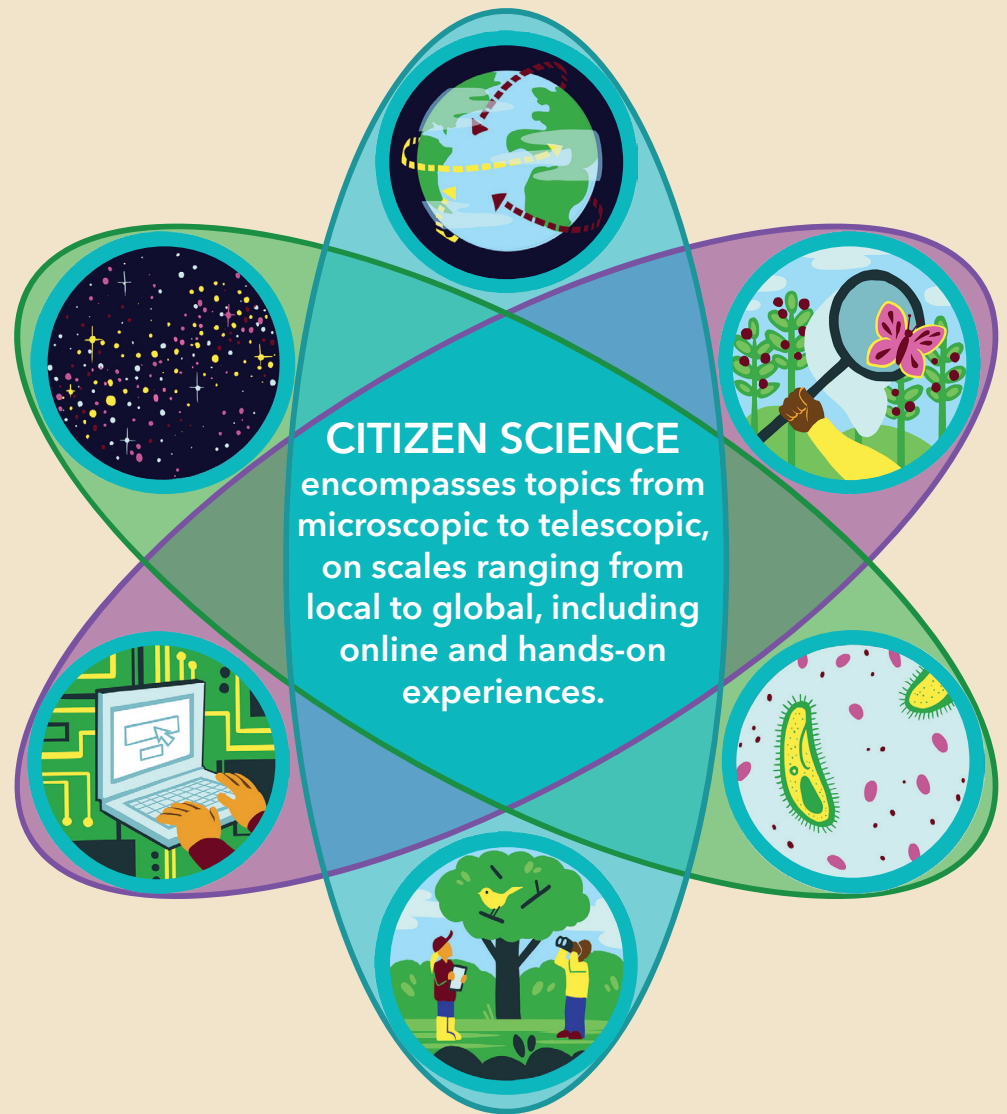


What is Citizen Science?

Citizen science involves the public as participants in real-world scientific research, in partnership with scientists or scientific organizations.

Youth can make and share observations that advance real science, on topics that engage their curiosity. Over 1,000 different citizen-science projects offer training activities, protocols, and materials to support investigations.

