Helping 4-H Volunteers Facilitate STEM Literacy in Traditional Non-STEM Projects

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Introduction

STEM literacy has been promoted as a necessary skill for the future workforce. STEM literacy is the ability of learners to have an awareness of STEM around them in their everyday lives and the ability to apply that knowledge to resolve everyday situations (Bybee, 2013). The call for more STEM education has caused K-12 and postsecondary education to focus on ways to improve these areas of instruction (Basham & Marino, 2013). 4-H educators have followed this important movement by expanding access to project areas such as Robotics (Arnold, Bourdeau, & Nott, 2013). 4-H youth are enrolled in many traditional non-STEM projects. The Breads project is one excellent example of a traditional non-STEM project that is imbued with STEM concepts

Front-line 4-H volunteers (project and club leaders) need tools to help them plan activities that highlight STEM competency development in all project areas, not just Robotics or similar projects, to build STEM literacy with all 4-H youth. While there is limited literature on the levels of science literacy among current 4-H volunteers, Pottebaum (2013) offers evidence that there is a need to improve recruitment and training of STEM volunteers.

How does it work?

Practical tools are needed by 4-H volunteers to identify STEM in traditionally non-STEM 4-H projects to help 4-H youth build STEM literacy in new contexts (Arnold, Bourdeau, & Nott, 2013). The more a volunteer identifies STEM for the member, the more STEM literacy they will develop. This affirms the current 4-H program model and gives new tools to volunteers to enhance current programing and deliver STEM learning to youth who may not have innate interest in traditional STEM projects such as Rocketry (Nugent, Barker, Grandgenett, & Welch, 2016; Riley & Butler, 2012).

The process of working through the experience, finding needed information, considering other viewpoints, resolving conflicts, and reflecting on the process is the experiential learning framework (Joplin, 1981; Kolb, 1983). While the outcomes or products need also to be correct, the process of arriving at the solution to the problem should be explained, justified, argued, and verified by a community of learners (Lindsey & Berger, 2009). This public debriefing of the learning process allows youth to critically analyze others' work and have social verification of their own. These transactions between social and personal knowledge are an important component of experiential learning (Kolb, 1983).

The Guiding Questions

The following are the seven guiding questions that can be used by 4-H volunteers to identify and facilitate STEM learning in traditional non-STEM projects:

- Is the project activity problem or activity based?
- Are there connections between project work & STEM topics? Is STEM connected to the project goal?
- Are the resources used authentic?
- Are 4-H members encouraged to seek out more information related to STEM topics in the project?

- Are activities offered with multiple methods or variations for ability levels?
- Are 4-H members encouraged to ask critical questions about the project and STEM?
- Are 4-H members asked to relate learning to their own non-project experiences?

4-H volunteers should be encouraged to use these guiding questions to identify STEM and STEM-related aspects of the traditional non-STEM projects they facilitate to address five characteristics of integrative STEM education identified in literature. These five characteristics drove the formation of the seven questions that are intended to guide volunteers in uncovering STEM thinking and STEM-related methods that may not seem obvious at first glance. The questions address not only finding science, technology, engineering, and math concepts but also provide volunteers guidance for thinking about different ways to pose problems to participants or alternatives to presenting instruction to enrolled youth.

Implications

As the call for STEM literate members of the workforce continues to grow and the challenges of recruiting STEM specific volunteers remains, it is important to help traditional non-STEM 4-H volunteers to support learning about STEM. This capacity growth retains the organizations roots and ensures the organizations relevance into the future. 4-H volunteers, with increased awareness of their role in fostering STEM education and STEM literacy, can be a valuable resource in preparing 4-H youth through traditional non-STEM projects. 4-H professionals can train front-line volunteers to use guiding questions within the 4-H experiential learning method "Do. Reflect. Apply." Volunteers utilizing these questions will better facilitate STEM learning in traditional non-STEM projects and foster improved STEM literacy in 4-H members. When youth are able to take STEM concepts and apply them in unique situations, the goal of STEM education, STEM literacy, has been achieved.

Future Plans

The questions were developed out of the literature and theoretical components and research needs to be conducted on the efficacy of these questions. Additionally, this strategy needs to be elaborated on so that 4-H professionals and volunteers can utilize this easily and effectively. The authors are interested in engaging others in pilot testing, revision, and development of a volunteer training guide.

Resources Needed

The strength of this model is that there are few resources that are required. 4-H volunteers and professionals can use these questions within any of their project areas to help improve STEM literacy in 4-H members, no matter the 4-H project.

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