Preparing Kansas' School-Aged Youth to Engage in Science Discovery and Exploration for their Workplaces and Careers

K-STATE Research and Extension

Program Focus Team Action Plan **2017-2018**

Situation

America faces a future of intense global competition with a startling shortage of scientists. In fact, only 35 percent of 8th graders and 26 percent of U.S. high school seniors are proficient in science (National Assessment of Educational Progress (NAEP), 2013.) In 2008, 31% of U.S. Bachelor's degrees were in STEM (science/engineering/mathematics/technology) majors, compared to 61% in Japan and 51% in China. Only 62% of students who started with a STEM major in 2013 were able to graduate with one.

Student STEM test scores are increasing slightly. However, the percentage of students who are proficient in science and math by grade 11 is 20% less than in grade 4. Students who are highly skilled in STEM are even more rare, with only 3% percent of high school students receiving an exemplary score. STEM test scores for Kansas economically deprived students are dismal, with more than 30% of 11th graders rated not proficient in math and 85% deficient in science skills. (Kansas State Department of Education School Report Card. 2015-16.).

When these statistics are coupled with the record number of retirements for current scientists and engineers, it is clear that America has a critical need to keep up with the increasing demand for trained professionals in these fields.

The American Association for the Advancement of Science document Science for All Americans describes a scientifically literate person as "one who is aware that science, engineering, and technology are human enterprises and who applies scientific content and abilities in meaningful ways."

Clearly, this challenge provides 4-H with an extraordinary opportunity to reaffirm its legacy as a leader in hands-on, non-formal science education. Understanding and appreciating the role of science is even more critical as the needs of our society and its workforce change. Now, more than ever, we must ensure that our nation's youth develop the necessary competencies and abilities for the United States to remain competitive in the 21st century.

Public Value

Youth participants in Kansas State University Research and Extension STEM programs acquire positive attitudes towards STEM, gain skills and abilities, and become better prepared to contribute to a globally sustainable world.
They participate and excel in science, technology and math courses at school at a higher rate than the general population, and are more likely to continue their post-secondary education or training in STEM-related fields.

Outputs

Activities to achieve STEM Abilities:

- Train staff and volunteers to utilize inquiry as they work with STEM in a variety of settings.
- Support best implementation practices for all 4-H science and other resources in a variety of educational settings.
- Increase the number of settings across-the-state that offer 4-H STEM educational opportunities.
- Train staff to utilize evaluation strategies.

*Also known as: SET (Science, Engineering, & Technology); STEM (Science, Technology, Engineering and Mathematics); and STEAM (Science, Technology, Engineering, Agriculture or Art, and Mathematics)

Short-Term (Knowledge)

Youth increase interest and engagement in 4-H STEM projects (i.e., become aware; adopt new or different attitudes; develop opinions, new aspirations and/or new motivation; or learn new knowledge)

Indicators

- Participation in 4-H STEM programs across subject areas
- Interest and mastery of science process skills (observation, comparison, hypothesis)
- Volunteers interested in science, engineering, and technology
- Use of the scientific method and/or systematic problem-solving
- Participation in 4-H presentations, demonstrations, skill-a-thons and rubric judging
- Evaluation Questions/Measurement Instrument Sources:
- 4-H Common Measures - Science (2013)
- Number of youth enrolled in 4-H projects using STEM-ready resources
- Number of adult volunteers mentoring in 4-H STEM-ready projects

Medium-Term (Behavior)

Youth use and act on their skills attributed to 4-H STEM (i.e., acquire new skills, practice new behaviors, or demonstrate new abilities

Indicators

- 4-H STEM learning environments and approaches are effective
- The number of youth seeking out opportunities to participate in 4-H STEM activities
- The number of youth seeking out leadership roles in 4-H STEM
- The comfort of 4-H adult volunteer mentors facilitating youth in 4-H STEM opportunities
- Evaluation Questions / Measurement Instrument Sources:
- Implementation of "Dimensions of Success" (PEARS Institute, Harvard, 2013) evaluation strategy to measure quality of 4-H science learning environments and delivery methods
- Aggregate the resources invested in 4-H STEM programs
- Compare performance of youth on 4-H Common Measures – Science (2013) over time
- Student performance on "Next Generation Science Standards" (NGSS).

Long-Term (Change in Condition)

Youth will appreciate science as a discovery process and many will choose occupations in STEM subjects matters for careers.

Indicators

- 4-H STEM participants who choose STEM-related post-secondary training
- 4-H STEM participants who choose STEM-related careers
- Number of youth who choose STEM-related post-secondary training or careers
- Number of youth who participate in STEM extra-curricular activities
- Number of 4-H alumni who sustain their involvement in 4-H STEM as volunteers
- Number of youth who attribute 4-H STEM experiences to their choice of post-secondary education and/or careers