Massive Online Open Citizen Science

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Massive Online Open Citizen Science: Use of MOOCs to scale rigorous Citizen Science training and participation

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KEY POINTS

- *Report on implementation of MOOCs to scale participation in rigorous citizen science*
- *GROW MOOCs train participants on soil sensor use, complete nutrient testing and land & soil surveys*
- *GROW "citizen scientist" approach offers learning on methods design, data collection and awareness*
- *Social learning approaches may overcome common barriers to engagement and training for protocols*

1 CITIZENS' OBSERVATORIES

Citizens' Observatories (COs), a new phenomena that builds on the growth of citizen science, are defined as community platforms for citizens to generate, share and utilise information to address community, science, policy and innovation challenges. Citizens' Observatories involve networks of citizens using sensors and mobile technology for community-based environmental monitoring. A fundamental feature of Citizens' Observatories is that citizens can use the data they collect to participate in and influence environmental management at a practical and policy level. The vision is to create a movement around environmental observations, to inform and empower citizens to participate in environmental decision making; to extend and reduce costs in global earth observation activities; and to lead towards more inclusive, sustainable and technology-enabled economic development. The emphasis is on combining the observations of ordinary citizens – as well as those of professionals and scientists – in Earth observation and environmental management to make a real contribution to science, while also having value to the citizens themselves.

2 GROW OBSERVATORY: SCALING UP CITIZEN SCIENCE

2.1 A citizens' observatory with international reach

The GROW Citizens' Observatory (GROW, European Commission Horizon 2020) is undertaking to deliver local and global impact by meaningfully engaging and supporting many people to take part in rigorous citizen science across wide geographic areas (Hemment et al, 2016). The concept for GROW is to support the emergence of a international movement of participatory citizens generating and acting on data and knowledge of growing and the land, leading to more sustainable land use practices, soil management and land governance and policy, and a unique data repository for science. GROW creates a proposition around newly available and powerful yet low cost consumer sensing technology, a strong science and policy narrative, and the collective power of shared and open data and knowledge. The GROW concept is built around two communities with a passion for soil and the land: growers and earth scientists. GROW is designed to answer real needs for citizens and science, and address the problematic issue of scaling.

The project aims to demonstrate a functioning CO, and that the concept itself and system can deliver widespread uptake, robust science, societal impact, and be sustained beyond the grant in order to support climate monitoring and the provision of novel services. Key dimensions are connecting the hyperlocal with

planetary monitoring, community and participation, credible citizen science and a focus on sustainability. A key issue for the success of any citizen science initiative and for COs in particular is the recruitment, participation and retention of citizens who are crucial as stakeholders in the provision of data, and users of potential service innovations emerging from that. GROW has adopted a number of strategies to support participation, appealing to both intrinsic and extrinsic motivations. These strategies include promoting social and peer to peer activity, offering rewards as well as support and education in training and learning, and finally the appeal of the fundamental nature of the topic itself, the health of soil and ergo, society and the planet. Specifically, GROW promotes opportunities for social interaction through learning and communications that emphasise the role of storytelling and impact to appeal to participants' altruistic motivations and by its very nature, the added benefit to wellbeing by spending time outdoors, in natural environments, which have been identified as important in sustaining volunteer effort (Snyder and Omoto 2001; Van den Berg et al. 2009). In achieving success in these areas, GROW's potential contribution to the field is to move COs closer to the mainstream of European science and society, and moving from a contributory, to a more collaborative model of citizen science. In this paper, we present an overview of our approach to fostering and maintaining the social dimension of the Observatory, and a discussion of our pedagogical strategies.

2.2 Engagement and Learning

Engagement methods in GROW build on expertise and experience in participatory mass observation such as Environment 2.0 (Hemment, 2010); participatory platforms and storytelling, digital art and digital culture festivals (FutureEverything, 2016); citizen sensing and citizen science (e.g. the WeSenseIt, Smart Citizen, Making Sense projects); campaign frameworks (Making Sense, 2017) and participatory scoping (Design in Action, 2016). Storytelling methods are employed with the aim of scaling dissemination and creating impact, and to achieve this there is a focus on 'circulation' not 'distribution' of content. This means creating compelling content that people want to share with each other so that information is amplified by the network itself. GROW also builds on experience and reach in communicating sustainable agricultural land management issues across Europe (ARC2020, 2018).

In common with citizen science and crowdsourced projects in general, participant recruitment and retention requires dedicated effort and user-focused development. GROW's engagement strategy is user-led and builds on a broad set of citizen, community and science challenges that GROW Missions (cycles of public citizen science activity) are designed to address.