Used in out-of-school settings, citizen science has great potential to activate STEM learning through experiences that are engaging, responsive, and which make connections to youths' lives, their interests, and their communities.



Citizen Science: Activating STEM Learning Out Of School

Citizen science offers youth and educators unique opportunities to observe and explore the world through authentic research experiences that are necessary for robust STEM (science, technology, engineering, and math) learning.

STEM learning is key to fostering informed and engaged youth who are ready to tackle the challenges of our future. Our increasingly complex world depends on helping youth cultivate skills needed to think critically and creatively about 21st Century challenges— skills such as observation, communication, and data literacy. STEM gives all students the building blocks for understanding and improving the systems that power our economy and advance our society.

“I can find citizen science opportunities that relate to almost any interest of our youth, connecting them to the larger world of science.”

—BILL MILLION, 4-H EDUCATOR



Productive STEM Out-of-School Programs

- Engage young people intellectually, academically, socially, and emotionally;
- Respond to young peoples’ interests, experiences, and cultural practices;
- Connect STEM learning in out-of-school, home, and other settings.

From the National Research Council's 2015 report, *Identifying and Supporting Productive STEM Programs in Out-of-School Settings* (1).

Out-of-school settings are an essential part of the ecosystem of education for STEM learning. Activities outside of the school day have great potential to provide STEM experiences that are **engaging, responsive,** and **make connections**, qualities that the National Academy of Sciences report best support positive youth learning beyond the classroom (1).

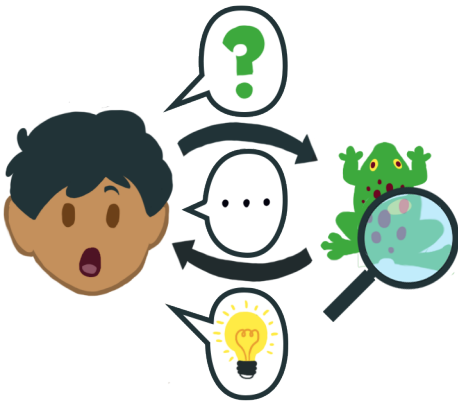
Research suggests that engagement in authentic science experiences is required to develop fluency with STEM—we have to **do** science to learn science (2). But youth have limited chances to participate in this kind of immersive, student-centered experience with STEM topics. Even more rare are opportunities to connect authentic science practices to students’ own lives, interests, and learning contexts. Educators and youth increasingly seek out ways to work with real data and scientific problems, particularly those that have a connection to their local community and environment (3). Citizen science directly engages youth and educators in real-world research, wherever they are and whatever their interests may be.

Through citizen science, youth take part in active investigations connected to science that has significance in the wider world. Citizen science immerses youth in the practices of science, and makes sense of those practices in the places where they live, learn, and play. Citizen science provides a context where youth educators can help learners develop STEM skills such as observation, technology use, and data literacy, and weave those skills together to apply them directly to problems they care about.

In these ways, citizen science can uniquely address robust STEM learning goals through learning that is as much about personal interest and identity as it is about content and concepts (4).

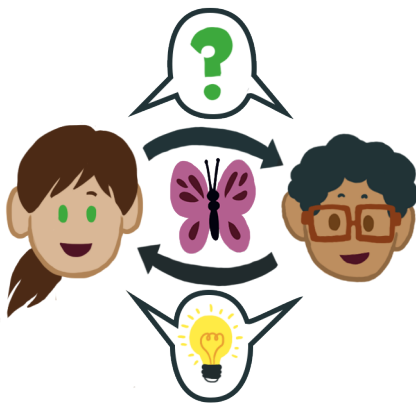
No matter where they live, youth and educators can take part in real-world science that is engaging, that responds to their interests, and that makes connections between science and the world around them.

Citizen Science Offers ...



