Journal of Extension

Volume 54 | Number 3 Article 15

6-1-2016

Minnesota 4-H Science of Agriculture Challenge: Infusing Agricultural Science and Engineering Concepts into 4-H Youth Development

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Journal of Extension
www.joe.org

June 2016
Volume 54
Number 3
Article # 3IAW4
Ideas at Work

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Abstract

Youth involved in 4-H projects have been engaged in science-related endeavors for years. Since 2006, 4-H has invested considerable resources in the advancement of science learning. The new Minnesota 4-H Science of Agriculture Challenge program challenges 4-H youth to work together to identify agriculture-related issues in their communities and to work with local experts, using scientific and engineering principles, to devise real solutions for those issues. The Minnesota 4-H Science of Agriculture Challenge program has the potential to change the way scientific and engineering principles are integrated into 4-H youth development programming.

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Background

Deficits in science literacy among school-age youth in the United States raise serious societal concerns (Heck, Carlos, Barnett, & Smith, 2012). Science plays an integral role in our daily lives in regard to the health and sustainability of the world's food sources as well as the world's economies. Science achievement among K–12 youth in the United States has lagged behind that of many of their grade-level peers from other countries for many years, prompting much concern from researchers (e.g., Miller, 2006; Murcia, 2007; Scearce, 2007) as well as from federal agencies such as the National Academy of Sciences (2007). In addition to these concerns, the low level of science achievement among U.S. high school students appears to be affecting youth in higher education (Heck et al., 2012).

Kisiel (2006) maintains that if science literacy "is an important goal within our society, then we must consider other learning settings, in addition to school, that can contribute to this goal" (p. 396). Nonformal education programs (e.g., 4-H, Boy Scouts, Girl Scouts, Boys and Girls Clubs, camps,

and docent-led museum education programs) can provide learning opportunities that expand curriculum offerings and complement classroom teaching (Carlson & Maxa, 1997; Mørch & du Bois-Reymond, 2006).

4-H Youth Development and Science Inquiry

Although youth involved in 4-H projects have been engaged in science-related endeavors for years, the formal call to increase science programming has changed the face of 4-H programs across the country (Arnold, Bourdeau, & Nott, 2013). Since 2006, 4-H has invested considerable resources in the advancement of science learning, and a recent report by external evaluators of the 4-H Science initiative indicated that there is "encouraging growth and variety" of science programs across the 4-H program (Riley & Butler, 2012). The National 4-H Science, Engineering, and Technology (SET) initiative was announced in 2007 (4-H National Headquarters, 2007) and was renamed to 4-H Science, as the newest effort to strengthen 4-H science education (Worker, 2012).

Minnesota 4-H Science of Agriculture Challenge

As part of the University of Minnesota Extension Center for Youth Development (UofMECYD), Minnesota 4-H has made improving science literacy a priority and is working to develop the next generation of agricultural scientists. 4-H's hands-on interactive programs expose youth to cutting-edge technology in agriculture that produces abundant, healthful, and economical food.

The Minnesota 4-H Science of Agriculture Challenge is a new program that challenges Minnesota 4-H youth (in grades 6 through college freshman) to work together on teams of four to identify agriculture-related issues in their communities and then work with local experts, using scientific and engineering principles, to devise solutions to those issues. The Science of Agriculture Challenge program provides a hands-on learning experience to inspire the next generation of agriculture leaders in Minnesota.

Teams present their solutions, in the form of demonstrations/presentations, at a statewide event on the University of Minnesota Twin Cities campus while competing for postsecondary education scholarships. Areas of exploration can include issues in agronomy, animal husbandry, soil science, agriculture business, finance, food science, engineering, and more. Youth are encouraged to be creative in exploring solutions. For example, teams could use remote-control drones to scout and solve weed issues, develop business plans for community food gardens, or design aquatic robots to research invasive species in local lakes.

Minnesota 4-H Science of Agriculture Challenge Educational Model

To properly implement the Minnesota 4-H Science of Agriculture Challenge program, a logic model (Figure 1) was developed by a team of youth development experts at the UofMECYD. The model identifies the following key elements:

1. needs of the project (i.e., outcomes, staff responsibilities, financial needs, community partners, timeline, target audiences);

2. development and instruction (i.e., quick start guide, volunteer training, judges training);

