

Providing Youth Authentic Opportunities to Practice and Share 4-H Science Abilities

Introduction

Excellent 4-H Science programs provide youth with authentic opportunities to practice and share new knowledge, skills, and abilities. Authentic quite simply means “real” – youth are engaged in finding solutions to “real” world problems and issues. Authentic opportunities to practice and share newly acquired *4-H Science Abilities* (see *4-H Science 101 in Resources* below) increase youth understanding of how science is relevant “in real life,” often through “ah-ha” moments of discovery or reflection.

Providing authentic opportunities to practice and share *4-H Science Abilities* helps youth:

1. Master new science abilities as well as other skills such as working in groups and public presentations;
2. Cultivate independence, as using science tools and abilities to address *current* problems helps them to envision themselves as *future* scientists;
3. Develop a sense of belonging as they work with like-minded peers, science professionals, and other members of the science community; and
4. Learn to share a spirit of generosity by addressing community issues and needs using science and technology.

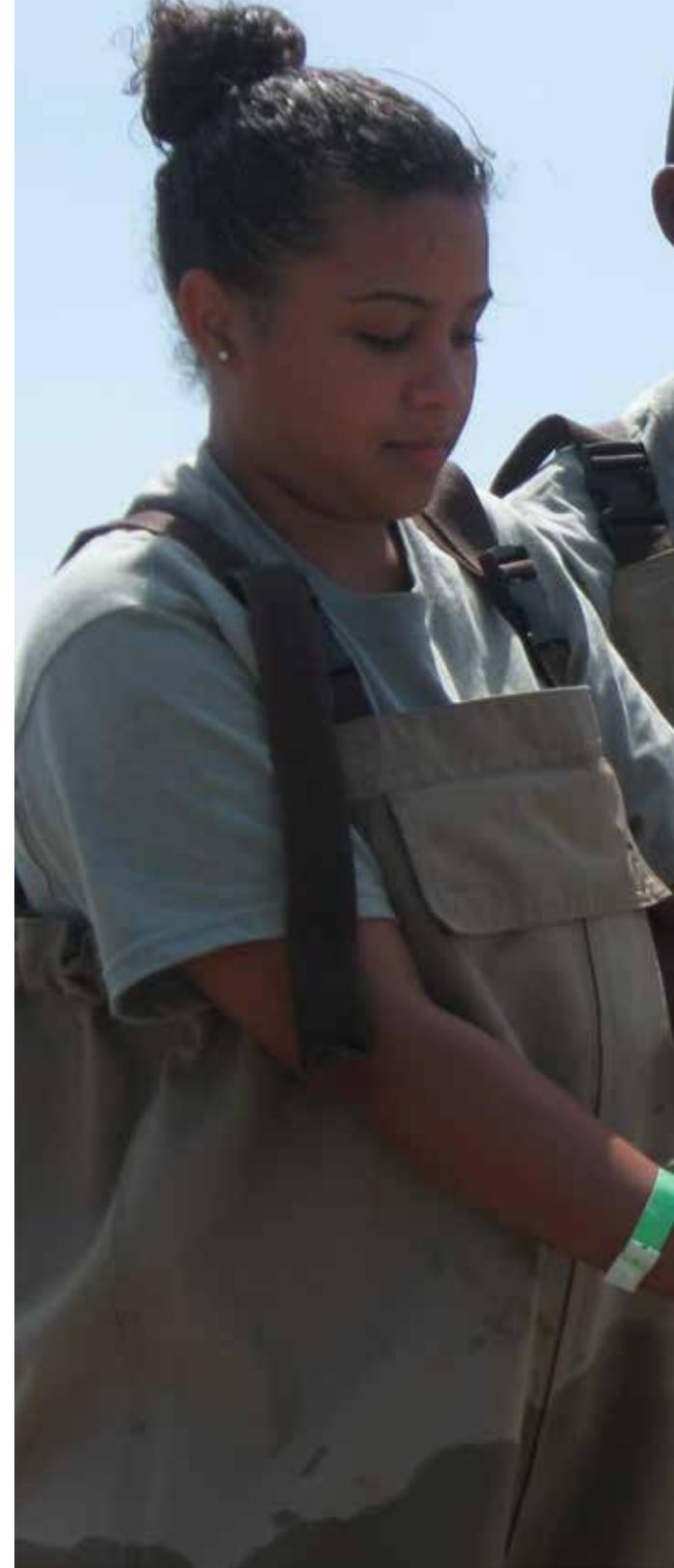
The purpose of this chapter is to help program planners identify and include authentic opportunities for youth to practice and share *4-H Science Abilities*.

