To understand the 4-H S.T.E.M. we first have to understand both S.T.E.M. and 4-H, then explore the concepts of STEM and its relationship with 4-H.

What is S.T.E.M.

S.T.E.M. is an acronym for Science, Technology, Engineering and Math. It is an interdisciplinary approach to learning (Lantz, 2009).

What is 4-H?

4-H is a youth development program that uses research-based, educational programs to enhance and develop life skills, such as critical and analytical thinking, problem solving, positive self-concept, healthy interpersonal skills, sound decision making, teamwork, and a concern for community. It accomplishes this through the experiential learning model of “DO,” “REFLECT” and “APPLY.” 4-H provides opportunities for youth and adults to work in partnership as they develop these skills that will help them to become healthy, self-directing, contributing members of society (Barker et al., 2008).

Experiential Learning Model

Adapted and modified from Norman and Jordan, University of Florida

Relationship between S.T.E.M. and 4-H

When focusing on 4-H Youth Development, there is often a tendency to put greater emphasis on programs and less on the life skills youth develop through their engagement in the programs. 4-H educators also tend to focus more on competition and less on the life skill that can be gained from the competitive event experience. In today’s working environment, employers look for candidates who possess, in addition to their required educational skills, soft skills such as critical and analytical thinking, problem solving, decision making and teamwork. These skills pay dividends in preparing youth for career goals and employment. Over the years, 1902 to today, massive changes have occurred in our world, yet we do not always readily accept the changes and prepare programs in response to these changes. Using the 4-H S.T.E.M. approach in combination with experiential learning, not only provides opportunities to gain knowledge, but also develops those life skills and positive attitudinal changes for youth development.
Defining the 4-H concepts for S.T.E.M.

4-H S.T.E.M. is an integration and scientific inquiry of the world in which we live. It is a scientific approach to all programs that includes:

**Science**
- Including plant and animal sciences; basic sciences including chemical reactions, and nutrition science and healthy lifestyles.

**Technology**
- Learning experiences include, as an example, the programming of robots, plotting coordinates and tagging sites for GIS/GPS, and exploring ideas of alternative energy: wind, solar, chemical and hydroelectric.

**Engineering**
- Utilizing basic mechanical principles to develop useful tools, such as robots or rockets and developing an understanding of the principles of flight and force resistance. Participants will construct an altimeter to use in mathematical activities.

**Math**
- Math concepts such as measurement, distance and similar mathematical calculations. Mathematical concepts are

Suggested Ideas for 4-H S.T.E.M. Programming

### Science

**Animal Science (latest advances)**
Identify areas that have both national and international focus and develop programs around those areas. Some of the areas of focus may include beef marketing, meat judging, small meat animals such as sheep and goats and processing the types of meat products. Other areas may include dairy, beef quality assurance, environment and biosecurity, biotechnology and biofuels. Expose youth to different manufacturing and marketing program opportunities that would lead them to career development and ultimately employability. Develop partnerships with other animal science entities to discover and learn new scientific advances within animal science.

**Plant Science (latest advances)**
Selection for program activities may include gene functioning in plants, tissue culture, growth and development and physiology. Program planners may also explore other plant-related areas in horticulture and plant genetics.

**Nutritional Science - Healthy Lifestyles (Latest advances)**
One of the greatest challenges is to develop and maintain healthy lifestyles. These may include food chemistry, biology and others.

### Technology

Engineering focuses on the construction of several projects and may, for example, include rocketry, remote controls robotics, computer game simulations, electronics and information dissemination through electronics.

### Engineering

The primary focus in this program area deals with the design, construction and manufacturing processes. This can be very wide in scope as we look at the developments in the different program areas. Some examples include designing and constructing new ideas in aviation, animal sciences, plant sciences and other areas.

