# People-powered research and experiential learning: Unraveling hidden biodiversity

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The microscopic leaves of a liverwort, a primitive plant that helps scientists track climate change. Credit: Photo by Lauren Johnson, Field Museum.

Ask any scientist—for every "Eureka!" moment, there's a lot of less-than-glamorous work behind the scenes. Making discoveries about everything from a new species of dinosaur to insights about climate change entails some slogging through seemingly endless data and measurements that can be mind-numbing in large doses.

Community science shares the burden with volunteers who help out, for even just a few minutes, on collecting data and putting it into a format that scientists can use. But the question remains how useful these data actually are for scientists. A new study authored by a combination of high school students, undergrads and grad students, and professional scientists showed that when museumgoers did a community science activity in an exhibit, the data they produced were largely accurate, supporting the argument that community science is a viable way to tackle big research projects.

"It was surprising how all age groups from young children, families, youth, and adults were able to generate high-quality taxonomic data sets, making observations and preparing measurements, and at the same time empowering community scientists through authentic contributions to science," says Matt von Konrat, an author of the paper in the journal *Research Ideas and Outcomes* and the head of plant collections at Chicago's Field Museum.

"This study demonstrates the wonderful scientific outcomes that occur when an entire community comes together," says Melanie Pivarski, an

associate professor of mathematics at Roosevelt University and the study's lead author. "We were able to combine a small piece of the Field Museum's vast collections, their scientific knowledge and exhibit creation expertise, the observational skills of biology interns at Northeastern Illinois University led by our collaborator Tom Campbell, and our Roosevelt University student's data science expertise. The creation of this set of high-quality data was a true community effort."

The study focuses on an activity in an exhibition at the Field Museum, in which visitors could partake in a community science project. (Community science is sometimes called citizen science, but since not everyone is a citizen, community science is a more inclusive name.) In the community science activity, museumgoers used a large digital touchscreen to measure the microscopic leaves photographs of plants called liverworts.

These tiny plants, the size of an eyelash, are sensitive to climate change, and they can act like a canary in a coal mine to let scientists know about how climate change is affecting a region. It's helpful for scientists to know what kinds of liverworts are present in an area, but since the plants are so tiny, it's hard to tell them apart. The sizes of their leaves (or rather, lobes— these are some of the most ancient land plants on Earth, and they evolved before true leaves had formed) can hint at their species. But it would take ages for any one scientist to measure all the leaves of the specimens in the Field's collection. Enter the community scientists.

"Drawing a fine line to measure the lobe of a liverwort for a few hours can be mentally strenuous, so it's great to have community scientists take a few minutes out of their day using fresh eyes to help measure a plant leaf. A few community scientists who've helped with classifying acknowledged how exciting it is knowing they are playing a helping hand in scientific discovery," says Heaven Wade, a research assistant at the

Field Museum who began working on the MicroPlants project as an undergraduate intern.


Microleaves Measured: 3
SUBMIT YOUR MEASUREMENTS
QUIT

Cuong Pham, Jimmy Crigler, and Joshua Torres, then students at Roosevelt University, working on a community science platform in an exhibit at the Field Museum. Credit: Photo by Melanie Pivarski.

Community scientists using the digital platform measured thousands of microscopic liverwort leaves over the course of two years.

"At the beginning, we needed to find a way to sort the high quality measurements out from the rest. We didn't know if there would be kids drawing pictures on the touchscreen instead of measuring leaves or if they'd be able to follow the tutorial as well as the adults did. We also needed to be able to automate a method to determine the accuracy of these higher quality measurements," says Pivarski.

To answer these questions, Pivarski worked with her students at Roosevelt University to analyze the data. They compared measurements taken by the community scientists with measurements done by experts on a couple "test" lobes; based on that proof of concept, they went on to analyze the thousands of other leaf measurements. The results were surprising.

"We were amazed at how wonderfully children did at this task; it was counter to our initial expectations. The majority of measurements were high quality. This allowed my students to create an automated process that produced an accurate set of MicroPlant measurements from the larger dataset," says Pivarski.

The researchers say that the study supports the argument that community science is valuable not just as a teaching tool to get people interested in science, but as a valid means of data collection.

"Biological collections are uniquely poised to inform the stewardship of life on Earth in a time of cataclysmic biodiversity loss, yet efforts to fully leverage collections are impeded by a lack of trained taxonomists. Crowd-sourced data collection projects like these have the potential to greatly accelerate biodiversity discovery and documentation from digital images of scientific specimens," says von Konrat.

**More information:** Melanie Pivarski et al, People-Powered Research and Experiential Learning: Unraveling Hidden Biodiversity, *Research Ideas and Outcomes* (2022). DOI: 10.3897/rio.8.e83853. preprints.arphahub.com/article/83854/

Provided by Field Museum