



University of California

Agriculture and Natural Resources | 4-H Youth Development Program

4-H Science, Technology, Engineering, and Mathematics (STEM) Initiative

Youth Scientific Literacy

Advancing scientific literacy among K-12 youth in the United States is important; however, measuring the construct has been problematic since there is no consensus about its meaning or component parts. Although a number of definitions have been developed, most have focused principally on the content and processes of major science disciplines while ignoring social and everyday aspects of science.

California 4-H Takes a Focus-on-Situations Approach to Scientific Literacy

California 4-H takes a focus-on-situations approach to science education with the recognition that science learning is contextualized; persons within a community have unique science knowledge bases; and that each person develops their own science learning trajectory influenced by their unique, personal values and desires. We posit that scientific literacy must be developed in situations from the viewpoint of the person and emphasize science-related situations individuals may encounter in their lives. This position counters definitions of scientific literacy, often advanced by state science standards and assessed by standardized tests that focus on generalized knowledge related to the major science disciplines (e.g., physical sciences, earth and space science, life science).

The 4-H vision for science education, an *everyday science* and *community science* approach, is essential in an out-of-school time community-based program like 4-H ([Smith, Worker, Ambrose, Schmitt-McQuitty, 2015](#)). California 4-H science programming is guided by environmental, social, and economic issues outlined in the *UC ANR Strategic Vision 2025*.

A focus-on-situations perspective allows the component parts of scientific literacy to be specified broadly enough that they address these diverse societal issues yet also provide opportunities to develop 4-H science programming that is culturally relevant and specific to county-based 4-H programs.



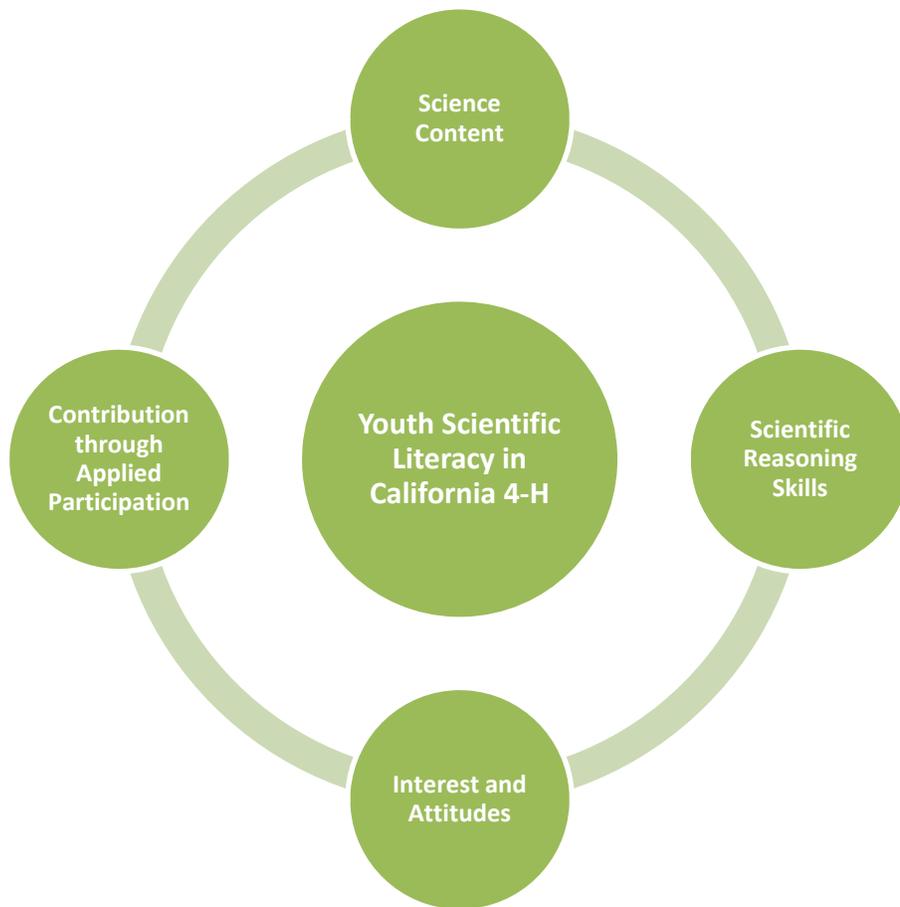


Goals for Youth Learning of STEM

While the 4-H program advances a long term goal to increase the number and diversity of youth pursuing higher education and careers in science, engineering, and technology fields, it is not our intent to only prepare future scientists. 4-H science programs help youth see science as a powerful tool to make sense of and construct knowledge about the world; address and think about issues in their lives that involve science, engineering, and technology; and connect learning with real-world situations where youth can adopt and use new science methods or improved technology to solve problems.

Based on a focus-on-situations orientation, the expected learning goals for youth participation in 4-H science programming include four intertwined anchor points (See Figure 1).

Figure 1. Four Anchor Points of Youth Scientific Literacy in California 4-H.





Content

Youth develop science-related conceptual understanding associated with issues relevant to their respective 4-H projects, their own lives, and to the citizens of California (See Table 1). This contrasts with tradition positions that view scientific content as a generalized body of knowledge from the perspective of what scientists need to know.

Table 1. UC ANR Strategic Initiatives (RUC, 2009)

| ANR Initiative | 4-H SET Priority |
|---|---|
| Water Quality, Quantity, and Security | Water |
| Competitive, Sustainable Food Systems | Gardening & Plant Science |
| Science Literacy | Science & Engineering |
| Sustainable Natural Ecosystems | Environmental Stewardship (ecosystems, natural resources) |
| Health of Californian’s and California’s Agricultural Economy | Nutrition |
| Healthy Families and Communities | Youth Development / Thrive |
| Safe and Secure Food Supplies | Animal Science (Bio-security, Welfare, Pre-harvest Food Safety) |
| Endemic and Invasive Pests and Diseases | |
| Energy Security and Green Technologies | Renewable Energy |

Scientific Reasoning Skills

Youth strengthen their scientific reasoning, the cognitive skills needed to understand and evaluate scientific information. These types of skills may include asking and answering questions; collecting data through observations; analyzing and interpreting evidence by comparing, grouping, and/or organizing information; developing and using models; making inferences and predictions based on observed data; and communicating results. Potential frameworks may include:

- NGSS scientific and engineering practices (<http://www.nextgenscience.org/>)
- 4-H SET Abilities (<http://4h.ucanr.edu/files/2077.pdf>)
- Science process skills (http://oregon.4h.oregonstate.edu/sites/default/files/Science_Process_Skills_Inventory_1.pdf)

Interest and Attitudes

Youth enhance their interest in and attitudes toward science, engineering, and technology. This may include general interest in SET, SET-related mindset, continuing motivation to do SET, usefulness and relevance of SET, and other constructs that influence individuals’ motivation and behavior for SET-related situations they encounter in their lives.

Contribution through Applied Participation

Youth apply their knowledge and skills to real-world problems to gain a deeper understanding of SET content; promote lifelong learning; allow for participation in authentic situations or tasks. This may happen through service learning, citizen science (public participation in scientific research) or through other activities.