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Youth-focused Community and Citizen Science

Title

Youth-focused Community and Citizen Science Research Brief: Youth Take Ownership of Data Quality

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Author

UC Davis Center for Community and Citizen Science

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KEY PRACTICE

Youth Take Ownership of Data Quality

WE'VE FOUND THAT GIVING young people responsibility for ensuring high-quality data collection and analysis positions them as responsible experts and encourages investment in the process and products of science[1]. Through community and citizen science (CCS), scientists can answer questions in ways possible only through collaboration with public participants, yet scientists express concern over data quality, particularly when working with young people. However, young people can understand scientific data collection standards, and collect high-quality data, sometimes more reliably than adults[2].

Why it's good for learning

By assuming responsibility for data quality, youth can develop ownership of, and investment in, their scientific work[1]. Youth participants can become frustrated by repetitive data collection when they don't understand the rationale or have little autonomy in how the data are collected[3]. It is important that young people experience CCS activities as meaningful and not simply as rote work[4]. Extensive research shows that a strong sense of ownership of the work is associated with more active engagement, increased sense of agency and self-efficacy, positive attitude toward science, and improved science learning outcomes[5,6.]

In our research[1], we saw educators foster youth responsibility for data quality by: (a) encouraging individual students to accurately calibrate instruments and ensure that peers were correctly measuring and inputting results; (b) facilitating conversation between students and scientists, managers, and the public that

Youth use a chart to ensure data quality in water samples.

prompted students to think through the strength of their evidence and relationship to claims; (c) making youth aware of other CCS project participants including students, community members, or scientists; and (d) having students develop their own questions for analysis, alongside those of the broader project.

Youth explained that they took up roles in ensuring data quality for a variety of reasons—they wanted to be

Drawn from our in-depth research in youth-focused citizen and community science, key practices can lead youth to be more engaged in scientific practice, see themselves as part of scientific and local communities, broaden possible career paths, and foster youth agency with environmental problem-solving.

viewed as professional, were curious about the results, didn't want to let down other participants, or just wanted to get muddy! Regardless of motivation, youth saw the need for trustworthy data and, in turn, took responsibility for that trust. This led youth to better understand how and why data can vary and why having accurate, reliable data matters in scientific endeavors. In some cases, this understanding helped them become leaders in the project.

Case 1: Leading water quality monitoring efforts

As part of the East Bay Academy for Young Scientists, middle and high school interns met during the summer to monitor water quality at their local creek. Although a first-year participant and the youngest in the group, Janey led the team's daily task of collecting and testing water samples, stepping into this role because she liked to "get things done". With encouragement from project scientists, she developed her own strategies for efficiently analyzing multiple samples at once, ensured that measurements were consistent across the team, and coached new youth and adult volunteers. Through this, Janey came to appreciate the role scientific research played in motivating and informing the group's restoration work on the creek.

Case 2: Submitting accurate bird identifications

To determine how they could support local biodiversity, students in a fourth grade class cataloged birds at a pond near their school. As part of a year-long investigation, they made observations, recorded notes, and photographed birds at the pond. Back in class, students discussed bird identifications, with the intention of submitting data to eBird, a citizen science project that tracks bird species. However, students had many questions about which birds they observed. Rather than the teacher simply identifying the birds, students used field guides and apps, photographs and field notes to determine which birds they had seen. The teacher emphasized the importance of being sure about the identifications because both scientists and other students in the class would use these data. Though they observed over twenty bird species at the pond, students decided to submit only their five most confident observations. Throughout this experience, the

FIGURE

Discussing Data

The right question from a peer or facilitator can help participants consider why data quality is important and how they can take responsibility for ensuring rigorous data collection and analysis in their project. Here are some effective questions we have seen CCS educators use.

When collecting or submitting data

> Are these data good enough for a scientist to use for her/his research?
> How certain are you about [your methods, species identification, count...]?
> What could we do to be more certain? What evidence would you need to be certain?
> What remains uncertain?
> Do others agree?

When reviewing data from other participants

> How do our data compare to the data [another project participant] gathered?
> How do you think [another project participant] collected their data?

When planning for data collection or analyzing existing datasets

> What do you want to find out?
> What data do you need to answer your question?
> Do you need data from additional sources?

teacher treated the students as knowledge builders and local experts, capable of discerning high-quality, usable data. They also learned about uncertainty in science and the importance of backing up claims with evidence.

Tips for implementing

1. **Engage youth in the question "Are these data good enough for somebody to use?"** Before and after data are collected, discuss what constitutes "good data" based on how other people will use the data. Give opportunities for youth to help determine what good data look like.

2. **Develop a culture of questioning data.** Create routines or roles in which youth question one another (and adults!) and ask for evidence to back up claims.

3. **Break up a complex protocol into smaller tasks and roles for which youth can take responsibility.** Youth can try out multiple roles, building expertise over time and noticing how data quality relates to other work being done.

4. **Encourage improvised practices.** Youth participants may come up with their own data collection strategies or ways to analyze data that do not compromise the scientific protocols. Look for these and, where possible, adopt them across the group. Doing so shows youth that they can have influence and bring their unique perspectives to science.

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