Promising Practices

The promising practices for *Authentic Opportunities to Practice and Share 4-H Science Abilities* are subdivided into five categories: (a) Program Planning and Evaluation, (b) Program Implementation, (c) Mastering 4-H Science Abilities, (d) Service-Learning and Community Involvement, and (e) Teaching and Presentations.

Program Planning and Evaluation

1. *Read the chapter 4-H Program Design – 4-H Science Checklist*. This chapter provides fundamental program planning and evaluation information required for successful 4-H Science programs. The information contained here is specific to providing youth authentic opportunities to practice and share *4-H Science Abilities*.
2. *Develop relevant programs*. Design programs that will meet the needs and interests of urban youth. Relate activities to community and world issues using emerging technologies as a hook for engaging youth (see also *4-H Program Design – 4-H Science Checklist*).
3. *Use experiential, developmentally appropriate research-based curricula that support the science inquiry process*. Refer to *Inquiry Based Learning Approaches* for more information.
4. *Make science fun and interactive*. Ensure youth have the opportunity to touch and try out as many science-related tools as possible (microscopes, telescopes, lab equipment, robots, GPS/GIS units, etc). Remind the





youth that these “tools” are more like “toys” in the hands of the scientists who use them – in the same way that for scientists – “work” is like “play” because they enjoy what they are doing!

5. *Recognize that youth can be scientists today.* Plan activities that allow youth to “be” scientists today, and to see themselves as scientists tomorrow.
 - Youth should use “real” tools and instruments and engage in “real” projects (e.g., water quality monitoring, GPS/GIS community mapping, etc.). Create a program name that includes the word “scientist.”
 - Use appropriate titles for the roles that group members will undertake (e.g., engineer, project manager, recorder, reporter, technician, materials coordinator, etc.). Ensure each group member has the opportunity to experience each activity and role.
6. *Include field trips to support learning objectives.* Youth interest and knowledge can be easily increased with the right field trips. Field trips should allow youth to do more than just tour the facilities (passive participation). Incorporate a project, activity, or shadowing/job experience that will allow youth to be more active and engaged in their learning.
7. *Provide opportunities to expose youth to a variety of science careers.* Guest speakers and university-based science camps are two great ways to showcase the variety of careers available in the sciences.
8. *Include entrepreneurial projects where appropriate.* Entrepreneurial projects that make the learning real and connect to the community, such as marketing plants produced through a hydroponics program, are ideal for moving youth beyond what they just learned to “how is this applicable?”
9. *Create issue, project, or theme based camp experiences.* Allow youth to select an issue or challenge at the start of the camp week. During the week they will research the problem and design a solution. On the last day of camp youth will present their projects and findings (see *Mullens* in *Case Studies* below).

Program Implementation

1. *Conduct orientation before and include reflection time after science projects.* Orientation: Before the program, let youth know what they’ll be doing and why. Reflection: After the project, bring the entire group back together to discuss. Ensure adequate time for reflection and self exploration.
2. *Allow youth to work in small groups.* 4-H Science programs deliver informal science education within the context of positive youth development. Youth will be working in groups of one kind or another for the rest of their lives. Science is practiced in interdisciplinary, multi-organizational, and/or multinational teams. Working in small groups allows youth to develop mastery of team skills needed for the future.
3. *Strive for the lowest facilitator-to-youth ratio possible.* To allow for maximum hands-on participation, include as many adult or teen facilitators per youth as possible.
4. *Incorporate the use of science journals.* Youth can use journals to record scientific observations and data, but perhaps most importantly, youth can record reflections and “ah-ha” moments. This may work particularly well for young women who are more comfortable with private reflection than sharing in groups. It is very important to provide personal feedback to youth through their journals.
5. *Give youth a science challenge, or make the activity a contest.* Presenting youth with a problem or challenge to be solved helps get them started, especially if this is the first time for the process. Contests raise the fun quotient! Provide simple incentives.

View Our World WITH Environmental Science

By: Kara, Dominique, Khalid & Bryan

WHAT IS SCIENCE?

Science is technology, research, and the studies of our world. We came to the 4H program at Rutgers to gain a college experience. This program broadens our horizons in science while molding future science ambassadors.

Imagery Exploration

Imagery Exploration deals with the complexities of remote sensing, and principles of imagery interpretation. It also takes a look at New Jersey geography.



GPS Navigation

GPS navigation stands for Global Positioning System. We learned how to determine coordinate locations, including in field navigation exercises.



INTEREST & WHY

Science is interesting and we want to observe how things work. For example, the GPS technology that helped us find our way during our exploration was a great example of how much technology has advanced the field of science.

