



PARTICIPATORY SCIENCE PLATFORM SOUTH AUCKLAND REGION PROJECT SHOWCASE 2015–2017

INTRODUCTION

Everyone has a question: what's yours?

If you had MONEY and EXPERTS to help, could you answer it?

SouthSci is a participatory science platform in south Auckland. It is a new way of connecting schools and communities with science, by supporting them to develop research projects around questions that matter to them. We aim to show our young people the value of science skills and to highlight career pathways through collaborations with local science businesses, researchers and technicians.

Co-hosted by COMET Auckland and the Auckland STEM Alliance, SouthSci is one of three regional initiatives under A Nation of Curious Minds – He Whenua Hihiri i te Mahara, funded by the Ministry of Business, Innovation and Employment.

During SouthSci's first three years as a pilot programme we funded 24 projects, increasing from six in 2015 to 10 in 2017. Three years of trialling SouthSci has demonstrated a keen appetite among communities and schools for these kind of science collaborations. We have seen an

expansion into new areas of science — robotics and chemistry — as well as our first iwi-led project.

There are also signs of longer-term capacity-building and connections for schools, with teachers involved in previous projects stepping up to run their own, and those who had been project leaders now mentoring new projects.

Several SouthSci projects are now receiving ongoing support from research institutions. The 2015 mould project at Rongomai School and Manurewa High School won Unlocking Curious Minds funding in 2016. Led by Landcare Research, the same schools are now looking at dust mites as a better measure of home health than mould spores. Rongomai's 2016 fitness project has spun off into a National Science Challenges project based at the University of Auckland looking at obesity prevention in school children and adolescents.

Fisher & Paykel Healthcare provides engineers as volunteer mentors for SouthSci projects. One focus for the future is to attract more businesses to become mentors and partners for SouthSci projects with schools and community groups.

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ORGANISATIONS
INVOLVED



PROJECTS
FUNDED



SCHOOLS INVOLVED
IN LOCAL RESEARCH

761



YOUNG PEOPLE
ENGAGED IN SCIENCE
AND TECHNOLOGY



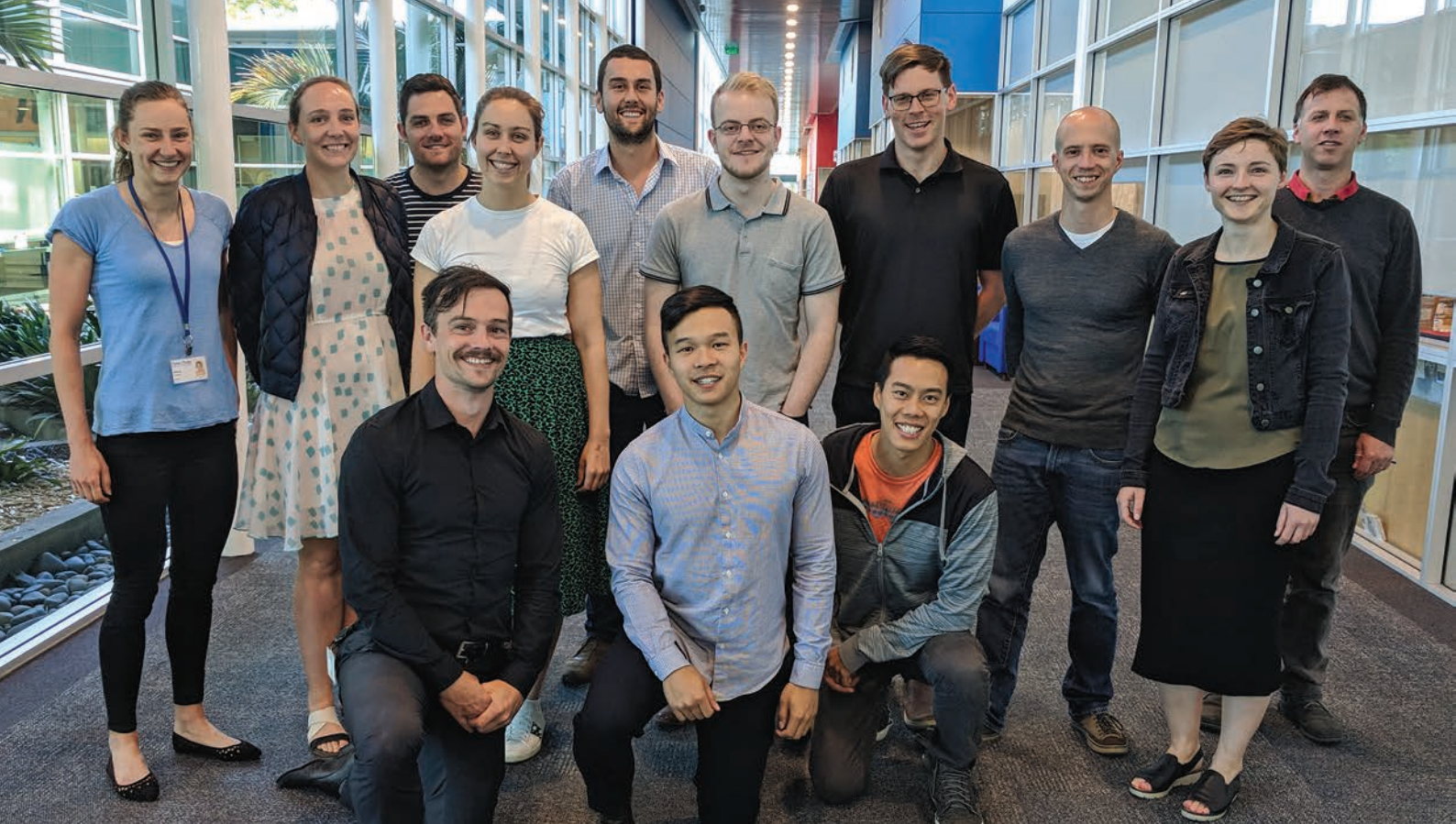
\$375,000

DISTRIBUTED IN SOUTH AUCKLAND

16



STEM DISCIPLINES UNDER INVESTIGATION



STEM INDUSTRY MENTORS

Fisher & Paykel Healthcare is the flagbearer for SouthSci mentoring. A trial with two projects in 2016 has grown into a formal mentoring programme. In 2017 volunteers from the East Tāmaki company supported seven projects, for which they provided technical expertise and help with project planning and occasionally with fabricating prototypes.

For the company and mentors, being involved in SouthSci is rewarding as they are contributing to an important community initiative and helping to inspire our young people about STEM.

Many mentors sign up for professional development but ultimately find the most rewarding part is the positive response from the kids.

The mentors also learn some great skills such as project management, coaching and communication, as they are working with unexpected challenges and unfamiliar situations. These are useful lessons that can be applied in the workplace.

Their other role is to talk about their jobs at Fisher & Paykel Healthcare and to get students interested in STEM and to realise they can have careers in science too.

Fisher & Paykel Healthcare also hosts the annual SouthSci symposium to showcase projects from that year. The company's involvement is part of its corporate social responsibility programme.

"Just seeing the kids so excited about being an engineer or a scientist ... makes it so rewarding to be part of SouthSci. It's fun to work with them and know that we are giving back to a part of the community that doesn't always get the opportunity to be exposed to STEM at such a young age."

