Citizen Science

NZASE resource

Sandy CO_2 geysers on Mars; part of a Newlands College project. Illustration by Ron Miller, NASA.

Citizen Science projects can involve students in "real" science and connect them with scientists, both of which are very engaging. The projects are not hard to find and there is a huge variety. They offer rich and meaningful ways to develop students' understandings about science and about the Nature of Science. Mike Stone talks to some teachers and a researcher who have been using such projects.

What is Citizen Science?

Citizen science (CS) projects allow students to contribute to scientists' work in the real world. Students can collect data, or help to analyse and interpret data collected by scientists. Online Citizen Science (OCS) projects require use of the internet, enabling participants to contribute globally.

But which project?

Before selecting a project, consider:

- Is it still operational? (Some finished projects still offer access to datasets.)
- What students need to do – will they manage what is asked of them?
- What prior learning and scaffolding will students need?
- Which of the Science Capabilities could it help develop?
- Can you communicate with the scientist or find out about them and their work?

TLRI

Over the last four years a Teaching and Learning Research Initiative (TLRI) project has been investigating the effects of integrating OCS projects in unit planning on students' development of science capabilities.

Brigette Glasson, one of the research team, has worked with both primary and secondary teachers in this project. Many of them had completed the Royal Society Te Apārangi Science Teaching and Leadership Programme, and had a sound understanding of Nature of Science and the Science Capabilities.

There were many results from this project. One thing noted early on was the role of the citizen in the project. In some projects, the citizen scientists were creating or collecting data themselves, then sharing it online. In others they analysed data in some way for a group of scientists.

Another interesting result was about the ideal student-to-device ratio. Initial fears of problems over not enough devices in some schools proved unfounded. It quickly became obvious that, by sharing devices, students had opportunities to collaborate, to question, clarify and discuss what they were doing, all of which added to the learning.

There were also potential difficulties which needed forethought and management: sharing the URL with students; the requirement in some projects to register as individuals; the opportunities for clicking out of the OCS and being distracted. Melissa and Richie (below) were part of this project.

Melissa Coton

A syndicate leader at Boulcott School, Melissa teaches a Y5/6 class. She has planned and taught using OCS projects for several years. Just two are described here.

The Wild Sourdough project, focussing on the role of microbes, investigated types of flour for growing a sourdough starter. Students had to learn how to make the sourdough starter, feed it 14 times, then use it in flour to bake some bread. As the starter began to make gas, students recorded the bread height, sending the scientists a measurement of the maximum height and a description of its aroma as well as photos of the starter.

Investigating how yeast produces carbon dioxide when activated with sugar and warm water. Photo: Melissa Coton.

Melissa and her students learnt about keeping to protocols and how to use an aroma wheel to make subjective judgements about the distinctive smell.

During this project, American scientist Dr Erin McKenny zoomed with the class, answering questions and talking about her work. This OCS project is now finished.

Melissa's classes also participated in the Pieris Butterfly Project (PBP). *Pieris rapae* is also called the white or cabbage butterfly. For this project, students had to catch the butterfly and put it in a crush-proof container to send to the scientists for DNA analysis.

As part of this unit, students planted a garden, observed and drew butterflies. They also learned about how scientists categorised living things, using and making dichotomous keys.

Her class were tuakana to a Yr 1 taina class, helping those students develop their observation skills. Many of the Yr 5/6 students became very involved, collecting butterflies in their lunchtime or at home. For both places students had to work out and record the GPS co-ordinates, a somewhat challenging task. This project is ongoing.

Melissa found her students really engaged with these CS projects: "They were an amazing vehicle for enthusing students about science." She specifically chose CS projects that required active participation, as these best suited her students. She sees the benefit of using CS to enhance teaching.

Students look for evidence of butterflies or other insects eating their vegetables. Photo: Melissa Coton.

Richie Miller

At Newlands College, Richie embedded his CS project in an astronomy unit. Students were learning about planetary conditions by addressing the question "Could humans survive on Mars?" Focussing on the Science Capability about using evidence, students were asked to come to a conclusion and justify it with evidence. Richie's continual mantra with students was "How do you know?"