Engaged Learning

Making observations, collecting data, and sharing results are central activities in citizen science. Youth gain first-hand experiences using—and sometimes even building—research instruments, from datasheets to apps, and binoculars to drones. Some citizen-science observations can be accomplished in minutes. Additional benefits are realized when youth engage in ongoing investigations, as they develop fluency with the skills and language of science while building new understandings of the world over time (5). By opening up real-world scientific activities, citizen science also invites youth and educators into a scientific community in which asking questions is valued as much as knowing the answer.



Responsive Learning

Asking questions is as much a part of citizen science as collecting data. Even when following protocols provided by scientists, youth make observations that ignite curiosity and lead them to wonder about the world, providing a “jumping off point” for inquiry (6). Citizen science creates a natural learning environment where everyone—from youth to educators to project scientists—can freely say, “we don’t know—let’s learn this together.” When asking questions about the world around them, research becomes more relevant to young people’s interests and their lives. With enough support, youth can use their new understandings to take action in their communities.



Connected Learning

By taking part in citizen science, youth join a community of learners all engaged in the same investigations, and their contributions help scientists and others understand the world (7). This imparts responsibility that sparks careful STEM practices, which in turn builds fluency in skills such as observation, technology use, and data interpretation. As many projects are partnerships between community organizations and science institutions, and often take place in local settings such as museums or nature centers, citizen science makes connections which reinforce STEM learning across different spaces—at home, in school, and in the community. Citizen science can also introduce STEM role models, revealing possible careers while building STEM literacy regardless of career choice. Finally, youth can connect with each other over a shared enjoyment of STEM activities (8).

“I like to do outside activities. We get to explore and touch things, and this helps my learning. I get to experience things outside”

—LIN (MIDDLE SCHOOL STUDENT,
SCHOOL OF ANTS PARTICIPANT)

Citizen science can be as simple as making and sharing an observation, or as robust as asking questions or generating data that lead to civic engagement. With an ecosystem of STEM programming and the many ages, interests, and goals it must serve, there is also an ecosystem of citizen science projects and learning opportunities that educators can access and use.

Educators can also benefit from doing science and connecting with scientists. Taking part in citizen science can serve as a professional learning experience, helping to build confidence using science practices. Doing so, educators can begin to see citizen science not just as a single project, but as a teaching method—and a tool in their teaching tool-belt—which can be used to address a wide range of topics and skills. An increasing number of citizen science projects offer support for educators, including activities for scaffolding youth learning. Some organizations even offer professional development to help educators tailor this teaching technique to meet their specific youth development goals, whether for youth inquiry, STEM skills development, or civic engagement.

“Citizen science gives the students the ability to participate in science. To feel like their observations count for something.”

– PHIL KAHLER, BIRDSLEUTH eBIRD TEACHER

Citizen science provides a place for youth and adults to do science—to learn together, to include fun as a part of science, and to use what they learn to make their communities a better place. In supportive out-of-school learning environments in every community, citizen science can activate curiosity, creativity, and critical thinking, setting up our next generation of leaders with the habits of mind to create a prosperous future for us all.

It's Easy to Get Started!

Check out the website [SciStarter.com](https://www.scistarter.com), where you can search over 1000 projects by topic and by area and read reviews of projects by educators.

For more information

For more in this series of resources for citizen science in out-of-school environments, visit CitizenScience.org/youth-learning

Resources and ideas from the Citizen Science Association's Education Working Group can be found at CitizenScience.org/category/education

Support for educators interested in fostering youth inquiry through any citizen science project can be found in BirdSleuth's *Investigating Evidence* materials and online courses (birdsleuth.org/investigation) and the University of Minnesota's Driven to Discover curricula (extension.umn.edu/environment/citizen-science/driven-to-discover)

For inspiring citizen science stories, watch online episodes of Citizen Sci-Girls (scigirlsconnect.org/citizen-science) and The Crowd & The Cloud (crowdandcloud.org)

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Photo on page 2: Teen volunteers participate in the Cascades Butterfly Project. Flickr photo (cropped) by Kevn Bacher, Mount Ranier National Park (flickr.com/mountrainernps/7714959554) | CC BY 2.0