– Vicky Gao, Fisher & Paykel Healthcare mentor

Fisher & Paykel
HEALTHCARE

CRITERIA

PARTICIPATORY SCIENCE PROJECTS MUST BE:



EDUCATIONALLY VALUABLE

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



LOCALLY RELEVANT

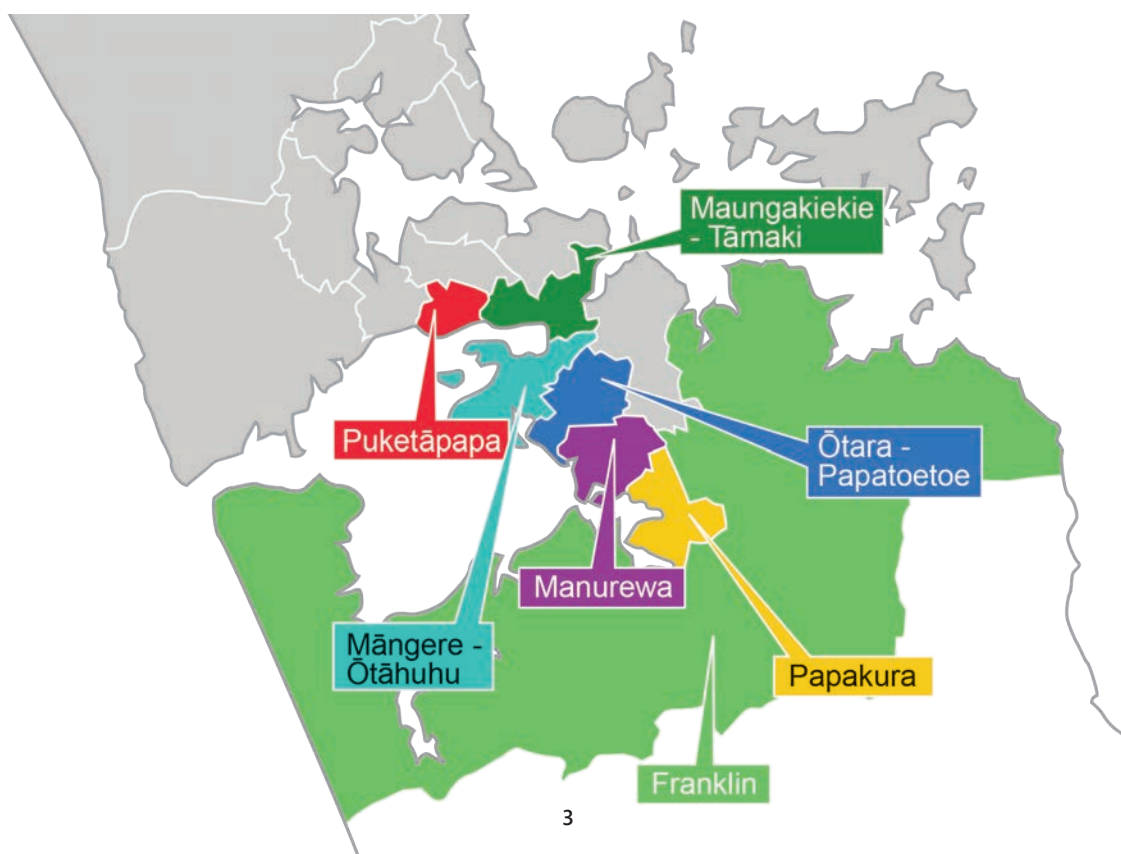
Involve community members in research that is engaging, locally relevant and community-driven



SCIENTIFICALLY ROBUST

Tackle a substantive scientific question in active partnership with a scientist or technology expert

AREAS ELIGIBLE TO APPLY FOR FUNDING:



PROJECT CASE STUDIES

THE MOULD PROJECT

What: Investigate mould in homes in Ōtara and Manurewa

Who: Rongomai School, Manurewa High School; Landcare Research, East Tāmaki Healthcare

Students from the two schools worked primarily with scientists from Landcare Research to collect temperature and humidity data from their homes and take swabs from around windows and walls in places like bedrooms and bathrooms. They also got help from the building industry and their community to plan how to share their journey, scientific results and ideas for reducing mould growth.

The students found mould in 18 of the 22 homes. They also found several yeast strains likely to cause harm, as

well as antibiotic-resistant bacteria. The temperature and humidity levels in all of the homes were likely to allow mould growth.

The students produced a video and created a series of posters and t-shirts, along with a song, both to spread their message (*'Don't hesitate, ventilate!'*) and to communicate that mouldy homes aren't dirty but just need ways to actively manage mould growth.

2015

"When you see it under the microscope ... it looks like insects ... when I looked I knew the mould can make people sick."

– Junior Wilson, age 11



"The whole idea was to get some data without stigmatising anyone. I think within our community, if people have underlying conditions such as being asthmatic and you have the other moulds present, it's just adding to it. We have lots of kids who have coughs and wheeze quite persistently."

– Nick Pattison, teacher & project leader

The Mould Project won Unlocking Curious Minds funding in 2016. Led by Landcare Research, the same schools are now looking at dust mites as a better measure of home health than mould spores.

www.curiousminds.nz/projects/dust-busters/

www.landcareresearch.co.nz/information-for/citizen-science/curious-minds



ŌTARA CREEK WATER QUALITY

What: Find practical ways to restore water quality in the polluted creek beside the school

Who: Sir Edmund Hillary Collegiate; AUT, Ōtara Waterways and Lake Steering Group, Wai Care

The students tested water samples for pH, turbidity, and oxygen saturation measures using state-of-the-art electronic probes. Their recording of data, analyses of data and report writing at the school was all done with help from Dr Armagan Sabetian, head of Applied Ecology at AUT.

As the clearing up and restoration of the creek progressed, students compared water sample data from year to year in order to track the improvements.

The students involved their community in the project via the Ōtara Waterways and Lake Steering Group.

“They learn to keep their environment tidy, why it’s not clean, and who’s responsible for that. They’re now aware of things such as paint and how harmful it can be. When oil or paint is thrown onto the ground it can wash away into the stream.”

– Indrani Wijesundara, senior teacher



KAVA TONGA RESEARCH

What: Compile and communicate research into the effects of Kava Tonga

Who: School leavers; Pupunga Taiafoni Tongan Community Trust, Te Pūnaha Matatini, the University of Auckland's School of Population Health

After a death in the church community, the Pupunga Taiafoni Tongan Community Trust tasked three school leavers with finding out about the University of Auckland's kava research. There were questions over whether heavy kava drinking had any impact, and it was noticed that there was a disconnect between kava facts and general knowledge.

The students completed a study of the current literature around Kava Tonga under the supervision of Tongan researchers from the university during the summer of 2015–16. They each then wrote an essay and a pamphlet to communicate their findings.

The Trust hosted a community meeting attended by about 350 people in February 2016 for the students

to present the results of their research. They explained the positive and negative implications of Kava Tonga consumption, which has helped the community understand the effects of kava on the human body more clearly. It also resulted in a conversation about how a cultural tradition can have negative implications when misused.

The students were able to use the library and meeting rooms at the University of Auckland's Tāmaki campus, the chemistry department and Te Pūnaha Matatini. They also benefited from supervision and support from university staff members and were much better prepared for their future university studies.

