



4-H Science Initiative: from Inception to Impact

Executive Summary

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NOYCE
FOUNDATION



Introduction

The 4-H commitment to improving the science, engineering, technology and math (STEM) skills of America's youth is stronger now than ever before in the organization's 110-year history. Thanks to the determination and dedication of the entire organization, 4-H recently achieved a major goal of engaging more than one million youth in science programs.

This milestone was established in response to an alarming report published in 2006, *Rising Above the Gathering Storm*, that warned: "the danger exists that Americans may not know enough about science, technology, or mathematics to significantly contribute to, or fully benefit from, the knowledge-based society that is already taking shape around us."

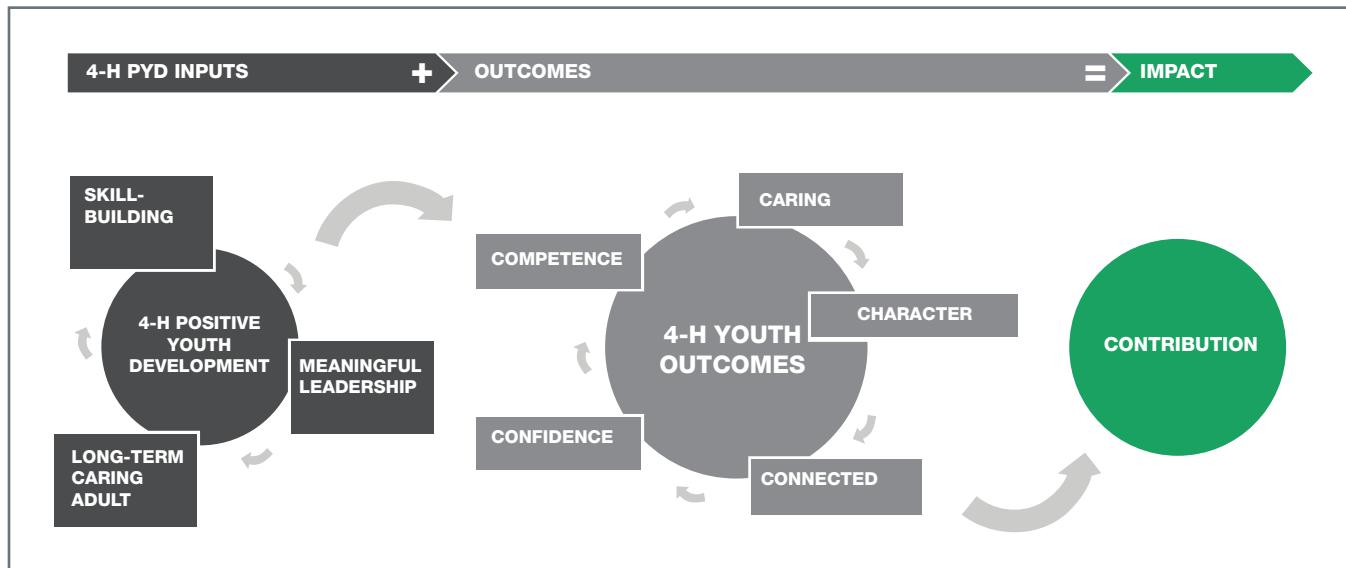
Building on its successful history of hands-on science education, 4-H responded in a significant way to help turn around the troubling trend. In 2007, 4-H partnered with the Noyce Foundation to develop a nationally recognized youth development approach to STEM in out-of-school time (OST). **The goal:** Engage one million new youth by 2013 in a dynamic process of discovery and exploration in OST STEM programs so they are prepared to meet the challenges of the 21st century. **The campaign:** "One Million New Scientists. One Million New Ideas."® **The result:** 1.33 million new youth engaged in 4-H Science-ready programs. The multi-year program that helped make this goal possible is detailed in a new report: **4-H Science Initiative: from Inception to Impact**. Link to full report: www.4-H.org/youthstem

Essential Elements of Success:

