Getting to Citizen Science

An investigation of the landscape, typologies, and design frameworks of public participation in scientific research

Stacie Beute | Arizona State University, School of Life Sciences

Why Citizen Science?

Public participation in scientific research, commonly called citizen science, has the potential to gather much-needed scientific data at large spatial and temporal scale, advance scientific literacy in participants, engage dialog between scientists and stakeholders, and grow capacity for science-informed management and policy. Encouraged by these potentials and more, public participation in scientific research (PPSR) is on the rise.

Methods

Questions 1 & 2: To become knowledgeable of the PPSR landscape and to ascertain what, specifically, citizen science is, I analyzed twenty-six randomly selected PPSR projects. I also immersed myself as a public participant in four projects. The thirty projects were analyzed across seven key project parameters for commonalities and differences. The parameters were: project goals, degree of public participation, study focus, method of data collection, spatial/temporal scale and scope, project self-description, and organizational features. Based on these parameters, I classified projects to type based on published PPSR typologies.

Questions 3 & 4: Through a literature review, I identified five typologies/models of citizen science to describe and delineate various kinds of PPSR. The typologies were analyzed for commonalities and differences, and used to classify each of the thirty case studies. If typologies/models missed key features of projects, I understood this to be a deficiency of the typology in capturing the landscape of PPSR.

Question 5: Through a literature review, I identified five program design and operation frameworks meant to guide practitioners in building projects to engage the public in scientific research and conservation. These frameworks were analyzed for commonalities, differences, strengths, and weaknesses, and subsequently aggregated into a comprehensive framework for the design and operation of PPSR projects.

Findings

The landscape of public participation in scientific research is rich. Projects vary widely across each of the seven parameters studied (Table 1). Despite this richness, particular parameters, combinations of parameters, and types of PPSR dominate the landscape. For example, 80% of projects studied were classified as the citizen science type (Fig. 2). Furthermore, 82% of projects studied focused toward conservation and/or ecology. In pairing project type and study focus, I found that 71% of PPSR projects were in the citizen science model focused on conservation and/or ecology (Fig. 3).

Table 1. A Cross Section of Case Study Project Parameters and Descriptions

<table>
<thead>
<tr>
<th>Parameter Category</th>
<th>Parameter</th>
<th>Sub-Parameter</th>
<th>Project Focus</th>
<th>Method</th>
<th>Scale/Scope</th>
<th>Self-described</th>
<th>Organizational Features</th>
</tr>
</thead>
<tbody>
<tr>
<td>Citizen Early Mime</td>
<td>Archetypical Dig</td>
<td>provide opportunities for public participation in research</td>
<td>public health</td>
<td>field-based</td>
<td>local, ongoing</td>
<td>public participation in research</td>
<td>Community-based, participatory-driven, project formed by students</td>
</tr>
<tr>
<td>Tc-Analyse</td>
<td>Advance science research</td>
<td>coordinate health data, disease surveillance, provide health data</td>
<td>public health</td>
<td>computer, phone app</td>
<td>international, ongoing</td>
<td>N/A</td>
<td>Non-profit/community collaboration</td>
</tr>
<tr>
<td>Great Lakes</td>
<td>salmon survey</td>
<td>count salmon, field work</td>
<td>public health</td>
<td>field-based</td>
<td>local, ongoing</td>
<td>volunteer monitoring, citizen science</td>
<td>Non-profit, volunteer-driven, non-competitive</td>
</tr>
<tr>
<td>Baltic Sea</td>
<td>Hydrophone Network</td>
<td>noise monitoring</td>
<td>public health</td>
<td>home-based, smartphone</td>
<td>international, volunteer monitoring</td>
<td>N/A</td>
<td>Non-profit, volunteer-driven, non-competitive</td>
</tr>
<tr>
<td>CI-Communicating</td>
<td>Climate Change</td>
<td>climate monitoring</td>
<td>public health</td>
<td>field-based, smartphone</td>
<td>citizen science</td>
<td>Managed by science center and university, science-driven</td>
<td></td>
</tr>
<tr>
<td>Great Maritimes</td>
<td>Net Survey</td>
<td>satellite monitoring</td>
<td>public health</td>
<td>field-based, online</td>
<td>citizen science</td>
<td>Science-driven, community-driven</td>
<td></td>
</tr>
<tr>
<td>Global Wildlife</td>
<td>Field Survey</td>
<td>data collection</td>
<td>public health</td>
<td>field-based, smartphone</td>
<td>citizen science</td>
<td>Science-driven, community-driven</td>
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<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>citizen science</td>
<td>Science-driven, community-driven</td>
</tr>
</tbody>
</table>

While there is wide variety in the PPSR landscape, 71% of PPSR projects studied were in the citizen science model focused on conservation and/or ecology.

Discussion

If we are to capitalize on and leverage the potential of PPSR, if we are to be successful in achieving goals by design, it is essential that we understand the variability in this system, that we recognize what distinguishes one PPSR activity from another, and that we know what program design elements are requisite for project success. This analysis of the PPSR landscape and suggested typologies has revealed where there is solid ground upon which we may begin to accrue findings, and where field remains unsettled. Analysis of project design frameworks has revealed the essential elements of PPSR and, in aggregating frameworks, I have produced a rough version of the kind of comprehensive tool that will be necessary in building PPSR programs moving forward.

Acknowledgements

My gratitude to Dr. Janet Douglass (SOULS) & Dr. Kimberly McCue of Desert Botanical Garden for their mentorship. Special thanks to CAP LTER for helping to support my continued exploration of public participation in scientific research.

References

3. Lepczyk, C, Boyle, O, Vargo, T, Gould, P, Jordan, R, Liebenberg, L, Masi, S, Mueller, W, Prysby, M, Vaughan, H. 2009. Citizen science is not only descriptive of one type of PPSR, but is also descriptive of the overall phenomena of PPSR. Agreed upon nomenclature is scarce, and problematic. Suggested typologies based on level of public participation did little to enlighten the fundamental differences between PPSR projects. Level of participation was not necessarily linked to other project parameters prior to project outcomes. Typologies based on project goals and organizational features captured more fundamental differences, but told nothing of level of participation – a meaningful parameter. Cross-pollinating typologies produced a more accurate description of the key differences in projects and of the variety in the PPSR landscape.
4. No single project design framework is complete in providing clear mechanisms to realize the full potential of PPSR. Aggregating frameworks is useful toward building programs to achieve goals by design.

Fig. 1: Trend in Google searches for the terms “citizen science” over time.

Fig. 2: Percentage of case studies classified to particular PPSR types. Most case studies (86%) were classified in the citizen science type.

Fig. 3: Pairings of goals and study focus show 71% of PPSR case studies were conservation/ecology focused in the citizen science type.