2015



“This project has successfully spread both the positive and negative implications of Kava Tonga consumption, as well as a better understanding of how it can affect the human body and general wellbeing. This project proved to be a key conversation point within the congregation and it helped the Tongan community involved acknowledge the issue of how a cultural tradition can have negative implications when misused. This project also helped prepare the students involved for university life.”

– Viliami Bloomfield, project lead



KAI WASTE COMPOSTING

What: Compare gas production from unassisted and microbe-assisted composting

Who: Koru School; Papatūānuku Kōkiri Marae, Sustainable Coastlines

What is the 'fart rate' of different composting systems? To answer this highly scientific question, students investigated whether adding microbes to food waste changes how much gas is made as it breaks down into compost. The project was part of the marae Para Kore (zero waste) programme, which emphasises reuse, recycling and composting.

The students collected kai waste (food waste) from home for a week. They added it to experimental compost barrels — either with or without a microbial starter — and measured the gas changes as the waste decomposed.

They used a gas analyser and found there were four main outputs: methane, oxygen, carbon dioxide and carbon monoxide.

Once the analysis was complete, the barrels were opened and the students spread the compost on the marae's kūmara beds. Students coined the slogan "*Don't be a loser, be a re-user*" during this project. Wearing their specially-designed "green" t-shirts, the students presented their research to the whole school at an assembly.





ORUARANGI AWA RESTORATION

What: Investigate restoring the mauri to the Oruarangi Stream

Who: Aorere College; rangatahi from Makaurau Marae, Ngā Pae o te Māramatanga, Auckland Council, NIWA, Wai Care

Working primarily with experts from NIWA, students collected water samples from two sites and tested them for water clarity, pH, nitrates, nitrites, phosphate and temperature. They found evidence of *E. coli* bacteria at one of the sites. They also found foreign plant species like Phoenix palm, woolly nightshade and privet choking the river banks.

The students set nets to collect animal species and found *Oligochaeta* worms, horsehair worms, damselflies, snails, and mosquitoes. There were also catfish, which

threaten the native species of eel and whitebait. The students noted that there was a lot of rubbish in and around the stream, including a half-submerged trailer!

They shared their suggestions for restoring the awa at a hui with whānau and manuhiri. Classes, schools, whānau and communities could adopt and clean up a stream, plant natives along the stream banks, ensure no chemicals are poured down sinks and toilets, use safe products, and recycle and dispose of rubbish properly.







2015

AIR QUALITY MEASUREMENT

What: Test air quality

Who: Five early childhood centres; Good Seed Trust, NIWA, Fisher & Paykel Healthcare

Five south Auckland early childhood centres wanted to test the air quality in their area after children asked about the smoke coming from a nearby factory stack. There is also a high rate of respiratory illness in the area.

They collaborated with experts from NIWA and Fisher & Paykel Healthcare to develop a tool to measure particulates in the air. The tool allowed the children to interact with an array of sensors and learn about the different aspects of air quality.

Staff members were surprised by the level of engagement among the young children. This was thanks to the great resources available and having experts on site to help with student learning. The staff benefited too and will have more confidence to introduce science topics in the future. They realised their students have a greater capacity for high-level learning than they'd initially thought.



“The heightened level of interest by my daughter and her application of scientific enquiry when we were at the beach or at the park, even in the car, was a revelation.” – parent



DIABETES & EXERCISE

What: Investigate physical exercise for diabetes prevention

Who: Manurewa High School's Health Sciences Academy; the Liggins Institute at the University of Auckland, Fisher & Paykel Healthcare

The Year 11 students worked with the experts to design physical activity interventions for diabetes. Together they then built a database of information that lent insight into both the physical and mental aspects of their interventions.

Using a class set of Fitbit Charge HR trackers, they learned how to collect robust heart rate data before, during and after the intervention to analyse its effectiveness. The students were also interested in emotional responses and designed a survey to capture this information.

The students showcased their progress at the Manurewa High School Health Expo. The Diabetes NZ Auckland Branch van was on site for testing, along with student-designed informational pamphlets and posters, a blind tasting of normal and healthily-cooked traditional foods, and a showcase of their physical activity interventions.

The project provided tangible, real-world context for part of the students' NCEA assessments, with the added benefit of exposure to industry experts and learning about career paths.

“Having the expo to present the findings to the community ... was a huge success. Access to a much greater audience [meant] students felt part of a larger picture of health across multiple disciplines. [They also] learnt how to present their findings in a usable way to their communities.” – Nicole Stevens, project lead

For more information, please visit:
www.sciencelearn.org.nz/resources/2155-getting-to-the-heart-of-diabetes-and-exercise



2016

WĒTĀ WATCHERS

What: Collect and analyse wētā poo to identify what trees they prefer to eat

Who: Rongomai, Bairds Mainfreight, and Dawson primary schools; Unitec, Lincoln University

Students from three south Auckland primary schools installed wētā motels in their school grounds. These are wooden structures with a hole that is big enough to let wētā in but too small for predators. Students collected wētā poo from the motels for DNA analysis.

Aided by ecologists from Unitec and Lincoln University, students extracted DNA and performed gel electrophoresis using a portable Bento lab in their classrooms. The real-time DNA sequencing was done at Unitec, while students used Skype to observe and ask questions.

The DNA analysis determined which trees wētā eat in urban and suburban ecosystems. The aim was to identify their preferred trees so more can be planted to increase wētā numbers. Wētā are also good indicators of biodiversity.

Their project attracted a lot of attention on social media, and Māori TV broadcast a news item about the wētā activity day. A poster was presented at the joint conference of the New Zealand Ecological Society and the Society for Ecological Restoration Australasia chapter in Hamilton in November 2016.

“The wētā poop smelled really horrible but I got used to it ... we had to mix the poop and put chemicals in it. It went into the DNA extractor and it spun around ... I had a great time, it was soo much fun!!!!” – Sativa, 10

Dawson Primary revisited this project in 2017 with a focus on redesigning the wētā houses. See the Wētā House Redesign project on page 31 for more details.

The project also inspired The Science Learning Hub to create new online resources on wētā, wētā poo and DNA: www.sciencelearn.org.nz/resources/1963-weta-poo-and-dna



2016

SCHOOL NUTRITION

What: Investigate sugar, fat, salt and additives in students' lunches

Who: Conifer Grove School; Massey University Albany

The slogan '*Sugar is taking over!*' on t-shirts designed by students from Conifer Grove School sums up the message from their research into healthier food.

The students collected food wrappers from their peers' lunches and analysed the nutritional information provided. With the help of a food technologist from Massey University they also conducted fat, sugar and salt tests, and they experimented to compare foods containing natural and artificial additives.

The research included testing the natural and synthetic ingredients in Skittles lollies, chocolate milk and bread.

They also visited Tip Top to investigate the company's decision to use only natural ingredients.

Students were surprised to learn how much sugar, salt, caffeine, saturated fat and other additives are hiding in their food. They spread their message of eating healthier options to the school community through a symposium, a school assembly, and articles in the school's newsletter and website.

Both students and parents reported changes in what they ate. Parents also said their children were now checking the labels on food packaging.





2016

MANUKAU HARBOUR LITTER

What: Investigate the data patterns of litter collected from around the Manukau Harbour

Who: Koru School, Zayed School for Girls; Papatūānuku Kōkiri Marae, Sustainable Coastlines, Te Pūnaha Matatini at the University of Auckland, Fisher & Paykel Healthcare

The students collected litter from a beach in Māngere to learn about the process of collecting samples for database building. They then did workshops on data analysis, visualisation and product packaging redesign with experts from Te Pūnaha Matatini, Fisher & Paykel Healthcare, and Sustainable Coastlines kaiako.