- The Approach: Provide Quality OST STEM Education Through Positive Youth Development. **Create life-changing experiences through multi-faceted initiative.**
- The Plan: Build and Sustain a National Infrastructure. **Set clear guideposts to achieve the vision and goals of a multi-year initiative.**
- The Process: Implement the Plan. **Identify the best people and resources at the national, state and local levels for achieving the organization's goals.**
- The Results: Measure and Report Impact. **Develop a comprehensive approach to effectively track and evaluate the progress of the science initiative.**

The APPROACH: Provide Quality OST STEM Education Through Positive Youth Development

At the core of 4-H's work with young people is a commitment to high-quality positive youth development. This approach requires that young people have access to a long-term relationship with a caring adult, meaningful leadership experiences, and the opportunity to build skills. These factors result in competent, caring, connected, confident, young people of character who contribute to society. The figure below highlights the Positive Youth Development (PYD) approach, which is the foundation of the 4-H Science Initiative.



The PLAN: Build and Sustain a National Infrastructure

Ensuring that the vision, goals and objectives were identified and clearly communicated was the initiative's first priority. It was also essential to develop a national framework to guide successful implementation. The framework included these components:

- Program Development and Design
- Professional Development
- Curriculum
- Evaluation and Research
- Marketing and Communication
- Funding
- Partnerships and Collaborations

The PROCESS: Implement the Plan

Successful implementation required dedicated teams of leaders, experts and educators. 4-H organized a Science Management Team—consisting of local, state and national 4-H leaders—to guide the development and implementation of the initiative. To ensure effective communication with state and local 4-H staff and volunteers, 4-H Science Liaisons from land-grant universities were recruited and trained to assist with the work. National teams of internal and external experts led the work. The full report details the work of each team. Key accomplishments include:

- The **Professional Development** (PD) team developed and offered an array of strategies, including web-based learning, webinars, conferences, and an E-Academy to prepare state and local 4-H educators and volunteers.
- The **Curriculum team** created a rubric and tools, and offered training to enhance current 4-H Science curricula and develop new resources.
- The **Evaluation** team developed a plan that: 1) Assessed 4-H staff capacity and capability for designing and implementing 4-H Science programs; 2) Determined the success of 4-H Science for increasing youths' interest, engagement, skills, knowledge and aspirations for STEM education and careers; 3) Identified best practices, including frequency, duration and intensity for offering high quality 4-H Science programs; and, 4) Conceived a longitudinal study to compare 4-H Science members with non-4-H youth to assess differences in STEM interest, engagement, skills, knowledge and aspirations.
- The **Marketing** team organized and implemented five 4-H National Youth Science Days (NYSD) to engage youth in a variety of activities to teach them the fun of STEM. The annual national science experiments focused on alternative energy, water conservation and engineering a robot to address environmental issues. In 2012, nearly 9,000 4-H NYSD kits were distributed to support the thousands of young people across the country who conducted the experiment simultaneously.
- The **Partnership** team worked with over 30 organizations to develop collaborative relationships to support 4-H Science. Partners' involvement ranged from sharing resources, to training, to serving as mentors, coaches and leaders of 4-H Science programs.
- The **Fund Development** team developed a variety of resources, including a Fund Development Toolkit with over 250 online learning modules, templates and resources to enhance fundraising capacity. The team presented fund development workshops and resources and offered webinars, training and technical assistance to 4-H staff and volunteers.