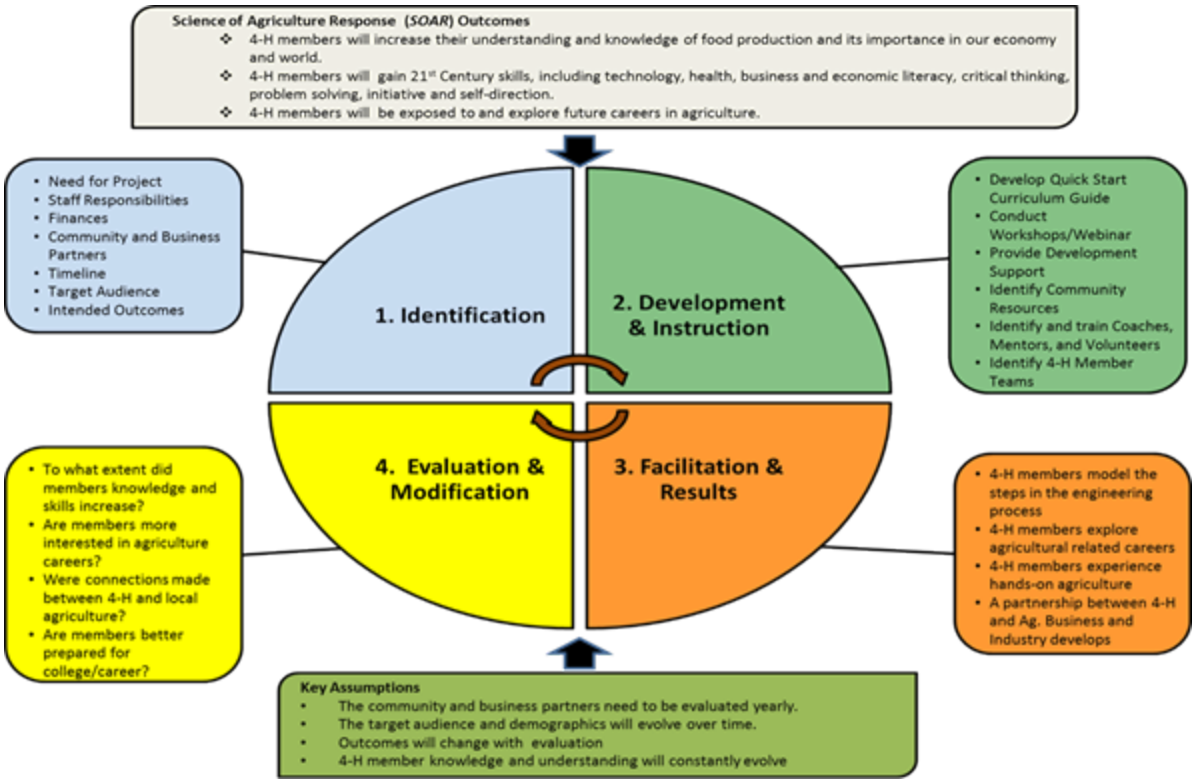
3. facilitation and results (i.e., 4-H members' responsibilities and outcome, the destination event); and

4. evaluation and modification (i.e., what 4-H youth gained, what volunteers gained, how the program can be strengthened and replicated in the future).

The logic model also addresses the desired outcomes from the youths' participation in the program as well as key assumptions that need to be made regarding future program development.

Figure 1.

Science of Agriculture Challenge Logic Model



Minnesota 4-H Science of Agriculture Challenge Outcomes

In addition to developing the logic model for the program, youth development experts at the UofMECYD developed three primary outcomes they would like to achieve through youths' participation in the program. The outcomes are as follows:

1. 4-H members will increase their understanding and knowledge of food production and its importance in our economy and world.

2. 4-H members will gain 21st-century skills, including technology skills, health skills, business and economic literacy, critical thinking, problem solving, initiative, and self-direction.

3. 4-H members will be exposed to and explore future careers in agriculture.

Conclusions

The Minnesota 4-H Science of Agriculture Challenge is a new program that has the potential to change the way scientific and engineering principles are incorporated into 4-H youth development programming. The unique nature of the scientific and engineering concept delivery system used by nonformal education programs such as 4-H is one of the reasons those programs have the ability to be successful. Submersing 4-H youth in a hands-on learning experience with the assistance of agriculture business and industry experts allows youth not only to learn the importance of agriculture and the career opportunities it provides but also to have opportunities to connect with potential peers and employers.

In a 2012 study conducted by Heck et al., results showed that by high school, 4-H participants were taking more and higher-level science courses than other youth. 4-H youth who take more and higher-level science courses in high school are more likely to be on a path to attend college, to major in science in college, and to have a science career. This interest in science concepts through 4-H engagement has the potential to increase the number of youth pursuing degrees in agriculture-related majors while also providing more qualified employees to fill the agriculture career pipeline.

Although the Science of Agriculture Challenge was developed for Minnesota 4-H, it has tremendous potential to be replicated in other states. The program design can be applied to all aspects of agriculture, allowing it to be tailored to the diverse nature of agriculture throughout the United States. The program promotes the development and/or strengthening of partnerships between state 4-H programs and agriculture business and industry entities while developing the next generation of agriculture leaders.

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