Te Pūnaha Matatini scientists worked with the students to visualise the beaches with graphs showing a breakdown of the types of litter found at each location — from coke cans to car tyres.

The project ended with a policymakers' hui where the students presented their results showing how littering

behaviour in south Auckland affects the Manukau Harbour. Attendees included a Green MP, a local board member and representatives from Auckland Council.

The students discussed ways to encourage the community to Refuse! Reduce! Reuse! and Recycle! Their ideas included lobbying the Minister for the Environment with data to ban single-use plastics in New Zealand, starting with plastic shopping bags.

Engineers from Fisher & Paykel Healthcare worked with the students on redesigning product packaging to make it less likely to create postage waste or to become waste at the end of its life.

“If an animal or a bird eats it or gets stuck in plastic, they can die.”

– Ann Tupou, 12

“People should put rubbish in their pocket or into the rubbish bin. We’ve found lots of rubbish and lots of little pieces of plastic.”

– Laila Fakalata, 11



SCHOOL FITNESS

What: Measure the effects of the school's morning fitness programme

Who: Rongomai Primary School; Fisher & Paykel Healthcare, the Liggins Institute at the University of Auckland

Twenty-one students aged 10 to 14 from Rongomai Primary School in Ōtara investigated the benefits of exercise for their health by measuring and tracking their heart rates. They determined baseline levels of fitness and then measured the effects of the school's morning fitness programme.

Engineers from Fisher & Paykel Healthcare introduced the students to using heart-rate sensors. They created

sensors and learnt about software for monitoring and recording their results. They also had to control for different variables and got help to develop a method for capturing their data from a scientist from the Liggins Institute at the University of Auckland.

Students communicated their findings to their parents and whānau at two community evenings.

“The PSP is a wonderful change in perspective in citizen science. Traditional citizen science has not had the same amount of relevance for south Auckland with a history of science organisations coming in to study and test, but not building long-term relationships. In stark contrast, these projects put the power and ownership back in the hands of the community which directly correlates to their engagement and success.”

– Nick Pattison, teacher and project lead

Members of Rongomai's fitness project team were invited to participate in a project looking at obesity prevention in school children and adolescents, funded by A Better Start, one of the National Science Challenges, based at the University of Auckland.

curekids.org.nz/research/obesity-prevention-using-systems-science-school-children-adolescents-opuss-schools/



2016

AWA MACROINVERTEBRATES

What: Investigate whether the bed of a waterway (whether it is soft or concrete-lined) affects the biodiversity of macroinvertebrates in waterways

Who: Aorere College, Mangere Central School, Te Kura Māori o Ngā Tapuwāe; NIWA, Wai Care

Twenty-three Year 9 students looked at water quality in two creeks within walking distance of their school. Both sites had negative associations for students because it was where locals (including some of them) gathered to smoke and dump rubbish. By focusing on animals in the streams, the students saw how their actions around waterways affected these organisms.

They conducted their research to determine how to improve their local environment. With help from Wai Care they tested the turbidity, pH, nitrites and nitrates in both waterways.

Aorere ran a clean-up of a local park and stream bank to pick up rubbish and remove weeds. This was eye-opening for the students because some of the landowners were dumping rubbish while they were there.

Students described what sort of freshwater environment macroinvertebrate species need and discussed what they could do to make the creeks a better habitat for macroinvertebrates. They shared this with the whole school and the wider community.

“Providing leadership opportunities to lower ability students ... is a valuable way of having them engage with science in a meaningful way ... Some students were excited that we could do work within our own community and would even come to school reporting to me if they had seen something of interest in ‘our creek’, such as people activity, excessive litter or bubbles indicating some sort of chemical contamination.”

– Chloe Innes, project lead





PUHINUI AWA WATER QUALITY

What: Investigate the effect of water quality from the Puhinui awa on the health of marine organisms in the Manukau Harbour

Who: Te Kura Kaupapa Māori o Manurewa, Te Wharekura o Manurewa; Manurewa Marae, Manurewa Local Board

Students took water samples from the creek's discharge point, along with sediment samples and live organisms for tissue analysis and tested them monthly. They also collected trace-metal data and produced charts showing the results.

The students and community were surprised that the levels of trace metals in the water and tissue samples were so high. They had expected to find evidence of more kaimoana but there were far fewer pipi, oysters and mussels than anticipated.

This work was important to the whole community. The students received an award from the Manurewa Marae for their awa work. They were also asked to present the results of their research to the Manurewa Local Board.



“Future plans are to expand the project for the kura kaupapa to explore the freshwater and marine zones in more detail ... Each kura will have kaitiakitanga responsibility of a stream system.” – Aareka Hopkins, project lead and kaiako pūtaiao



2016

RECYCLED BUILDINGS

What: Test different plastics going to landfill for use as building materials

Who: Alfriston College; Futureintech, Fisher & Paykel Healthcare, Habitat for Humanity

Thirteen Year 11 and 12 students from Alfriston College were concerned about the problem of homelessness in their area of Auckland. They were also aware of the amount of waste that goes into landfills.

They decided to develop a project that would address both problems by looking at whether some of the plastics going into landfill could be repurposed for building.

With the help of scientists from Futureintech and Fisher & Paykel Healthcare, the students tested the suitability of different kinds of plastic for different methods of

building. They also got advice from Habitat for Humanity for building a model of their final design. They got huge support from whānau and the community.

After spreading the message about how dangerous plastics are for the environment and starting a bottle-collecting drive, they were surprised and very pleased with the response. The students collected more than 2000 bottles and aimed to get 20,000 by the end of the project. Unused bottles were destined for The Roots Creative Enterprise for repurposing.

“We think this has been a fantastic initiative and are very grateful to have been a part of it. The learning gained from the project has been invaluable to learners and also to the teacher ... in planning integrated programmes in the future. Meeting experts in STEM fields has helped learners choose pathways.”

– Trisha Munthre, science learning leader at Alfriston College

The students continued their project into 2017, with their aim being to build a greenhouse with recycled plastic. See more at the students' blog: forthefutureac.blogspot.co.nz



2017

BEEHIVE HEALTH

What: Using sensor technology to measure the health of beehives

Who: Aorere College, Tangaroa College, Ormiston Junior College, Kauri Flats School; BeezThingz, BuzzTech, For the Love of Bees, Fisher & Paykel Healthcare

This project investigated whether it would be possible to predict beehive health by using sensors to monitor a cluster of hives at several south Auckland schools and two central city parks.

Students began by learning about the important role bees play in pollinating our food crops and producing honey, as well as the threats to bees' survival due to climate change, disease and parasites. The students received a short course in beekeeping from BeezThingz, who have hives at some schools, and from For the Love of Bees at Griffiths Garden. Mentors from Fisher & Paykel Healthcare helped the teachers manage the project and worked with students on analysing the data.

Sensors placed inside the hives by BuzzTech were used to measure temperature and sound and to compare data with other beehives. The students hoped to collate the data into a model linking sound and temperature with

bees' health and honey yields. The students also wanted to assess the presence of different types of pollen and parasites like Varroa mites and American foulbrood.

