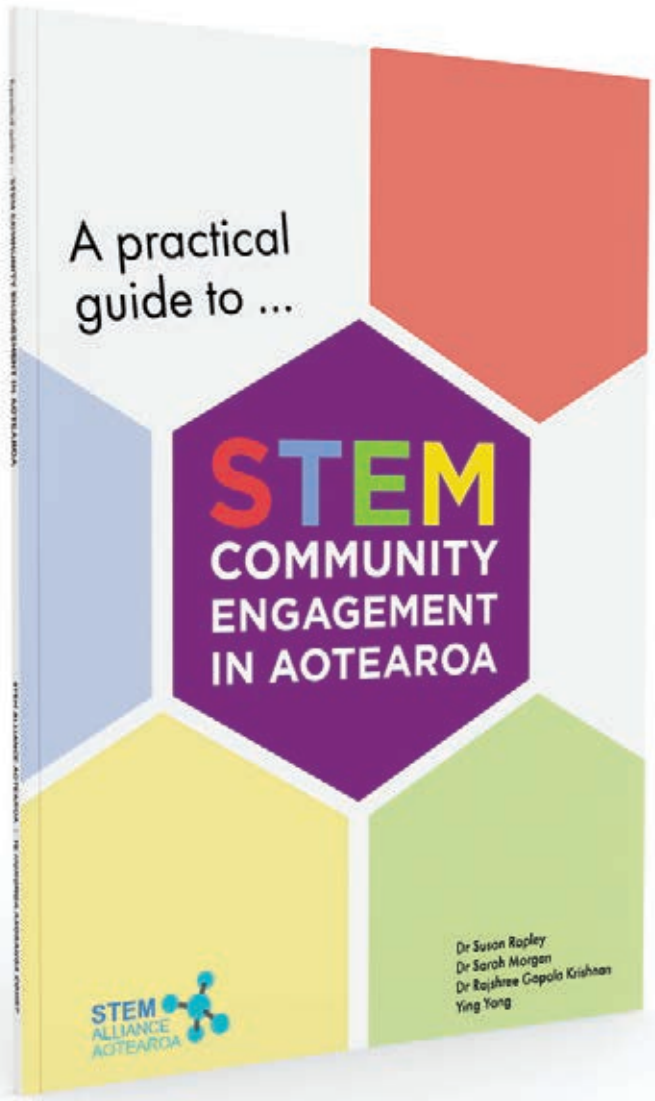
STEM ALLIANCE AOTEAROA

The WeSTEM participatory science platform has consistently shown the value of community and science partnerships for creating engaging opportunities for students to explore science, technology, engineering, maths and mātauranga in real-world contexts.

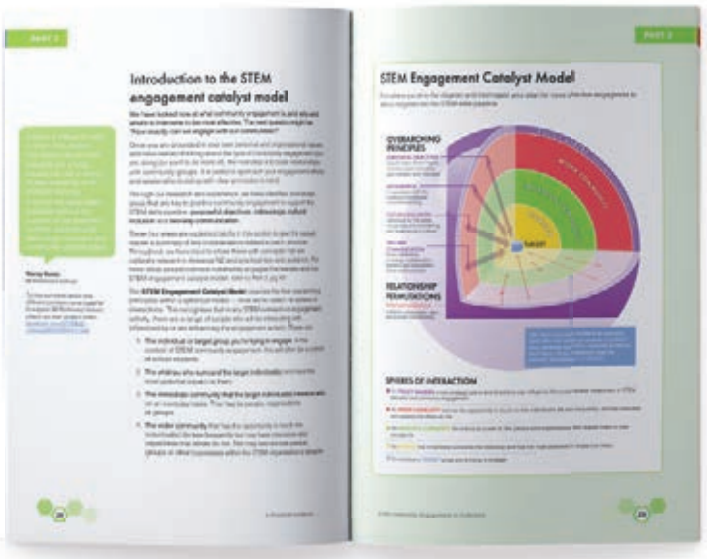
Successful project collaborations rely on a wide range of stakeholders coming together — students, educators, community members, businesses, academics and families.

The STEM Alliance Aotearoa network was created to strengthen these connections across the STEM sector. We provide resources, connections and advice to support businesses, educators and community facilitators to improve outreach and engagement across the STEM education system. Our vision is for a diverse and equitable STEM-literate Aotearoa NZ.

We know that community outreach and engagement initiatives work, but it takes effort. A Practical Guide to STEM Community Engagement in Aotearoa (see below) is an easy-to-use, research-based response to this challenge.



This three-part guide offers advice, tools and guidance to help educators, community facilitators and STEM professionals collaborate to show young people the value of science and technology.



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WESTEM

Te Hononga Akoranga COMET is an independent charitable trust and an Auckland Council CCO championing better and fairer education, skills and lifelong learning for all Aucklanders. We provide high quality and effective research, project development and leadership for cross–sector initiatives and action.

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TE HONONGA AKORANGA COMET

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Te Manatū mō ngā Iwi ō te Moana-nui-ā-Kiwa