The RESULTS: Measure and Report Impact

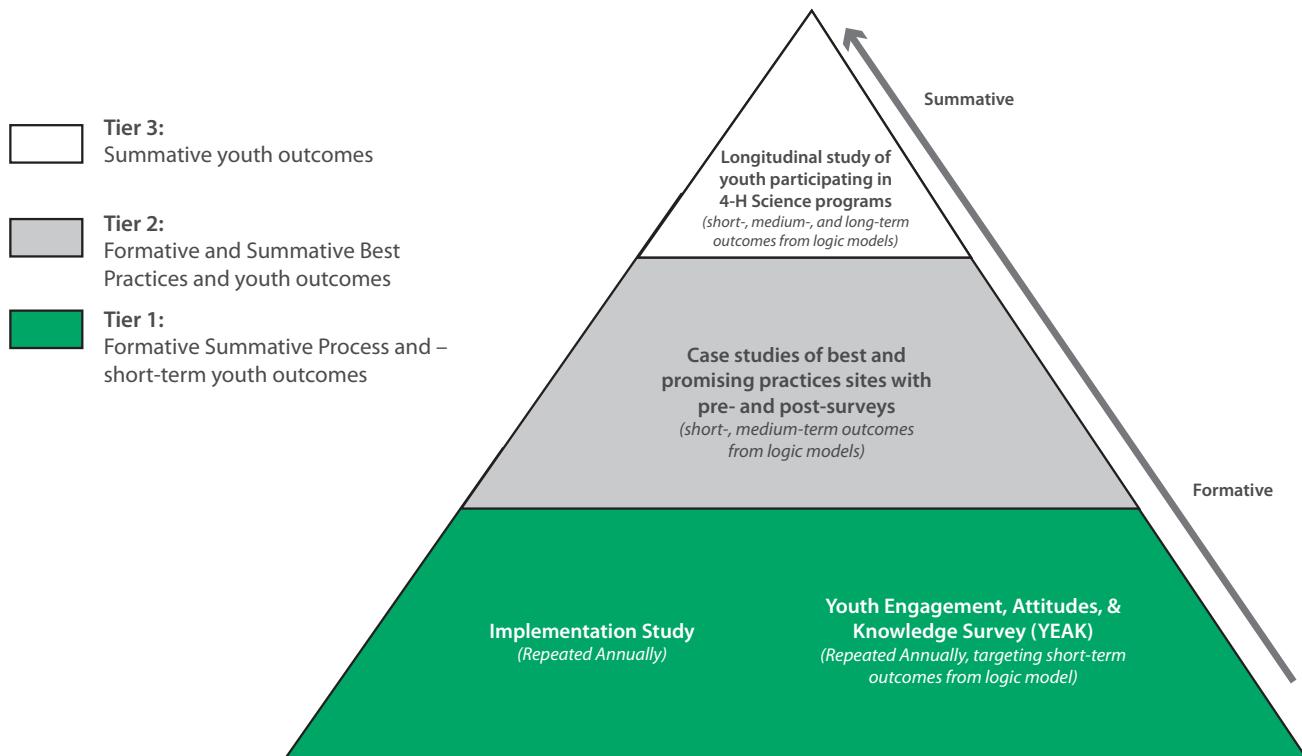
Since its inception, 4-H Science Initiative has sought to further the success, sustainability and scalability of the 4-H Science initiative. The focus of this work was to assess evidence of impact and identify promising practices. Evaluation goals for the 4-H Science effort were:

- Track and monitor the implementation of 4-H Science efforts at the state level
- Understand the nature of promising and best program practices and how they can be replicated
- Determine the impact that 4-H Science efforts have on positive youth outcomes

In 2012, ahead of schedule, 4-H achieved its goal of engaging one million new young scientists with 1.33 million youth enrolled in 4-H "Science Ready" programs. 4-H's "Science Ready" standards have helped the 4-H system: (1) identify science-focused programs; (2) improve the quality and quantity of programs; and, (3) track youth participation in programs that are aligned with these quality standards.

The 4-H Science Checklist became a guide for high-quality "Science Ready" programs. Specifically, "Science Ready" 4-H experiences: (1) are based on National Science Education Standards; (2) develop participants' science-related skills and abilities; (3) use positive youth development practices; (4) are led by staff who are well-trained in youth development and appropriate content; (5) use an experiential approach to learning; (6) foster creativity and curiosity among participants; and, (7) address outcomes on the 4-H Science logic model.

In addition, a comprehensive, three-tiered evaluation model assessed the impact and effectiveness of the 4-H Science Initiative.



