Science, Engineering, and Technology: A National 4-H Mission Mandate

Why Teach Our 4-H Youth About Science, Engineering, and Technology?

Our nation is facing a significant workforce shortage in the critical science, engineering, and technology fields that will put our leadership as a nation at risk. Studies show young Americans do not have the science, engineering, and technology career skills necessary to meet our country's future workforce needs:

- Only 18 percent of high school seniors are considered proficient in science. (NAEP 2000)
- A mere 5 percent of college undergraduates earn degrees in science and engineering. (*Rising Above the Gathering Storm* 2006)

To remain the great nation it is today, the United States needs to remain at the forefront of technology and vigorously pursue solutions to help energize and educate a changing world.

So How Can 4-H Help?

Our goal in 4-H is to teach youth that science is fun and that they can be good at it. Our youth need to know that knowledge of science enables us to think critically and ask good questions. Without scientific knowledge, we are wholly dependent on others as "experts." With knowledge of science, engineering, and technology (SET), youth are empowered to become participants rather than observers. Ultimately, SET is a resource for becoming a critical and engaged citizen in a democracy.

4-H provides youth with the opportunity to "tinker" with science, engineering, and technology in ways they often don't get to do in a formal school environment. In the age of nationally mandated proficiency tests, classroom teachers don't often have time to allow kids to tinker, explore, and think like a scientist.

4-H Volunteers Can Make a Difference

The 4-H Youth Development program creates opportunities for youth to develop skills, practical knowledge, and wisdom through observing and learning through experience.

The 4-H Youth Development emphasis is on practical application of knowledge or "learning by doing" to develop skills and acquire a sense of responsibility, initiative, and self-worth.

As a 4-H club leader, you recognize the importance of developing activities and programs for members that allow youth to learn while having fun. SET activities can be incorporated in any type of 4-H project or event. 4-H SET activities provide youth with hands-on learning experiences that foster exploration, discovery, and passion for the sciences.

To make sure your 4-H club's activities incorporate Science, Engineering, and Technology, design your activities so they include:

- The Essential Elements of 4-H Youth Development
- Some SET abilities
- Youth/Adult Partnerships (See *Creating Successful Youth - Adult Partnerships*)
- Programs delivered in a variety of settings and locations and involve diverse audiences

The 4 Essential Elements of 4-H Youth Development

- Independence (*Head*) - to think, plan, and reason
- Sense of Belonging (*Heart*) - to gain a sense of connection to others in the group and be part of positive activities
- Generosity (*Hands*) - to demonstrate concern with the welfare of others, accept responsibilities of citizenship, and develop positive attitudes
- Mastery of Skills (*Health*) - to apply the skills learned to be self-motivated, competent, and successful

SET Abilities: The Skill Sets That Youth Should Incorporate into Their Projects

Our job in 4-H is to help kids practice thinking and behaving like a scientist. Young children usually have the creativity and natural curiosity to do this already so your job should be easy! Overall, 4-H volunteers should focus on guiding youth through the process of scientific inquiry. As a 4-H volunteer you can set up activities that:

- Engage kids in thinking and reasoning about evidence or information.
- Allow kids to work together in cooperative groups to explore ideas and information.
- Allow kids to build a model that explains their understanding of a SET content area. A model could be a drawing or any other physical representation of their ideas about science. Encourage kids to use technology to express their understanding of science.
- Encourage kids to talk and to discuss their ideas about science. Kids should make predictions, then collect data (evidence) through measuring and researching, and finally, analyze their data.
- Perhaps most importantly, encourage kids to examine, review, and evaluate their own knowledge. Challenge youth to develop solutions, compare, and communicate their findings with others.

Ways to Integrate SET in 4-H

There are many ways to integrate and elevate 4-H SET in projects and programs. It can all start with bringing in partners to help you. Here are a few suggestions:

Working With University Faculty and Staff

You might also contact the science department at your local university and see if there is a professor willing to work with your

youth. Often scientists are required to demonstrate the "broader impacts" of their research. Your club may be just the outlet he or she is looking for to share their knowledge beyond the confines of campus.