Students at Tangaroa College got a lesson in the ups and downs of research science when they discovered all of the bees in their hive had died over winter. An abnormally early heatwave had led the queen bee to lay her eggs too early in the year. A cold snap immediately after meant the worker bees couldn't collect nectar and pollen for the larvae and ended up starving once their honey stores had run out. The hive was replenished and moved to a shadier spot and students resumed data collection.

After setting up in 2017, three schools continued collecting hive data into 2018 to start building the model for healthy beehives.

"We noticed that our school hive was no longer being vandalised by students."

– Chandar Dewan, project lead

"I really enjoyed interacting with students from other schools and working on the bee project together."

– Tangaroa College student



2017

BIOCHAR PROJECT

What: Investigate whether biochar from plant waste can be used to grow vegetables without soil

Who: Papakura High School, Conifer Grove School; New Zealand Biochar Research Centre at Massey University, Fisher & Paykel Healthcare

This was a two-phase project investigating the process of making biochar and using it to grow vegetables. Using biochar to grow plants helps to sequester carbon, which can reduce the impact of climate change.

Phase One was a preliminary trial of various kinds of biochar, including some sourced externally and others made at school. Students set up a hydroponics system at each school to grow plants, measuring the biochar's effectiveness. They grew vegetables like lettuce and tomatoes for Food Tech classes. After the project concluded, all three schools continued to use their hydroponic systems.

In Phase Two, Papakura High School decided to investigate the safest, least expensive way to make biochar that would still be of a commercial quality. Local nurseries were keen to trial any biochar produced.

Results from the research project were shared with the community, providing knowledge of how to create a valuable soil replacement to grow food even in confined spaces. The students also planned to share their findings with primary schools in Palo Alto and Katy in Texas, USA, via blogs, websites, email and Skype.

“The teachers are more engaged with us and our learning and it’s something different.”

– Papakura High School students

“We thought science was explosions and colour changing and potions; now we think it’s more about making things and making things easier to do — and edible!”

– Arnique and Taina, both 11



DUNG BEETLES

What: Investigate the effect of dung beetles on water run-off from pastures

Who: Ormiston Junior College; Chris Clay, Ngāi Tai ki Tāmaki

Twenty students from Ormiston Junior College in collaboration with local iwi investigated whether dung beetles have an effect on the volume of run-off as well as the biochemical composition of the water from effluent-affected pastures. Both the students and the iwi are deeply concerned about their freshwater resources. The beetles feed on the dung of ruminants, dig burrows that aerate the soil, and bury the dung deep in the soil, which releases its nutrients back into the pasture.

Dr Shaun Forgie, New Zealand's foremost expert on ecosystem services provided by insects, helped the students design and implement their project.

Eleven species of exotic dung beetle already approved in New Zealand by the Environmental Risk Management

Authority were released into restricted research enclosures near the school. The aim was to compare three different pasture treatments: no dung and no beetles, dung with no beetles, and both dung and beetles.

However, the students got an unexpected insight into the realities of scientific research when the dung beetles drowned after unusually wet weather. This lesson was incorporated into the students' communication strategy to share their research with the school and local community. The students also developed games that teach facts about animal farming and the effects on the environment.

“Game design yielded some really interesting results for this project. Whilst game-based learning is nothing new, the use of game design is less common. The potential for people to ‘play’ with ideas as they attempt to model and represent real life socio-scientific issues is huge and this will surely be an area for continued exploration by both the education partner and the teachers at the school.”

– Chris Clay, project lead

2017





RECYCLED PLASTICS PROJECT

What: Investigate how to safely recycle HDPE plastic into high-value usable items

Who: Wesley Intermediate School, Conifer Grove School, Kauri Flats School; Reforge Plastics, Astron Plastics, Fonterra, the University of Auckland's Centre for Advanced Composite Materials, Fisher & Paykel Healthcare

This project was the brainchild of Wesley Intermediate teacher Andy Crowe, whose social enterprise Critical Design is based at the school and incorporated into the curriculum.

Students began by investigating the uses and harms of plastics in their schools and communities, and conducting school-wide waste audits. They were interested in HDPE plastics — the kind found in milk bottles and grocery bags — and in turning them into high-value usable items.

Families helped to collect waste plastic. Students then learned about 'design thinking' and used it to produce pendants, hammer handles, drumsticks, and numbers and letters for gates and letterboxes.

Fisher & Paykel Healthcare engineers worked with the students to design a better mechanical system for shredding and melting the plastic, including the capacity to extrude it as either pellets or filament suitable for 3D printers.

A long-term goal was to share their design with whānau in the Pacific islands for schools there to tackle local plastic waste and provide materials for building school learning and play structures.



HARBOUR FLOUNDER PROJECT

What: Trial a pātiki (flounder) nursery to restock the Manukau Harbour

Who: Point England School, Kauri Flats School; Ngāti Pāoa Iwi Trust, Aquaculture Services, University of Auckland's Leigh Marine Institute, Plant and Food Research

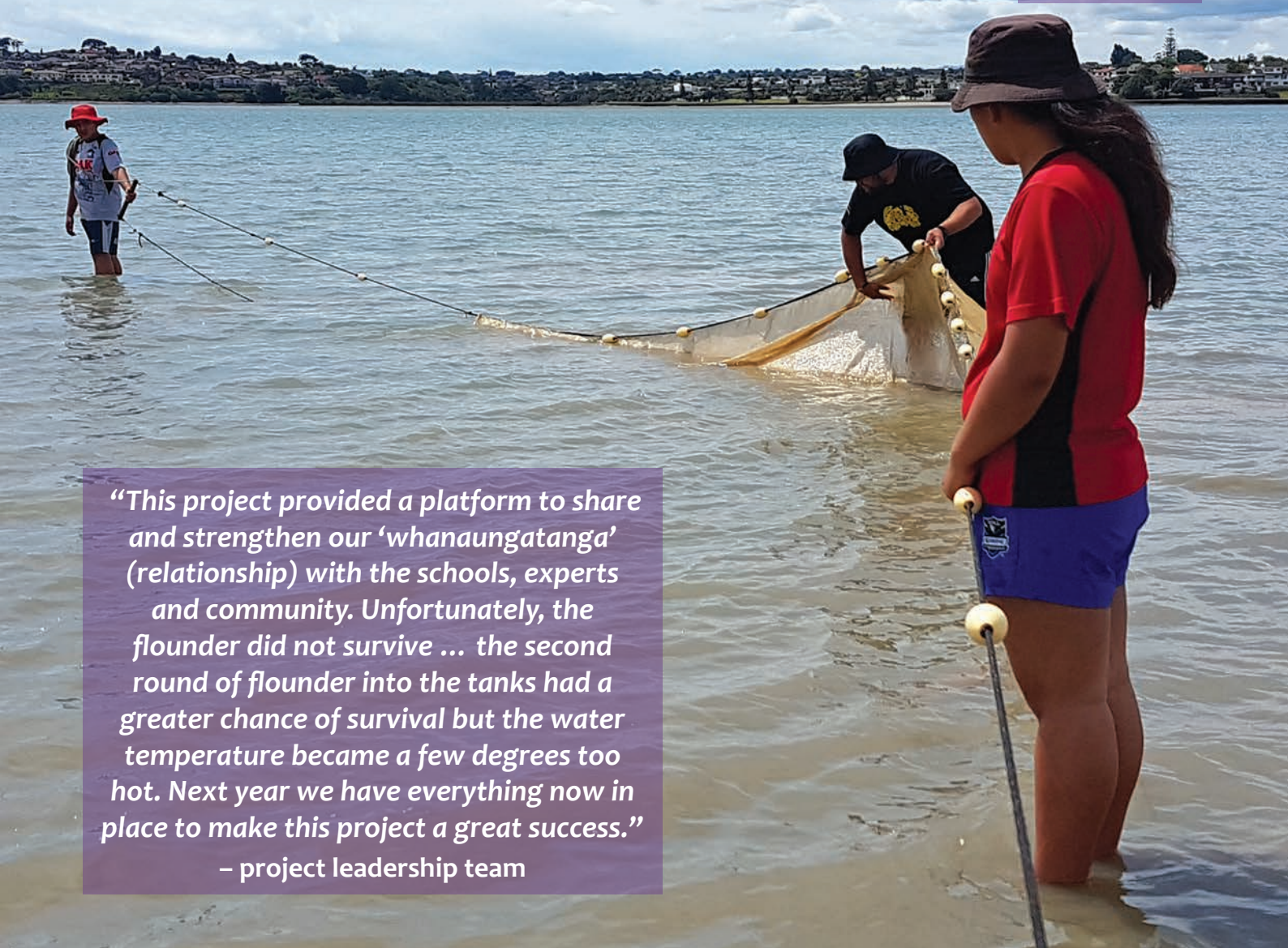
The Ngāti Pāoa Iwi Trust worked with students from both schools to catch baby pātiki or flounder and raise them in tanks at the schools to juvenile size more likely to survive once released back in the wild. The aim was to develop a system to sustain flounder in captivity to ultimately improve long-term stocks in the wild. Pātiki stocks are in slow decline in the Manukau Harbour. The fish is important as a food staple and to provide at hui during poukai, an annual circuit of visits by the Māori king that includes feasting and cultural performances.