Tier 1: Process Evaluations: Implementation Surveys

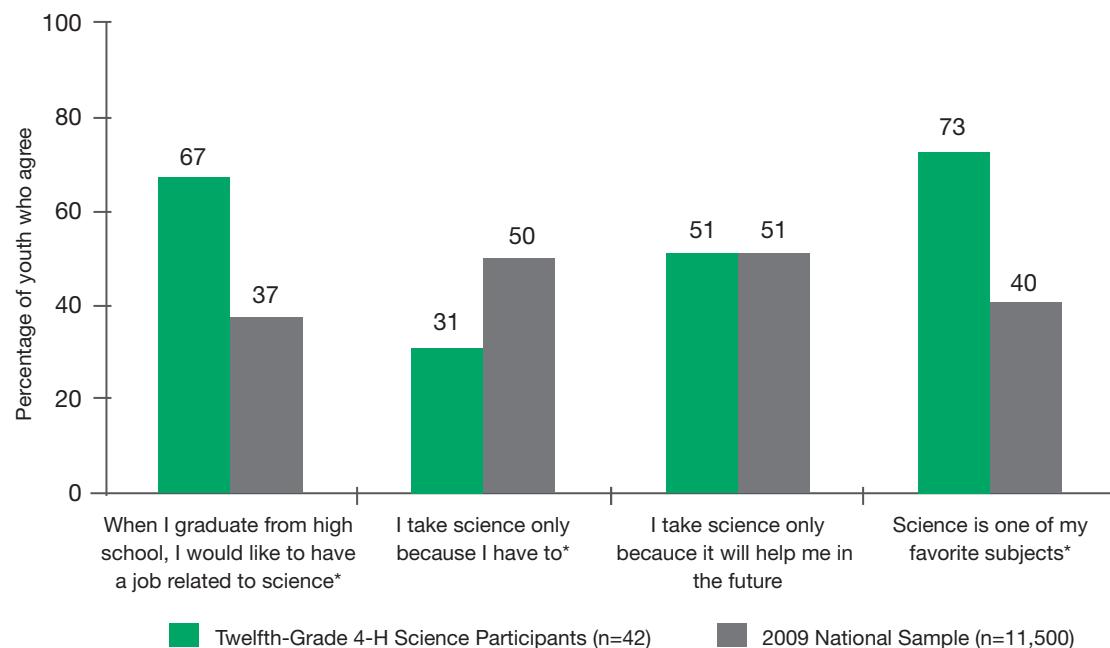
These annual studies provided essential information about the capacity and capability of 4-H professionals and the 4-H system to deliver 4-H Science programs. They also gathered accountability data on the reach of the program, including documenting the number of new youth in 4-H Science programs. Methodologies included surveys and interviews with state-level leaders and surveys and interviews with county level leaders.

Youth Outcomes: Youth Engagement, Attitudes and Knowledge (YEAK) Surveys

The purpose of the Youth Engagement, Attitudes and Knowledge survey was to determine if 4-H Science programs increased youth engagement, interest, knowledge, skills and attitude toward STEM. The survey was administered three different times to samples of 4-H youth. Major findings reported in 2011 include:

- Youth who participated in 4-H Science programs are significantly more likely than their peers to hold positive attitudes about science.
- Participants in high-exposure 4-H Science groups (those spending at least one hour per week for five or more months) gave higher ratings to their decision-making, critical thinking and problem solving skills than participants from the low-exposure group.
- 4-H Science participants reported helping in science-related community service projects and teaching others about science.

Further, when compared to the National Assessment of Educational Progress (NAEP) Science examination, youth in 4-H Science programs were more positive about science learning and science careers than other students in the NAEP sample. Comparisons between youth in 4-H Science programs and youth in the NAEP sample from 4th, 8th, and 12th grades yielded similar results.



Tier 2:

Work in this tier sought to gain a deeper understanding of how program practice impacted youth outcomes. An in-depth, multi-method case study was conducted, gathering data from eight highly effective programs. The resulting *Priming the Pipeline* report recommended the following:

- Youth Outreach and Recruitment : Design strategies to recruit under-represented youth
- Staff and Science Volunteers: Recruit scientists to deliver the science content they know and love
- Professional Development: Provide guidance to science experts on lesson planning, youth delivery and positive youth development
- Science Curricula: Manage a realistic yet productive balance between adaptation and fidelity to curriculum
- Youth Development and Attitudes Towards Science: Enable youth to make meaningful choices about what they learn and how they learn

