CITIZEN SCIENCE

Remote learning – exploring a new frontier in citizen science

Citizen science has received increased interest over the years, acknowledged within academia and policy as a bottom-up approach to scientific research due to its ability to increase public participation in citizen science. This, far from novel, the idea has deep roots, dating back to the 1800s, when the public was involved in nature observation and documentation of plants, animals and weather patterns. Article by Nkosi Sithole.

The most historic written account of citizen science is the Christmas Bird Count, which has been an annual event since the 1900s. These labours of public documentation continue through efforts such as the Bird Atlas projects and iNaturalist events, which now help us make sense of global ecological changes and impacts on biodiversity. While definitions vary, citizen science has been acknowledged as an effective tool to bring public policy mandates into effect and for bridging the gap between scientific research and citizens. In addition, citizen science tools have been acknowledged by the United Nations (UN) as instrumental in contributing to reporting against SDG 6 by encouraging citizens to be proactive where water quality management is concerned.

The essential power of citizen science lies in democratising science through empowering communities, co-developing scientific knowledge, increasing social innovation, improving data collection and fostering a sense of confidence within individuals which builds a stronger social fabric within communities. However, the current definition of citizen science has been criticized for not taking into account the diverse forms, scales and varied contexts in which citizen science can exist.

The COVID-19 pandemic was a wake-up call to change the approach to citizen science learning, which was predominantly conducted in person. Citizen science learning and monitoring of water-related issues drastically decreased during this time, which affected the amount of data collected and subsequently reported against SDG 6. This emphasised the need to explore other citizen science learning approaches.

As a response to these challenges, a remote learning platform for citizen science learning for biological monitoring of water systems with the goal of empowering communities being trained in citizen science was developed and piloted with a marginalised community. To select the community, a GIS desktop-based application known as a Multi-Criteria Analysis (MCA) was performed to highlight a community that met the

following criteria: limited access to technology, significant water and social issues, a need to maintain their water resources, and have had a pre-existing relationship with GroundTruth, and be willing to participate in the research (this was confirmed through engagements with the relevant authorised leaders within the community). The Tribal Authorities of Zikhali and Mabasa, located around Lake Sibayi in the Maputaland area, emerged as the selected community through this process.

To action this goal, GroundTruth was tasked with adapting and simplifying the current citizen science toolbox to suit online learning. This included the adaptation of existing instructional manuals into simple picture-based learning materials with supporting video-based content. Two additional citizen science tools were included in this effort as they add value when used with the other citizen science tools in the toolbox. These were the E. coli water test and the Dragonfly Biotic Index.

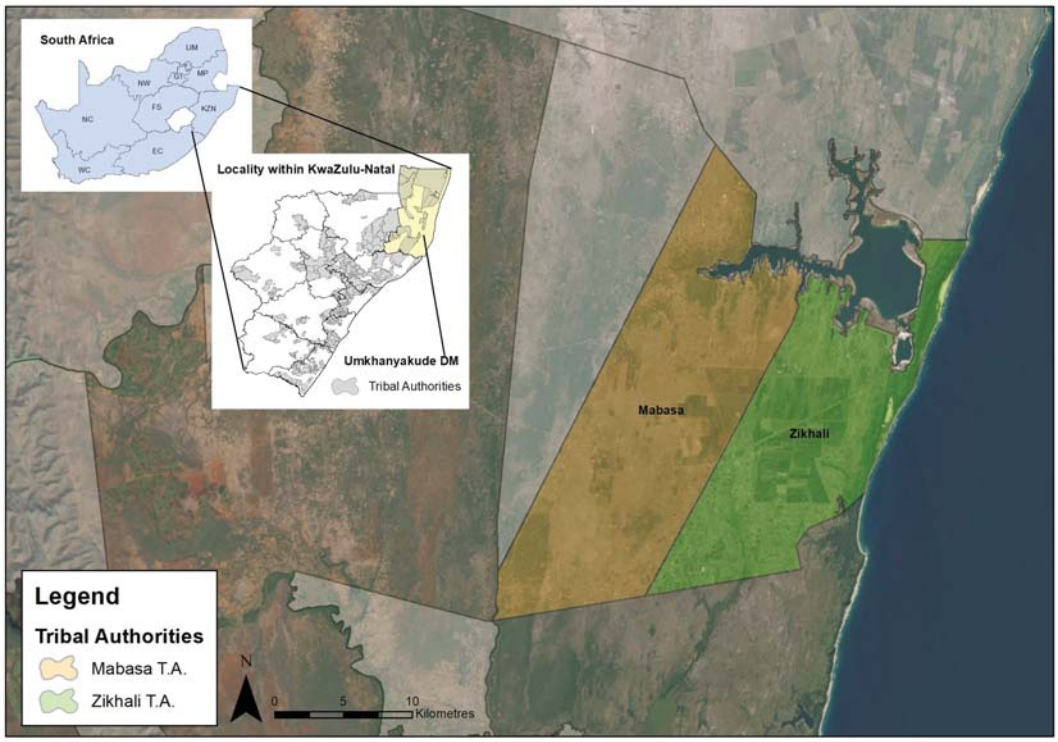
To pilot the remote learning system, the project applied an Action-Orientated Research Approach, which included three phases. Each phase was focused on the following objectives, respectively: understanding how citizen science learning was currently taking place and the tools currently being used; designing the remote learning platform for citizen science learning whilst retaining the learning principles that emerged from phase one and identifying applications to support remote learning; and piloting the remote learning platform in a marginalised community while concurrently assessing how the learning is taking place to inform the refinement and improvement of the remote learning platform.
To assess the learning experience of the participants, a summative assessment was conducted. The following emerging principles were identified and informed the design of the remote learning platform:

1. Relationships between the facilitators and participants and between the participants themselves need to be organically developed and maintained.
2. Learning should be situated in the context of the participant and linked to their experiences and needs.
3. Commonly shared environmental concerns should be explored using the Action Learning approach and assessed through the lens of indigenous/local practices.
4. Citizen science can then be introduced as a monitoring and evaluation tool to assess the change in the environment over time.
5. Citizen Science learning should be contextually relevant, action-based, and regularly practised.
6. Learning about citizen science should be gently scaffolded, building on the existing knowledge of the participants to expand the discourse within their community.
7. Participants need to feel that they are making a significant difference within their community.
8. The remote citizen science learning platform needs to be accessible, user-friendly and include the charge of the internet.

The learning journey of the participants was documented and evaluated, and the findings were used to simultaneously and continuously adapt the online learning programme to improve its functionality. Once participants from the two groups had both completed the course, a final evaluation was carried out and key learnings from the process were summarised into a case study.

The main recommendations from this are summarised below:

- **Visual learning content was effective in supporting remote citizen science learning:** Video and image-based learning material proved to be most effective for



Locality map of Zikhali and Mabasa Tribal Authorities.

online citizen science learning as participants learnt more about the tools through observing them being practically demonstrated. The videos also allowed participants to rewatch the demonstration of the tools, which facilitated a deeper learning to take place.

- **The translation of learning materials to other South African languages increased access to citizen science learning:** The citizen science learning material was translated into three other South African languages, namely Sesotho, Afrikaans and isiZulu, to increase access and understanding of communities or individuals who were not English-speaking. The participants expressed gratitude for this effort, as they reported that by moving between identical materials in English and their home language, they were able to gain a deeper understanding of the concepts. The development of learning material in other South African languages has widened the scope and reach of online citizen science learning, which is useful within the South African context. The translation process is not complete; with the help of volunteer citizen science groups from wider regions in South Africa, the materials are currently being translated into even more languages, which will be added to the online learning tools.

- **Participants demonstrated an increased level of confidence:** Participants noted that partaking in the remote citizen science learning course helped them gain increased confidence and developed their personal agency. The participants also highlighted that the design of the in-person component, which included the participants needing to do presentations, group activities, and interpret citizen science data, challenged them to overcome obstacles such as fear of public speaking and develop their scientific communication skills. In addition, the participants felt that the knowledge they had gained empowered them to make changes in how they interact with the environment and gave them the confidence to teach others.

- **Participants were able to overcome the challenge of access to the internet through creatively working together:** Participants were able to overcome the challenge of internet charges to view or download the learning content through creatively working together. The project made provision for an initial internet connection for participants to download the Pluto LMS app and associated learning materials. Thereafter no additional provision was made for internet connection, which meant that the participants had to work together to find means of completing the course, as quizzes needed to be done online. Many participants used the public library as it had a free Wi-Fi connection to complete their online tasks. This highlights the importance of local libraries in communities, and more so, in rural communities, as they offer educational support through the provision of free and publicly accessible computers and Wi-Fi. In addition, some participants shared the cost of purchasing data among themselves and used the downloaded content collaboratively to ensure that everyone had access to it. Their creative efforts to overcome the challenge of the cost of internet use would not have been possible if the groups had not been able to form social bonds during the course.

- **Facilitating the space for social learning is vital**: The above example brings to light the value of facilitating social learning, even within the online learning space. Social discourse, interaction, and purposeful engagements with others were facilitated through the use of WhatsApp groups, online forums, group assignments, and the "Change Project" task. Participants in each of the groups reported that they valued the connections that they made with other participants greatly, and many said that they felt that they could not have completed the course without the help of others. They reported that they learnt more from each other than from what was represented in the online materials and that they felt that the practical in-person field demonstrations helped them the most in gaining a deep understanding of the citizen science tools.

These learnings are important aspects to consider for other facilitators hoping to use the online learning materials GroundTruth have developed. The researchers involved in this project have compiled a Best Practice Guide (visit: https://www.groundtruth.co.za/olt) that summarises how to use and apply what we have learnt in this process.

In conclusion, the piloting of a remote learning platform for citizen science learning in a remote community was successful due to the willingness of the participants to engage with the content. This spoke to their need to improve their personal circumstances and the challenges faced by their immediate environment. Their individual drive was evident in the participants' ability to overcome challenges through working together and exploring innovative ways of engaging with the learning platform, bringing to light the importance of public infrastructure like community libraries and the provision made by the facilitators to foster social connectivity within the online learning space. The outcomes of this research highlighted the importance of designing citizen science learning using an Action Learning approach in a way that facilitates social learning processes. With careful consideration and conscious effort, citizen science learning can take place effectively using an online platform within a South African context.

• To read more about the project, view the report, 'Citizen science online training and learning system', here https://bit.ly/3B0uD3o

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