Students went on floundering missions with members of Ngāti Pāoa and PhD students from the University of Auckland's Leigh Marine Institute to catch baby flounder from Te Wai Mokoia (Panmure Basin) on the Tāmaki River estuary to raise in hatchery tanks. David Cooper from Aquaculture Services explained the importance of testing the salinity of the tank water before transferring the fish.

The students discovered that fish use up oxygen in water very quickly when there is either very little water or too many fish. This suffocation can make them die later on, even when they make it into the big tank. The problem was solved by using chilly bins with a battery-operated oxygen pump, to transfer the flounder from the net in the harbour to the big research tank housed in a shipping container at school. They also collected an impressive number of crabs and other sand-dwelling invertebrates for the big research tank to provide an ecosystem and food for the flounder.

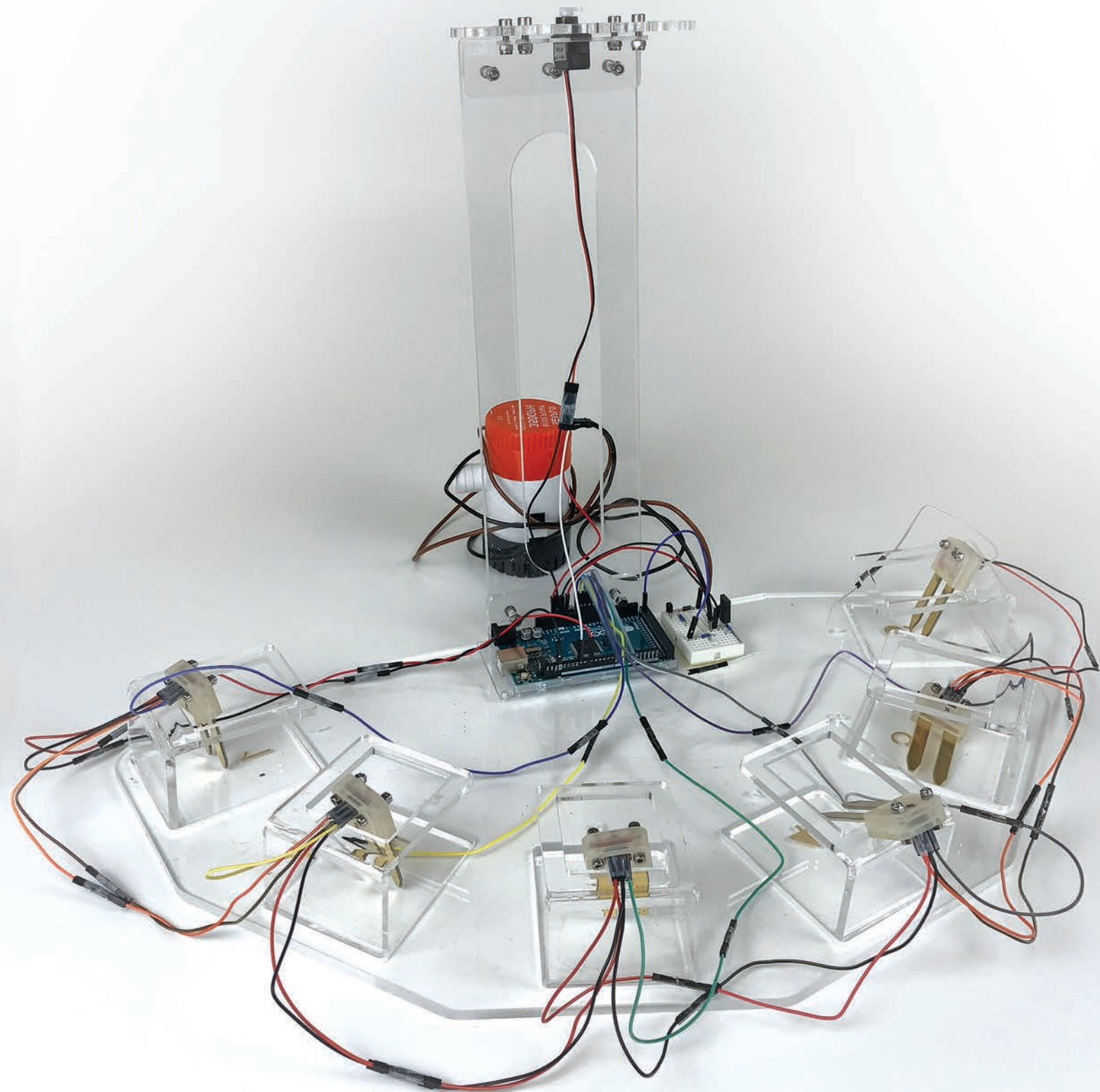
The salt water tanks were maintained by staff from Aquaculture Services. Once there were fish in the big tank, students and the wider project team collected data on environment and growth.