Planet Four involves analysis of satellite photos of Mars, from the High Resolution Imaging Science Experiment (HiRISE) camera on the Mars Reconnaissance Orbiter.

The poles of Mars are made of solid carbon dioxide, dry ice. As the south polar region starts to be exposed to more sun in spring, the heat sublimes solid CO_2 under the surface, forming a gas. The pressure of this gas builds until it bursts through the icy surface in geysers of gas and dust.

As the debris falls to the surface, the shape of the deposit shows the direction of the winds; it leaves a blotch when there is no wind and a fan-shape when it is carried.

Students had to use an online tool to mark out the edges of the debris deposits. Students knew they were helping a scientist and wanted to do it well and be accurate. Students can lose interest in these analysis activities after a while, so they were asked to work on it for only 30 minutes.

As they were analysing the images, Richie noticed the students were relating it to their theme, and asking how such geysers might affect humans on the planet. Richie made up a worksheet to go with this activity, asking students to explain what they were doing and take a screenshot of a delineated deposit. They were asked to fill out a PMI (what are the pluses, the minuses, and the interesting things about this CS task) and create six questions for the scientist.

All this was embedded in a series of hands-on lessons that developed students' ideas about conditions on Mars. "Included was making our own model of the geyser, with baking soda and vinegar to cause the geyser eruption, and a hair dryer to provide the wind – lots of fun!"

Meg Schwamb, an American astrophysicist working in Belfast, met with the students in a zoom call. She answered their questions and talked about her work, how she got into it and why she was interested in the astrophysics branch of science.

Richie suggests having a look at the wide range of CS projects on Zooniverse or the Science Learning Hub. He says: "Try it out yourself; they often have tutorials, but some are more user-friendly than others. You get a good sense of it fairly quickly."

Vicki Alderson-Wallace

Over the last three years at Mt Maunganui College, Science teacher Vicki has explored two CS projects in a conservation/sustainability unit with Y10 students. They were learning about birds, food chains, ecosystems and ecology.

These students took part in the Garden Bird Survey, observing tui, seagulls and kererū in the school grounds. They recorded their observations, but they were not uploaded.

They also monitored pests with tracking tunnels, in the same way that DoC and volunteer groups do. Using wooden planks, corflute and staple guns, students built tracking tunnels at school. They baited them with peanut butter and placed them around the school grounds and neighbouring properties, at some student homes and at a neighbouring primary school.

In their next Science period, the students checked the tunnels and identified the footprints. Vicki had obtained tracking records from her voluntary conservation work for comparison. Students found evidence of lots of rats and mice near the canteen, hedgehogs in the garden and even a print of a frog's feet and undercarriage.

During this unit speakers from the Bay Conservation Alliance and Predator Free BOP came to talk with the students about their work.

As a conservation volunteer from childhood, Vicki enjoyed sharing her passion with her students. They became very engaged in the work, enjoyed making the tunnels, putting them out and identifying the footprints. She finds rural students have a lot more experience with this than students in urban schools.

Other CS projects

Teachers may want to consider:

- iNaturalistNZ – Photograph plants and animals.
- Myrtle rust reporter – Photograph myrtle species and upload to iNaturalist.
- How deep is your snow? – Using a NIWA app to measure depth and the melt water volume, and calculate density.
- Marine Metre Squared – Survey a rocky shore.
- Te tatauranga o ngā manu māra o Aotearoa/NZ garden bird survey – Record the number and types of birds in your garden over one hour.

Ngā Kupu

- **Inenga** – Measurement
- **Manu** – Bird
- **Mauhanga** – Record, documentation
- **Ngāwhā** – Geyser, boiling mud
- **Parāoa moī** – Sourdough bread
- **Rangahau** – Research, survey
- **Taina** – Junior/younger brother or sister
- **Tātari** – To analyse, analysis
- **Tuakana** – Senior/elder brother or sister
- **Whāomoomo** – To conserve, conservation.

Te Aka Māori Dictionary and Paekupu