### Math

Math is the identification of various forms of measurements and calculations within 4-H S.T.E.M. For example, in rocketry the size of fins, angles where fins are attached and distance between fins can be measured. Math enhances analytical and critical thinking.
<table>
<thead>
<tr>
<th>Learning objectives (Knowledge, Skills, Attitude K.S.A.)</th>
<th>Programs used to accomplish objectives</th>
<th>How, when and where are the objectives assessed?</th>
<th>Expectations/anticipated outcomes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Knowledge</td>
<td>Science, Technology, Engineering and Math (using the 4-H concepts for S.T.E.M.)</td>
<td>Pre/posttest assessment and dialog after completion of the suggested program. (A program that is identified for the subject-matter area of S.T.E.M.)</td>
<td>Hypothesis: Can the 4-H S.T.E.M. program develop and enhance life skills: knowledge, skills, critical thinking, problem-solving and reasoning, attitudes and collaborative skills/teamwork toward the 4-H S.T.E.M. program? Can the 4-H S.T.E.M. program create an impact on youth ages 8 to 15 years old? Can 4-H Science positively influence youth?</td>
</tr>
<tr>
<td>Life Skill Development</td>
<td>Science, Technology, Engineering and Math (using the 4-H concepts for S.T.E.M.)</td>
<td>Pre/posttest assessment Processing by use of dialog after the completion of the suggested program. (A program that is identified for the subject-matter area of S.T.E.M.)</td>
<td>Can the 4-H S.T.E.M. program develop and enhance life skills: knowledge, skills, critical thinking, problem-solving and reasoning, attitudes and collaborative skills/teamwork toward the 4-H S.T.E.M. program? Can the 4-H S.T.E.M. program create an impact on youth ages 8 to 15 years old?</td>
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<tr>
<td>1. Analytical and Critical Thinking:</td>
<td>Science, Technology, Engineering and Math (using the 4-H concepts for S.T.E.M.)</td>
<td>Pre/posttest assessment and dialog (focus group) after completion of the suggested program. (A program that is identified for the subject-matter area of S.T.E.M.)</td>
<td>Can the 4-H S.T.E.M. program develop and enhance life skills: knowledge, skills, critical thinking, problem-solving and reasoning, attitudes and collaborative skills/teamwork toward the 4-H S.T.E.M. program? Can the 4-H S.T.E.M. program create an impact on youth ages 8 to 15 years old?</td>
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<td>2. Problem Solving:</td>
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<td>3. Decision Making:</td>
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<td>4. Collaborative Learning/Teamwork:</td>
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<td>5. Attitudinal Changes:</td>
<td>Science, Technology, Engineering and Math (using the 4-H concepts for S.T.E.M.)</td>
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**Assessment/Evaluation**

Several methods to measure the success of 4-H S.T.E.M. programs can be used. One which was used with great success can be adapted from Barker et al, 2011 and Barker and Stevens, 2012 (fact sheet).
Community Involvement and Engagement

A successful 4-H S.T.E.M. program depends on strong partnerships with various organizations. The main focus should be placed on youth. The ecological model of youth development: engaging schools, home, peers and community organizations including businesses, governmental and federal agencies, fosters conclusive evidence of positive outcomes when all sections are involved. The delivery of programs that guarantees successful life skill development must consider learning styles in combination with experimental learning.

Learning Goals and Objectives

The major goal of the 4-H S.T.E.M. program is to provide opportunities for youth 8 through 15 years of age to develop knowledge and enhance life skills such as critical and analytical thinking, decision making, problem solving and teamwork through their involvement and engagement in research-based educational programs provided by University of Nevada Cooperative Extension system, an outreach of the University of Nevada, Reno and a land-grant institution. Another objective is for youth to develop a positive outlook towards their future growth and development.

Sustainability of 4-H S.T.E.M. Programs

The strength of any program is its sustainability. While funding is a critical part of continuing a program, there are other main components that add to its sustainability. One of the most critical components is a well-trained staff, who knows the S.T.E.M. conceptual framework and understands and applies the experiential learning process to create an environment for identification and application of the life skills (critical and analytical thinking, decision making, problem solving and teamwork). Program activities should be age-appropriate and gender and culturally diverse.

Volunteers are also important for sustainability. They help to expand and support the program and should be a part of the training and delivery process.

Youth outreach and recruitment: Recruitment should reach all ethnic, social and economic populations. Cooperative learning that combines the physically challenged with the high achievers should be encouraged during all parts of the program and activities. Such integral programming enhances group teamwork, problem solving, critical and analytical thinking and decision making.

Curricula should be comprehensive to include all the major conceptual frameworks (community involvement and engagement with schools, businesses, other local government agencies and civic organizations). These provide a holistic approach to the growth and development of community youth.

References


Riley, D., & Butler A., (2012). Priming the pipeline, lessons from promising 4-H science program


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