Scavenger Hunt!



Using the small GPS system/mobile mappers (Garmin systems), the 4H staff created a scavenger hunt activity. We got into small groups and plotted (x, y) coordinates of latitude & longitude to search for 6 tin cans around the Rutgers Campus. This was a fun activity that showed how many different scientists use GPS systems to track down several species of animals in the environment & more!



GIS & Spatial Analysis!



In the GIS Analysis Lab, we worked in groups of 2 in a computer. We looked at different maps of New Jersey and how the earth has changed over time.

study land use. This activity showed how scientists map out seasons and the vegetation in different regions of the world. Google Earth was a great example of how much technology has benefited the field of science.



WHAT WE LEARNED

My opinion of science hasn't changed. However, I had some great experiences at our camp. I learned more about what a college campus and how to manage time. I also got a feel for other scientists' study within...

In my opinion, respect enhances science. I had the beginning to my life. I became my short, nephew,

Some key things I learned from the Rutgers 4H Program: the importance of hard responsibility and responsibility.



Mastering 4-H Science Abilities

1. *Provide opportunities for practice, repetition and problem-solving.* The more youth practice, the more confident they will feel in their abilities.
2. *Hold skillathons regularly.* They are a great way for youth to practice science abilities and will also motivate youth if they include some kind of competition.
3. *Extend the learning to the home.* Use curricula that provide opportunities for youth to share at home what they learned in the program. Provide take-home challenges that encourage practice in order to continue the learning process. Also provide parents with follow-up questions to ask the youth.

Service-Learning and Community Involvement

1. *Include service-learning projects.* Service-learning projects tied to real community needs (issue-based programming) are great opportunities to make the learning real and connect to the community. In addition, service projects move youth beyond being *future* change agents to being change agents today!
2. *Engage youth in citizen-scientist opportunities.* Citizen-scientist programs exist in many science fields. Youth collect and report their data online (e.g., wildlife inventory, precipitation, migration patterns, etc.) along with people from across the state, region, country, or even the world. These data are compiled and used by the appropriate scientific agencies or organizations to discover regional, national and/or worldwide patterns and trends (see several examples in *Resources* below).
3. *Provide opportunities for youth to design and implement personal research projects.* Connect them to science mentors (e.g., community scientists, university scientists, etc.) who are willing to provide assistance and direction through project completion.

Teaching and Presentations

1. *Arrange for youth to present service-learning project results.* If youth have worked on addressing authentic community needs, there will be built-in audiences for project presentations among appropriate government, civic, and/or environmental agencies and organizations.
2. *Provide opportunities for youth to facilitate and teach.* To complete the learning cycle, help youth share their abilities and what they have learned with others. Engage youth as teachers. Being exposed to information is very different from being expected to teach it to others. Possible audiences include younger youth, peers, parents, community groups, and so forth.
3. *Be alert for presentation opportunities.* The more authentic opportunities youth have to present their projects and findings, the more competent they will feel in their knowledge *and* presentation skills. Possible venues include:
 - Community events (e.g., Recycling Awareness Day, Earth Day, science fairs, etc.);
 - Conferences (e.g., youth, school, professional, etc.); and
 - Government agencies, science professionals, and other interested community members.

Case Studies

Moon – Developing 4-H Science Abilities Through Robotics. In 2004, 4-H started a partnership with the 21st Century Community Learning Centers administered by the Local Investment Commission of Kansas City. This partnership led to 4-H Afterschool robotics project clubs in elementary schools and expanded into collaborations with two high school FIRST® Robotics teams. The majority of afterschool staff at the LINC sites have limited post-secondary education with little to no experience in providing science based programs to the afterschool youth. The 4-H afterschool programs are focused on schools with high populations of youth who are under-represented in STEM fields. The majority of the programs were concentrated in the elementary grades until the last two years. This year, clubs were organized in the Hickman Mills and Independence middle schools and the Lincoln Prep high school. The Independence 4-H Robotics Club competed in the FIRST® Lego League program and the two high schools each have FIRST® Robotics teams. The primary goals of the 4-H robotics program are threefold: (a) to provide a structure for providing youth with project based experiential learning opportunities in career areas with strong opportunities, (b) to improve the academic success of inner city youth in science related subject areas, and (c) to establish a support system that will prepare previously underperforming youth to compete for educational opportunities in middle school, high school, and college. The afterschool programs provide Lego League based programs two to three afternoons a week to youth in afterschool programs in the Kansas City metropolitan area. Summer programs feature “camps” for robotics and GPS which feature the 4-H curricula developed by 4-H (Nebraska GEARTECH) and/or programs based on the Lego League training from the Carnegie Mellon summer institutes. The summer programs have allowed 4-H to expand to partnerships outside of the afterschool programs of the school year. The primary partner is The Local Investment Commission of Kansas City. We are also major partners of the FIRST® Lego League and FIRST® Robotics efforts through the University of Missouri Kansas City and Kauffman Foundation. —**Leon Moon, University of Missouri**

