Breaking the Barriers to Citizen Science
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Citizen science risks excluding people who lack knowledge, technical skills, self-confidence, time and access; for example, someone who was told they are "bad at science" at school, lives in a rural area or has many family responsibilities may lack the opportunity to get involved. The EU funded Do-It-Together Science (DITOs) consortium is testing a process for how to implement a variety of opportunities for engagement at a level that suits the user, while gently encouraging them to move to a higher level; or, if life demands are too much, to move to a lower level and thus be able to continue to engage in citizen science. We therefore present the Logic Model, which examines the process by which a participant deepens their participation in citizen science and informs institutions on good practices in engaging underrepresented communities. Our presentation will first introduce the Logic Model, then showcase lessons learned from our use of good practices in events run by our 11 institutions: for example, partnering with organisations with experience working with disadvantaged groups, providing facilities and workshops for small children and partnering with local government and industry where time and money are identified as obstacles - and present what has worked well and what has not, from the point of view first of a researcher, then of a citizen scientist. We will present relevant literature, then open up questions and encourage an interactive session on the Logic Model.

Citizen Science and Open Hardware: Creating a Roadmap for Accessible Technology Innovation
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Hardware forms a vital part of the scientific method and advances in instrumentation have been central to scientific progress by extending observations beyond standard human senses. Although scientists are frequently natural tinkerers, the current supply chain for science hardware limits ability to customize and incrementally improve tools and hence impedes scientific creativity. Open Science Hardware addresses part of this problem through sharing open designs, which often take advantage of modern digital fabrication techniques. Expanding the reach of this approach within citizen science has the potential to increase access to experimental tools and ease their customization and reuse while lowering costs. The first Gathering for Open Science Hardware (GOSH) was held in 2016 at CERN in Switzerland and in 2017 the conference will move to Santiago, Chile to acknowledge the global interest of open hardware in science practices. The coordinating leads of GOSH represent the diversity inherent in Open Science Hardware-- citizen science practitioners, biohackers, makers and university scientists. This paper will introduce conference participants to the burgeoning connections between Open Science Hardware and citizen science and discuss a roadmap for the development of open science hardware, emphasizing the aspects that are important to citizen science practitioners, research administrators and policy makers, such as improved knowledge transfer, international collaboration and accelerated innovation. The roadmap features actions citizen science stakeholders can take alongside the community of Open Science Hardware developers and users to advance the integration of open source hardware in citizen science, overcoming barriers to implementation and uptake.
What We Learned from Talking to 110 People About Citizen Science Tools: Scaling and Sustaining Through the NSF Innovation Corps for Learning Program

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Citizen science engages the public in scientific inquiry, most prominently through data collection and environmental monitoring projects that use tools. There are often challenges to access the right tools necessary for many projects. Through participation in the National Science Foundation's Innovation Corps for Learning program (Chavela Guerra et. al., 2014), we adapted lean launch methods to develop a better understanding of the ecosystem of stakeholders around citizen science tools. We used "customer discovery" practices to interview more than 100 people, focusing on the "pain points" for the "customer segments" of citizen science volunteers and project organizers. We will report on the learnings from this work, and how this approach (usually applied to for-profit businesses) delivered significant insights applicable to the larger citizen science community. With specific examples, we illustrate discovered "value propositions," which are 1) to save time and effort by connecting people, projects and vetted turnkey project-tool bundles to collect a lot more quality data, and 2) to increase confidence when making decisions on quality instruments, protocols, instructions and additional citizen science resources from a trusted source. And we will share how these guiding principles are shaping the development and deployment of a citizen-science-in-a-box tool kit, starting with one for the GLOBE Program's El Nino protocols in partnership with SciStarter. We can share how this extends to scale and sustain a citizen science experience for people to contribute to multiple projects over time, and for project organizers to get numbers of participants who can collect useful and quality data.

Getting It Right or Being Top Rank: Games in Citizen Science

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The use of games in citizen science is growing, but can create tension as these can be seen as incompatible areas of activity. For example, the motivations of winning a game and the scientific pursuit of knowledge may be seen as contrary. Over a one-year period, we conducted a virtual ethnographic study of the public forums of two online projects, Foldit and Galaxy Zoo (GZ). The first where gaming is an explicit design feature and the second where it is not. The aim was to give a nuanced view of how participants topicalize and respond to tension between games and science. Thematic analysis of the forum posts showed that participants in the two projects respond differently to the tension. GZ participants highlighted the value of sharing and openness to sustain a healthy community while Foldit participants expressed concern for the project becoming the exclusive playground of an ever-decreasing elite group. For example, leaderboards were portrayed as antithetical to a healthy community in GZ as scores bring unhealthy competition and adverse effects on scientific validity. By contrast, the notion that ranking performance could be antithetical to the spirit of science was not part of the established community repertoire for Foldit. By unpacking participant responses to the tension between games and science, our study highlights that citizen science projects using games are not just about fun. In order to enrol and retain volunteers, they must also recognize and manage the implicit normative scientific ideals participants bring with them to a project.