Citizen Scientists in the Classroom: Investigating the Role of Online Citizen Science in Primary School Science Education

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Project Description

This project explores the impact on student learning and engagement with science of incorporating online citizen science (OCS) projects in classrooms. OCS is an extension of citizen science, where the tasks to be completed are aided, or completely mediated, through the Internet allowing volunteers' contribution to real scientific endeavours. The co-constructive partnership between researchers at Victoria University of Wellington and primary teachers who are advocates of science education in New Zealand is the first ever attempt to investigate the potential of OCS projects to contribute to the improvement of science education of primary-age children.

Aims

A primary goal for this project was to improve understanding of the OCS impact of the science education or primary-aged children. As such, the overarching question guiding this work was: *How can OCS be purposefully embedded for Year 3-8 students in New Zealand primary classrooms in ways that meet the aims and intentions of the Nature of Science strand of the New Zealand Curriculum?* Within the framework of this project, our aims were:

- Identify which existing OCS projects best align with the NZ science curriculum and are most suited for use in the classroom.
- Identify what learning benefits derive from embedding particular OCS projects in the classroom.
- Identify how participation in OCS support development of science capabilities for citizenship.
- Develop practitioner support materials to support teachers in science education practice, with an emphasis on engagement with New Zealand's youth.
- Offer observations and recommendations on the design of projects that can attract sustainable and purposeful contributions from primary-age children.

Why is this research important?

OCS projects have great potential to help to improve scientific engagement, develop scientific skills and increase children's science capabilities at different ages, while also supporting the development of basic skills such as counting and reading, and advancing digital literacy. However, our current knowledge about learning through OCS is limited to informal settings where individuals participate in OCS because they want to, and little is known about the impact of OCS use purposefully in schools. The project provides insights into the practical use of OCS in primary science education and the resulting educational outcomes, as well as findings that inform use of technology in the primary educational setting.

Key Findings

OCS alignment with NZ Curriculum and classroom

Collaboration with teachers who embedded OCS projects into their teaching contributed to assessment criteria when selecting an OCS for classroom use. Specifically, this resulted in eight assessment criteria for OCS projects on their suitability for NZ primary school classrooms: *Purpose of OCS project, Project timeframe, Requirements (technical and student skills), Support provided (from the project to the participants, if any), Age level suitability, Relevance to students' learning, Geographic scope,* & *Data availability (accessibility for further classroom use).*

Digital Devices for OCS use in the classroom

Device use, features, and related technical aspects of OCS use affected student learning in the cases examined. 'One device per student' affected engagement and interaction with others in group activities. There were many cases of 'face-to-screen' communication, where students communicate with each other without looking away from their screen, whereas with groups assigned to one device, more 'face-to-face' engagement was possible. The most effective cooperation was observed when students were sharing a PC with a large touchscreen. Because the nature of many OCS tasks includes aim-and-click or drag-and-draw, touch screen allowed several students to actively participate in the process and not be hindered by the control of input devices (physical mouse, etc.). Additionally, school devices, usually customized for school use, sometimes limited options and restricted access, while less restricted devices had higher likelihood of students becoming distracted and triggering exit actions (going to Google Maps, YouTube, etc.).

Learning benefits of embedding OCS projects in the classroom

All four teachers highlighted *student engagement* as a strongly positive outcome of using the OCS. Students mostly indicated that they *found OCS helpful in their learning*, specifically with science capability-related learning and in context-related learning about the topics. Additionally, benefits for learning about *the nature of science* from OCS were apparent through observations and in comments from teachers and students. The OCS complemented contextual learning opportunities provided through practical investigations and researching information.

OCS support for development of science capabilities for citizenship

Participation in the OCS provided rich opportunities for capability development. It appears the experiential and participatory nature of OCS made capability-related learning explicit for young learners. The high degree of student reporting of capability related learning was significant. Specifically, gathering and interpreting data was the most common capability identified in all cases. Other capabilities were not directly connected to the use of the OCS but were more a result of the way the teacher embedded the OCS within the overall unit. This, therefore, highlights the importance of the teacher in recognising opportunities for capability development and planning ways to support this learning with regard to the OCS.

Implications for Practice

Science education practice

- Teachers need to be able to recognise opportunities for science capability development and learning about science itself if OCS is to be of benefit in addressing the intentions of the New Zealand Curriculum.
- Linking the OCS to a local issue or context appears useful in engaging students.
- A limited number of digital devices is not a barrier for purposeful engagement with OCS in the classroom. Instead, it is beneficial to develop meaningful group activities involving shared devices.
- General purpose devices and applications may not be best suited for students at all ages to engage purposefully with OCS. While the flexibility of general-purpose technology may appear beneficial, it increases the potential that students get distracted and lose focus.

Science education research

- Longitudinal research is needed to fully understand the impact of interventions like the ones described here, as well as effects on students' attitudes towards the sciences in general; their performance in science subjects at school; and their likelihood to move on to a professional career pathway in the sciences.
- Investigation of *how* exemplary teachers, such as the ones in our project, can extend their motivation and knowledge to other teachers within and beyond their schools.

Human-computer interaction research

- OCS platforms should consider making all data collected available not only to other researchers on request but even the citizen scientists themselves by default. This would contribute to further research and classroom use.
- Emphasis on R &D is needed into platforms that allow for citizens to engage with science at all stages of the scientific investigation cycle.

We have released a guide on how online citizen science can be utilised in science education practice on the Science Learning Hub. This provides an inventory of OCS projects along with descriptions about their use with the NZ curriculum, clips of our partner teachers describing experiences and best practice using OCS in classroom activities, and materials such as lesson plans. This resource is available at: https://www.sciencelearn.org.nz/citizen_science

Our Partners

Our partners were four primary teachers, teaching at a range of year levels from year 3-8 in the Wellington region: Dianne Christenson (Koraunui School), Melissa Coton (Muritai School), Carol Brieseman (Hampton Hill School) and Matt Boucher (South Wellington Intermediate School). Partners also included a research advisory panel of experts guiding the project: Dr. Azra Moeed (Victoria University of Wellington), Dr. Cathy Buntting (Waikato University), and Dr. Craig Rofe (Victoria University of Wellington).

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