Mullens – Youth Wetlands Project Provides Service-Learning Opportunities. The Youth Wetlands Project is a statewide program created to provide science based hands-on activities and educational supplies at no cost to educators. Program curriculum is developed to help youth gain an understanding of the functions and values of wetlands and explore strategies for sustaining these unique ecosystems. Participating educators are encouraged to teach the lessons from the curriculum manual and conduct restoration projects and service-learning activities in their community. Program materials include structured lesson plans, materials used to teach lessons, and step-by-step procedures to activities. The program curriculum is endorsed by the Louisiana Science Teachers Association and lessons are designed to follow Louisiana’s Grade Level Expectations (GLE’s). Pre- and post-tests are completed by youth, and the results reflect increased knowledge of main science concepts.

Opportunities to participate in wetland restoration projects are available to teachers and youth throughout the year in various locations across the state. Participating youth have helped with vegetative plantings, tree plantings, and invasive species removals; constructed and installed wood duck boxes; and assisted in trash bashes/ beach sweeps. During the summer months, youth are encouraged to attend four summer camps that utilize program curriculum and provide wetland-related, hands-on learning activities: (a) 4-H Camp Grant Walker, (b) Louisiana Outdoor Science and Technology (LOST) Camp, (c) Marsh Maneuvers, and (d) Wild Woods Wanderings. —**Ashley Mullens, Louisiana State University**

Warner – Application of Science to Entrepreneurial Ventures in the Community. Building on over 20 years of research in hydroponics, Cornell University Cooperative Extension, NYC (CUCE-NYC), in collaboration with Cornell University partners, developed *Grow with the Flow* curriculum, a hydroponic gardening project. This curriculum, together with its leader’s guide, outlines a hands-on, science based program targeted to 4-H, afterschool, and summer youth that integrates multiple science disciplines into a comprehensive model that uses innovative, ex-





periential activities to teach science and its application to the real world. The process of designing and building a hydroponics system and growing, harvesting, and selling produce to NYC markets provides youth with inquiry-based, hands-on experiences. Topics covered include plant biology, sustainable agriculture, environmental and earth sciences, chemistry, physics, mathematics, ecology, computer science, marketing, economics, as well as the social implications of science and technology in real world settings. The *Grow with the Flow* curriculum addresses many standards in science education recommended by the American Association for the Advancement of Science (AAAS), the National Research Council (NRC), and the New York State Education Department. —**Philson Warner, Cornell University**

Resources

4-H Science 101 – this training guide provides four hours of activities that will help introduce your staff and participants to the development, delivery, and assessment of 4-H Science programs. Available at <http://www.4-h.org/resource-library/professional-development-learning/science-training-guides-resources/>.

4-H Service Learning Curriculum – sites includes information about the curriculum, additional resources, and a link to purchase the three-book service-learning series. Available at <http://new.4-hcurriculum.org/projects/servicelearning/>.

4-H There's No New Water! Curriculum Page – includes information and additional resources on service-learning and Youth-Adult Partnerships. Available at <http://www.4-h.org/resource-library/curriculum/4-h-theres-no-new-water/service-learning/>.

Citizen Scientist Opportunities – the following websites are representative of the increasing opportunities for youth and others to participate as citizen scientists – recording and sharing data with the greater scientific community. A database of Citizen Scientist opportunities, searchable by subject, is available at <http://scienceforcitizens.net/>.

Community Collaborative Rain, Hail and Snow Network - <http://cocorahs.org/>.

Cornell Lab of Ornithology - <http://www.birds.cornell.edu/citsci/>.

NASA Science - <http://science.nasa.gov/citizen-scientists/>.

Project BudBurst - <http://www.neoninc.org/budburst/index.php>.

National Service-Learning Clearinghouse – a wealth of information and resources on service-learning and exemplary service-learning programs. Includes professional development (conferences and webinars) and grant opportunities. Available at <http://www.servicelearning.org/>. A site designed for youth is available at <http://www.servicelearning.org/youthsite>.

School Gardening: Best Practices – a guide developed as part of the Louisiana 4-H Seeds of Service School Gardening Program with suggested practices for starting and maintaining youth gardening programs. Available at http://www.ext.colostate.edu/4_h/school-garden.pdf.