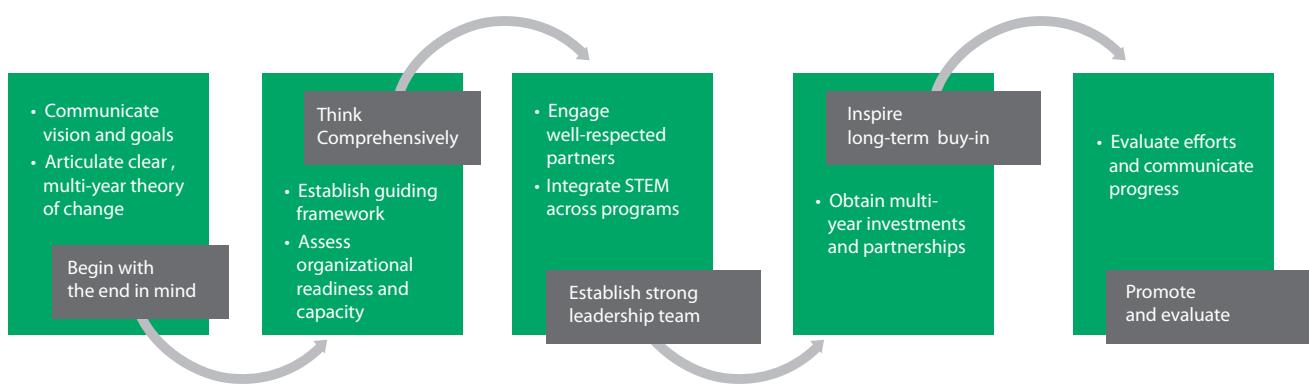
Tier 3:

Finally, the evaluation team worked to lay the foundation for a longitudinal study to assess the long-term impact of participation in OST STEM and to identify the characteristics that may contribute to positive outcomes. Researchers are currently developing and conducting this study.

CONCLUSIONS: Lessons Learned from the 4-H Science Initiative

In the fall of 2012, at the request of the Noyce Foundation and other partners, 4-H compiled *the 4-H Science Initiative: From Inception to Impact* report. This comprehensive report chronicled the work of the initiative from 2006 to 2012, identifying critical lessons learned and best practices required for implementing the plan. Figure 3 highlights those lessons.

Figure 3: LESSONS LEARNED FROM THE 4-H SCIENCE INITIATIVE: FROM INCEPTION TO IMPACT



Beyond the numbers, 4-H Science opened up a world of opportunities for youth. It created youth engagement, increased STEM interest, improved STEM content and provided evidence that this approach does and can produce positive outcomes for youth.

National 4-H Council thanks the Noyce Foundation for its generous support of the 4-H Science Initiative. Its commitment to positive youth development has made a profound difference in the lives of 1.33 million young people (and growing) whose future is brighter thanks to 4-H Science.

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The campaign:
“One Million New Scientists.
One Million New Ideas.”®

The result:
1.33 million new youth engaged
in 4-H Science-Ready programs.

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About 4-H

4-H is a community of six million young people across America learning leadership, citizenship and life skills. National 4-H Council is the private sector, non-profit partner of 4-H National Headquarters located at the National Institute for Food and Agriculture (NIFA) within USDA. The 4-H programs are implemented by the 111 land-grant universities and the Cooperative Extension System through their 3,100 local Extension offices across the country. Learn more about 4-H at www.4-H.org.

About the Noyce Foundation

The Noyce Foundation is interested in significantly increasing the number of youth in the United States who pursue professions in Science, Technology, Engineering and Mathematics (STEM). It believes that providing large numbers of young people with out-of-school, engaging, quality, hands-on science, engineering, and technology experiences will enhance general STEM knowledge and stimulate a larger percentage to pursue STEM careers. The Foundation's goal is to support the informal science community in developmental initiatives that address gaps in outcome measurement, research and evaluation, program scale-up, leadership development and policy issues. www.noycefdn.org

4-H Science Initiative from Inception to Impact: Full Report

- Click to [Download the Report \(PDF\)](#)

For other 4-H Science research reports from the past few years go to

- <http://www.4-h.org/about/youth-development-research/science-program-research/>

For 4-H Science professional development, promising practices, and evaluation resources – geared to professionals and volunteers go to:

- <http://www.4-h.org/resource-library/professional-development-learning/science-training-guides-resources/>