

News and Perspectives

Making Citizen Science Work for Everyone

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Abstract

Science doesn't have to be a one-way exchange; public involvement in science can go beyond reading research summaries and filling out self-report forms. In this *News and Perspectives* article, JMIR Correspondent Katie Cottingham reports on the growing citizen science movement, speaking with experts about why it's gaining popularity and what it takes to make it work.

Key Takeaways:

- Citizen science, performed by people who do not have formal training in a given discipline, can build trust in science, improve scientific literacy, and expand scientific discovery.
- Projects can face data quality challenges, and scientists must actively work with participants.

Humans have always been curious about their environment, charting stars in the night sky, keeping track of weather patterns, noting which plants grow well in certain climates. Some become “citizen scientists”—regular people with no formal scientific training who voluntarily collect data or conduct experiments. In the United States, from [Benjamin Franklin](#) charting the Gulf Stream and conducting experiments with electricity to [Eunice Newton Foote](#) conducting some of the first experiments on the greenhouse effect, citizen scientists have made key discoveries over the centuries.

As science has grown into the formal institution it is today, the public has continued to contribute. When community members participate in projects, they learn how science works, which goes a long way toward building trust in science as a whole. This positive sentiment could ultimately lead to even more public involvement and more government funding. Citizen science can also [help](#) people from underrepresented groups be heard in important conversations that involve their own communities, as well as expand the reach, pace, and policy uptake of scientific discovery.

There are many ways to participate, but [a few main types](#) of citizen science have emerged. “I like to think of three different types of citizen science—‘for-the-people’ citizen science, ‘with-the-people’ citizen science, and ‘by-the-people’ citizen science,” says [Abby King](#), David and Susan Heckerman Professor and professor of epidemiology & population health and of medicine at Stanford Medicine.

More Hands, More Ideas

Volunteering for a clinical study is an example of the for-the-people category. Typically, participants provide information about themselves to researchers, and the interaction ends at the clinic door. With- and by-the-people projects open up more possibilities.

With-the-People

Citizen science with the people is common in the environmental sciences. In [these projects](#), members of the public observe and actively collect data that they provide to scientists, who crunch the numbers and publish the results.

When [Frauke Ecke](#) and her team wanted to better understand trends in rodent-borne diseases among humans, conducting a with-the-people [project](#) was a no-brainer. “From a data perspective, the sheer amount and extent of data sampling just would not have been possible to achieve with a traditional field campaign,” says Ecke, professor at the University of Helsinki. “This is especially valid for data that might be of a sensitive nature—not everyone would have allowed us to trap rodents in their house or garden.”

Recruited via social media posts and radio broadcasts, citizen scientists involved in Ecke's project in Sweden downloaded an app called “Mouse in the House.” Whenever they saw a small, wild rodent like a mouse or vole inside their homes, they would note it in the app along with the date, location, species, weather conditions, comments, and photos.

These data were instrumental to the project. “By putting together weather data with the citizen science and disease incidence data, we could show that wet autumn conditions drove the target rodent, the bank vole, indoors, which in turn resulted in human disease cases 1-2 months later,” says Ecke. “The indoor observations from citizens provided the missing link.”



You can't go in with hubris, thinking you know it all. You have to be comfortable listening and respecting the voices of community members, who also have valuable insights and expertise.

Abby King, PhD

By-the-People

King conducts by-the-people citizen science. She is the faculty director of a global research initiative called [Our Voice](#), in which community members help design research projects, collect data, discuss their results with researchers, and present their findings to decision-makers who can take action. This bottom-up approach can empower residents to make real changes in their communities. “The residents learn how to present their data about their community—both positive and negative—to local decision-makers, which goes beyond simply registering a problem,” says King. “The data and the stories make the difference. Science needs to go beyond just touching people’s minds—we need to grab their hearts, too.”

[Our Voice](#) is an initiative that facilitates [community-based projects](#) internationally and has been active in more than 30 US states. It began in 2010 when King and her team realized that they really didn’t know the community well in the area where they wanted to lead a project. “We could have guessed at some of the issues, but we thought, wouldn’t it be better if they told us what the issues were?” she says.

People from various sectors in a community often come to [Our Voice](#) researchers with an idea, and the interdisciplinary team of researchers and program implementers help them refine it. Community members use the [Stanford Healthy Neighborhood Discovery Tool](#) mobile app to securely upload photos, add explanations, and enter ratings with emojis.

The [Women’s Health Initiative Strong and Healthy \(WHISH\)-Encore](#) research study is an example of an ongoing [Our Voice](#) project. The goal is to evaluate the added impacts of with-the-people and by-the-people approaches

when combined with traditional behavioral physical activity programs in older women. Participants provide data about themselves and help identify solutions to challenges they face when walking in their neighborhoods.

Josephine Poole is a participant in the study. “I’m dedicated to research to provide information that might help others later on,” she says. She was especially excited about WHISH-Encore because it was so different from any other study she had participated in. Instead of just answering a few questions or providing a blood sample, Poole is an active team member. She uses the app to upload photos of hazards in her neighborhood and attends videoconferencing calls where the researchers and participants share and discuss results. “It has been fulfilling, and I like being part of something productive,” she says.

Potential Pitfalls

Although citizen science projects have many benefits, researchers who want to get involved should recognize some potential pitfalls. For example, data quality is a major challenge.

“The data from our project might have been biased due to certain people contributing with a disproportionately large number of data points, people often reported the wrong species, and it was impossible to get data from areas where people don’t live year-round,” says Ecke. To improve correct species identification, Ecke herself is providing feedback on photos that participants upload, and her team is developing an automated species identification tool for the app using AI.

Data handling is also a challenge. King’s team has been collaborating with colleagues at Stanford to figure out how to combine data from citizen science projects that can often include qualitative and quantitative data with “big data” from other projects and databases. The researchers have found some novel insights as they continue to develop methods for merging such diverse datasets.

To help other researchers who want to start citizen science projects, King and her colleagues have written an upcoming book (*Community Voices Building Healthier Choices Together: A New Era of Citizen Science*) that includes over 40 chapters of case studies and a workbook section. Having reflected on the numerous projects her team has managed, she notes that perhaps the most important piece of advice she can give is to become real partners with a community. “You can’t go in with hubris, thinking you know it all,” she says. “You have to be comfortable listening and respecting the voices of community members, who also have valuable insights and expertise.”

Keywords: citizen science; data; community; environmental science; public health

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