Partnering With Your Local Science Center, Zoo, or Aquarium

Informal Science Education facilities around the state are looking for opportunities to work with you to engage kids in science learning. Many have interesting science programs and residencies in addition to staff/experts willing to help you develop exciting science, engineering, or technology experiences for your club or afterschool program.

Citizen Science Projects

There are many opportunities available to help your 4-H club practice being a scientist. Project Stardust, Journey North, and Audubon's Christmas Bird Count are three examples of online projects where your 4-H kids can participate in collecting, measuring, or computing scientific data. These projects are designed to allow volunteers who do not have extensive training or expertise to contribute to real scientific research.

Digital Photography and Video

We usually take 4-H pictures for personal record books, club scrapbooks, publicity, or to preserve our personal 4-H memories. Allow your members to come up with creative uses for digital photography and video for public displays, creative presentations, teaching modules or a fun way to present club highlights. There are a variety of free and commercial products that you can use to work with digital photographs and video productions. Don't forget to look for open source and free trial/demo software that you can use for workshops or meetings.

Geospatial Technologies

GPS (Global Positioning Systems) are the satellite-based technologies that tell us where things are. GIS (Geographic Information Systems) is the software that utilizes maps to expand on GPS data. GPS and GIS technologies are being used by a variety of businesses. GPS use goes far beyond keeping drivers from getting lost!

Wildlife and forest management, agricultural production and pest management, emergency management, community management, and law enforcement are using geospatial tools in their work. Ask the youth to think about ways they can use GIS and GPS in their 4-H projects.

Your county or municipal government is using GIS/GPS technology to manage resources and plan future growth. Local professionals may be able to provide you with maps that illustrate vital and interesting information on how this technology is being used. Contact your local GIS professional through the NJ Geographic Information Network.

Microscopes

Scientists look at things with a wide variety of instruments, approaching them from various and diverse perspectives. Using microscopes or magnifying lenses, students may experience new ways of looking at the world around them. Have you ever stopped to look closely at your 4-H projects? Get up close! You can look at different foods, salt, sugar crystals, molds, and more with a magnifying lens. Check out insects, animal hairs, feathers, parasites, and cells. Examine the different parts of plants Compare different textiles and fibers – cotton, silk, wool. You can take a close-up look at just about anything.

Web Design

Websites are a way to share information about your 4-H club's activities with a large audience. They may document what your club has been up to through text, pictures, or video or may provide a calendar to help members (and parents) remember important events and dates.

You can use free or commercial web tools to create a club or project website. You can also create learning modules for your club members or interactive displays for exhibits and fairs. Just remember to follow the *New Jersey 4-H Web Policy*.

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For More Information

New Jersey 4-H Youth Development SET - www.4hset.rutgers.edu

"*Nurturing Scientific Literacy Among Youth Through Experientially Based Curriculum Materials*," Author: Horton, Robert; Suzanne Hutchinson, Ph.D. Publisher: National Network for Science and Technology (NNST)--Children, Youth and Family Network, CSREES-USDA (1997).

"*Science Guidelines for Nonformal Education*," Author: Carlson, Stephen; Sue Maxa, Publisher: University of Minnesota (1997).

References

Jim Kahler, Program Specialist, National 4-H Headquarters, CSREES, USDA, *Ways to Integrate SET in 4-H.*

Michaels, Sarah, A. W. Shouse, and H.A. Schweingruber. 2007. *Ready Set Science: Putting Research to Work on K-8 Classrooms*. National Academies Press. 195pp.

Cathann Kress, Former Director, Youth Development, National 4-H Headquarters, CSREES, USDA, *Essential Elements of 4-H Youth Development.*

For more information on New Jersey 4-H, please visit www.nj4h.rutgers.edu.

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