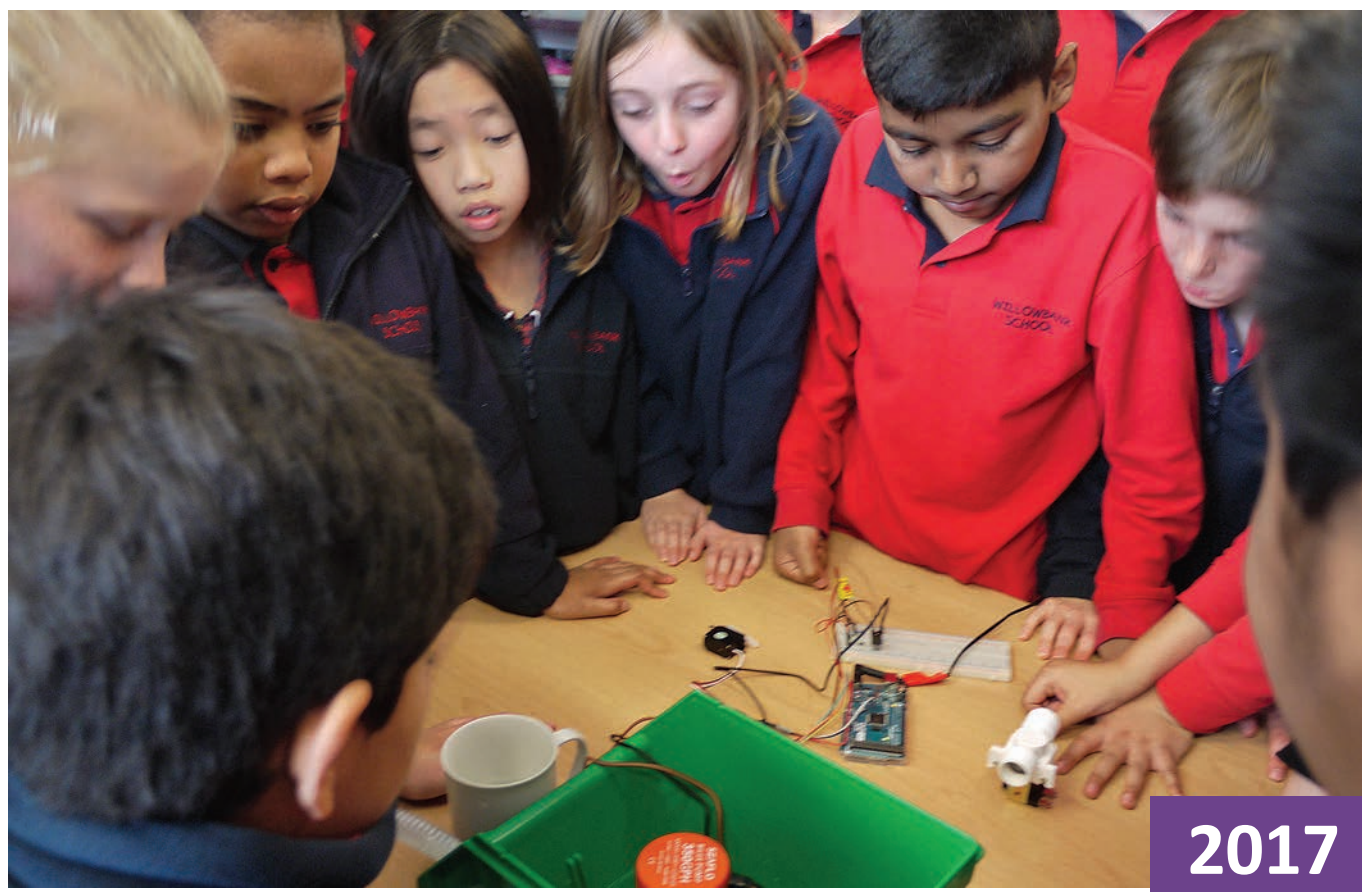
2017



"This project provided a platform to share and strengthen our 'whanaungatanga' (relationship) with the schools, experts and community. Unfortunately, the flounder did not survive ... the second round of flounder into the tanks had a greater chance of survival but the water temperature became a few degrees too hot. Next year we have everything now in place to make this project a great success."

– project leadership team





ROBOTIC WATERING SYSTEM

What: Design and build an autonomous watering system triggered by the sensed level of soil moisture

Who: Willowbank School; Watercare, Fisher & Paykel Healthcare, University of Auckland School of Biological Sciences, Plant and Food Research

Students decided to design and build a robotic watering system as part of a school-wide project to conserve water. They wanted to investigate whether autonomous watering or fingertip sensing of soil conserved more water. Ultimately, they aimed to use the robotic watering system in the school's greenhouse, which is used to grow native plants.

Groups of students came up with designs and then voted for their favourite. The winning design was then computer modelled and turned into a prototype with help of engineers from Fisher & Paykel Healthcare. They had many rounds of testing the prototypes at the school.

Students presented their robotic watering system at the annual SouthSci symposium.



“It was great to gain some project management experience along the way, but the biggest accomplishment was seeing how excited the kids were to learn, even with some things that we thought were quite basic.”

– Andrew Fan, Fisher & Paykel Healthcare mentor



2017

SCHOOL CLIMATE PROJECT

What: Investigate the impact of ventilation, humidity and temperature on the learning environment

Who: Sir Douglas Bader Intermediate School; Fisher & Paykel Healthcare

The project was sparked by students complaining that a lack of ventilation in the classroom made it too hot and humid to concentrate. Teachers, students and Fisher & Paykel Healthcare mentors worked together to design a project that enabled the children to investigate viable, low-cost solutions that would be more conducive to learning.

They began by recording humidity and temperature inside their classroom at regular intervals during the school day and surveying their classmates about the impact of the temperature and humidity on their ability

to learn. At the same time, they experimented with low-cost changes to cool the classroom environment — for example, by testing which combinations of open windows provided the best cooling draught.

With the help of industry experts and Fisher & Paykel Healthcare mentors, the students analysed patterns to come up with ways to minimise the effects of poor ventilation and high humidity in the classroom. A highlight of this project was the focus on giving students the support to take charge of changing their own learning environment for the better.



“There needs to be more of this in schools. Science is everywhere in our world and can be integrated into any topic students study because science explains how our world works.”

– Mel Bland, project lead



RAT BUSTERS

What: Identify the scale of rat damage to kūmara gardens and the most effective traps and locations for rodent control

Who: Māngere Bridge School; Māngere Mountain Education Centre, Makaurau Marae, Auckland Council biosecurity, Department of Conservation

Māngere Mountain Education Centre delivers its kūmara-based educational programme to around 10,000 students every year. However, its kūmara gardens were plagued by rats that severely damaged the crop. All previous efforts to stem the loss had been largely unsuccessful.