In order for people to undertake environmental monitoring in GROW Missions, we are collaborating with FutureLearn, a commercial subsidiary of The Open University, to build education resources using the most reliable, high quality and established platform for its Massive Open Online Courses (MOOCs). From its launch, FutureLearn's vision has been 'to pioneer the best social learning experiences for everyone, anywhere'; this goal is aligned to GROW's open data and social learning experience approach. FutureLearn's platform is one facet of a framework to provide citizen scientists with the training they require to be able to collect quality data and take an active part in the observatory. The ambition in using MOOCs is to position the observatory as THE online learning portal for citizen science in soil and land use/cover issues and regenerative food growing practices that is open to everybody everywhere. In addition to the MOOCs, GROW also offers training and protocols face to face and remote feedback, as well as data visualisation on the GROW website, a curated information resource, with infographics and social channels.

2.3 Scaling up citizen science via MOOCs

MOOCs can deliver training to tens of thousands of people concurrently across a wide range of subjects as well as engender social and peer-to-peer – or 'MOOC 2.0' – models to promote social learning. We suggest by supporting the social needs of a learning community, these approaches may overcome common barriers to engagement, training for scientific protocols, data collection and sustainability currently experienced when

supporting citizen science at scale.

Through a MOOC 2.0 approach GROW is scaling participation in citizen science while maintaining scientific rigour. GROW's four MOOCs in 2018 on the FutureLearn platform (see Table 1) are designed to enable participants to learn about soils, regenerative food growing practices and making the most of open data to create positive change (Hecker et al., 2018). Creating communities of citizen scientists to foster long term engagement in citizen science projects typically have a skewed pattern of participation, where a large proportion of volunteers contribute in small quantities and it is hard to sustain long term engagement. Following the recommendations for design of online citizen science projects described in Jennet et al., (2016), GROW is testing how MOOCs can help overcome barriers to meaningful and sustained participation by offering a wide range of indirect opportunities for learning and creativity, including social peer to peer discussions, polls and quizzes, gamification elements and online spaces for participants to share their own work and communicate with experts via the forum and webinars.

GROW MOOCs are enabling us to engage with and train thousands of participants in the use of sensors, nutrient testing kits; land and soil survey; methods design; data collection and data awareness. Uniquely, the MOOC platform also provides the necessary data to be able to assess and evaluate how learners are progressing, by for instance tracking which steps of a course or topic attracts comment and which do not. We suggest these approaches and platform capabilities may overcome common barriers to training for scientific protocols, data collection and sustainability currently experienced when supporting citizen science at scale (Wehn and Evers, 2015).

Table 1. GROW MOOCs in 2018

MOOC n.	Title	Date	Enrolment	Data collected
MOOC1	Citizen Science: From Soil to Sky	19/2/18-16/3/18	4,388	• Soil texture & stone content • Slope angle & canopy cover • Food growing regenerative practices
MOOC2	Citizen Science: Sensing the World	26/3/18-6/4/18	1,304	• Sensors used by learners • CS projects learners are involved with
MOOC3	Citizen Science: Living Soils, Growing Food	16/4/18-4/5/18	2,652	• Regenerative practices • Polyculture experiment parameters • Land and Soil survey
MOOC4	Citizen Science: From Open Data to Positive Change	5/11/18-23/11/18	TBA	• Harvest data indicators • Nutrient testing results

GROW has also been working on developing data collection channels that can foster learning and engagement while ensuring data quality. GROW has been testing different data collection methods and has moved from using Typeform online surveys and forms to submission forms on the GROW website where participants are registered and where they go to interact with other citizen scientists on the GROW Forum. A new mobile app has also been developed, which serves both as a data submission channel for certain parameters including GROW's Land and Soil Survey indicators, and as an advice service for new growers, offering help with planting times and plant care. Both the GROW website forms and the GROW app have been developed with a user-centred approach in mind and considering aspects in relation to usability, engagement (gamification, feedback) and a design that helps improve data quality and assurance. Interviews and workshops with participants took place to gain their feedback, which informed the design process of these platforms. Following Sturm et al., (2017) we hope this approach will lead to wider and deeper engagement with participants. Both the FutureLearn MOOC forum and the GROW forum support two-way and constant communication to provide support and gather participants' ideas and feedback throughout the project.

3 CONCLUSIONS

Collaborative models of participation are being developed and evaluated within GROW with the aim to provide an example of how the effectiveness of COs can be amplified by adoption of online social learning methods. GROW has initially adopted a model of collaborative citizen science (Bonney et al., 2009) with an emphasis on social peer-to-peer tools and platforms, also aligned to open digital science and citizen cyberscience (Jennet et al., 2016). GROW is starting to evaluate and provide evidence on what happens to a citizen science system when it is scaled up and 'opened out', with evidence of retention of participants provided through quantitative analysis of MOOC activity, alongside qualitative data gathered from participants through discussion forums and survey feedback. Our aim is to support participants through learning and education at scale, and supporting participants to have more responsibility for the data they produce as well as communicating their findings to other civil society groups and policy makers (Grainger, 2017). Whilst proven methods and mechanisms for citizen science provide the foundation for the gathering of data, further work is required to underpin and sustain the development of new services to support people in a changing climate. We posit with training and education, this goal can be achieved which in turn will help support a successful and sustainable Observatory.

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