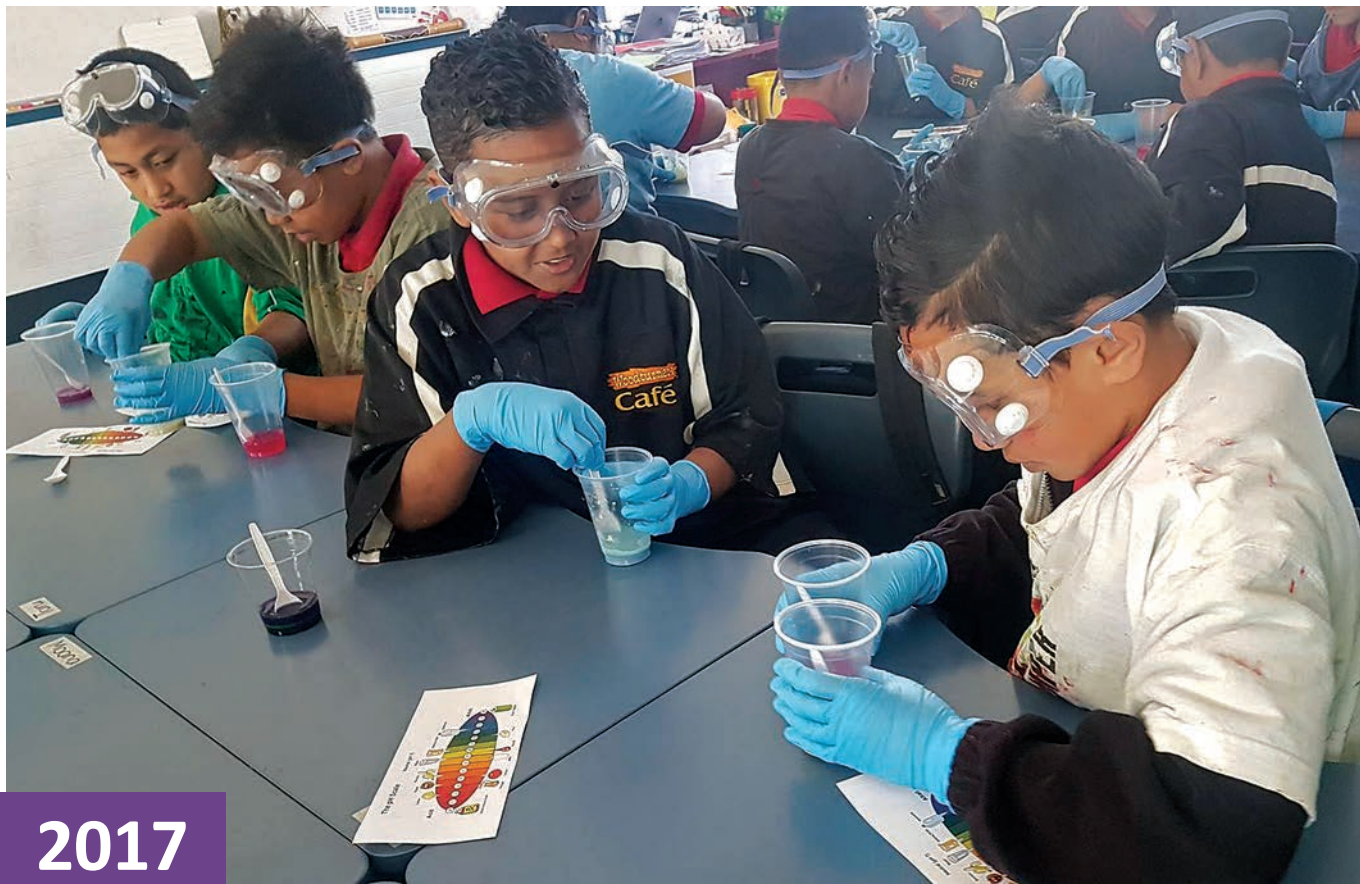
Students and staff from Māngere Bridge Primary School first set out to quantify the rodent population and the damage to the kūmara crop. They found 85 per cent of the community kūmara patch had rodent damage.

With the help of members of Makaurau Marae, students set up rodent control areas and compared the effectiveness of different types of traps. They checked the traps and visually compared crop damage in the control zone with the trap zone to determine the most effective trap and locations.

Sara Gibbs, bio-security adviser to the Auckland Council, helped the students with the project design and analysis of the most effective traps.

“We have noticed during this harvesting season that we have had less rat damage to our kūmara due to the rat trapping that the Department of Conservation assisted with. We know through research that total eradication would be easier once our entire community works together.”

– Māngere Mountain project team



WORM TEA PROJECT

What: Investigate which elements of worm tea make plants grow the most

Who: East Tāmaki School; University of Auckland School of Biological Sciences, Auckland Council's Sustainable Schools

East Tāmaki School had an organic garden and students knew that worm tea (the liquid produced by tiger worms) made a highly nutritious plant food. They wanted to find out what elements of the worm tea helped plant growth the most and how that changed depending on what the worms ate. Auckland Council's Sustainable Schools adviser Cate Jessop supported them to implement their project.

The students fed each worm farm a different type of food. Dr Erica Zarate from the University of Auckland's

School of Biological Sciences helped them to analyse samples of worm tea and vermicast. The students also measured the effects on plant growth.

The result of their investigation could influence the choices students make in their lunches because their food scraps are what is added to the worm tea. The students presented their research to acclaim at the Science Communicators Association of New Zealand conference in late 2017.

“We are very grateful to be a part of such an amazing science inquiry. I have learned alongside my students and have taken what I have learned into my own life. An unforgettable experience that I know the students will remember and take their learning into their future.” – Robyn Malcolm, project lead

Auckland Council approached the school to expand their project in 2018 to trial the worm tea for controlling a pasture parasite that causes the deaths of thousands of sheep and cattle without also killing earthworms.



WĒTĀ HOUSE REDESIGN

What: Design more desirable houses for wētā

Who: Dawson Primary School, Aorere College; Auckland Zoo, Unitec, Fisher & Paykel Healthcare

This grew out of a 2016 project which studied wētā poo to identify their preferred diet. During the project it became clear the wētā houses weren't ideal either for scat collection or habitation (as evidenced by the many one-star ratings on Wētā MotelAdvisor!). Effective wētā houses at schools would encourage the species to populate the area around schools and allow scientists access to urban populations for research.

Students from Dawson Primary School and Aorere College learnt more about wētā from a visit to Auckland Zoo's giant wētā breeding team and Unitec's Dr Stéphane Boyer, an expert in the conservation of endemic animals and the restoration of native ecosystems.

Students at each school worked in groups to design houses that would be more desirable for wētā. After voting, a design was chosen for the first prototype. The house not only keeps out pests, but also makes it easier to see what's inside and to collect scat.

The Fisher & Paykel Healthcare engineers ran design workshops with the children and helped to manufacture the first few prototypes. The prototypes were initially

installed around the schools and at Fisher & Paykel Healthcare's campus in East Tāmaki.

The goal for 2018 is to produce enough wētā houses to share with other schools and science partners and trial the design in different environments. The Department of Conservation also indicated an interest in using the wētā houses in national parks.



This project was featured in an episode of TVNZ's *Fanimals* show:
www.tvnz.co.nz/shows/fanimals/episodes/s2018-e67

SOUTHSCI SYMPOSIA


Each year SouthSci runs a symposium and all the projects are invited to present. The symposium is attended by family, local MPs, community leaders, MBIE officials and project partners.

In 2015, we held the symposium at the Manukau Civic Centre, and in 2016 and 2017, the symposia were generously hosted by Fisher & Paykel Healthcare at their East Tāmaki campus.

We've had students deliver oral presentations with (or without) PowerPoint, videos and even music videos. Te Wharekura o Manurewa presented theirs entirely in te reo Māori. They've also brought prototypes to show off along with static displays of their design drawings.



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We provide high quality and effective research, project development and leadership for cross-sector initiatives and action.

The Participatory Science Platform is currently run in south Auckland, Taranaki and Otago. It is an initiative under A Nation of Curious Minds, a government programme to encourage all New Zealanders to get involved with science and technology.

A Nation of Curious Minds is coordinated by the Ministry of Education, the Office of the Prime Minister's Chief Science Advisor, and the Ministry of Business, Innovation and Employment.

For more information, visit www.curiousminds.nz