Building Science Literacy in 4H Youth through Science of Agriculture Challenge

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Introduction

According to Brooks and Loevinsohn (2011), the global effect of climate change on agriculture production has revealed a set of environmental, demographic, social, and economic drivers that are generating food insecurity around the world. To address complex and global issues like climate change, it is essential to have a scientifically literate population who can participate in solving societal problems (National Research Council [NRC], 2007). Programs such as the Pennsylvania 4-H Science of Agriculture Challenge serve as potential assets in this endeavor as they afford an opportunity for youth to exercise their critical thinking and scientific skills. This study explored how the 4-H Science of Agriculture Challenge impacted the science literacy of its competitors.

Framework

The 4-H Science of Agriculture Challenge is an experimental learning program that challenges youth participants to investigate ways to solve agricultural related issues by working with mentors and agricultural industry leaders. It promotes career exploration as students learn about careers and educational opportunities in agriculture while identifying novel solutions to the issue they are addressing (Penn State Extension, 2017). To determine the change in science literacy we utilized the Science Literacy Assessment (SLA) (Fives et al., 2014). There are a variety of science literacy measurements (Gormally et al., 2012; National Academies of Sciences, Engineering, and Medicine, 2016, Chapter 2), however, SLA was chosen for this study as it measures motivation, and beliefs in science literacy in addition to the analytical skills of interpreting scientific data present in most measures (Gormally et al., 2012; National Academies of Sciences, Engineering, and Medicine, 2016, Chapter 2).
The following questions guided the study:

1. What is the demographic landscape of participants competing in the Pennsylvania 4-H Science of Agriculture Challenge?
2. Is there a difference in participants' science literacy after competing in the Pennsylvania 4-H Science of Agriculture Challenge?
    a. Is there a difference in participants' *science knowledge* after competing in the Pennsylvania 4-H Science of Agriculture Challenge?
    b. Is there a difference in participants' *value of science* after competing in the Pennsylvania 4-H Science of Agriculture Challenge?
    c. Is there a difference in participants' *self-efficacy for scientific literacy* after competing in the Pennsylvania 4-H Science of Agriculture Challenge?
    d. Is there a difference in participants' *personal epistemology of science* after competing in the Pennsylvania 4-H Science of Agriculture Challenge?

Methodology

The population of this study was 4-H members who participated in the 2019 Pennsylvania 4-H Science of Agriculture Challenge. Random sampling was not utilized in this study; instead, the researchers invited all 4-H members who participated in the competition to take part in the study. An initial recruitment email was given to Pennsylvania 4-H, who distributed the email to 4-H leaders along with the registration information regarding the Pennsylvania 4-H Science of Agriculture Challenge. The 4-H leaders administered the pre-test to participating 4-H

members during one of their meetings prior to any preparatory meetings as a team. Immediately after participants presented their project at the Pennsylvania 4-H Science of Agriculture Challenge, they completed the science literacy post-test. Both the pre-test and post-test were administered online via Qualtrics. A total of 45 4-H members registered for the Pennsylvania 4-H Science of Agriculture Challenge and asked to participate in the study. Pre-test data was collected from a total of (n = 39) 4-H members, and post-test data was collected from a total of (n = 34) 4-H members due to 5 participants who did not complete the competition. The questionnaire was a previously validated instrument adopted from Fives, Huebner, Birnbaum, and Nicolich (2014). Each construct of the questionnaire demonstrated reliability (science knowledge: KR-20 = .83, value of science: α = .80, self-efficacy for science literacy: α = .72, personal epistemology of science: α = .88) (Fives et al., 2014).

Findings

The first research question was to describe the 4-H members who competed in the Pennsylvania 4-H Science of Agriculture Challenge. The members who participated in the study (n = 39) were predominately white (94.9%), and 64.1% of participants were female (Male = 33.3%, Other = 2.6%). Approximately two thirds (66.7%) of participants reported their average grade in science courses is an A. Approximately 30% of members were in middle school (Grade 6 = 7.7%, Grade 7 = 7.7%, Grade 8 = 15.4%), and 60% of members were in high school (Grade 9 = 10.3%, Grade 10 = 23.1%, Grade 11 = 20.5%, Grade 12 = 15.4%). For 67.7% of participants, this was their first time competing in the Pennsylvania 4-H Science of Agriculture Challenge. The second research question was to determine if there was a difference in participants' science literacy after competing in the Pennsylvania 4-H Science of Agriculture Challenge. Paired samples t-tests were conducted to determine if competing in the Pennsylvania 4-H Science of Agriculture Challenge affected participants' science knowledge, value of science, self-efficacy for scientific literacy, and personal epistemology of science. There were no significant differences between the pre-test and post-test for any of the science literacy components.

Conclusion and Recommendations

Through the Pennsylvania 4-H Science of Agriculture Challenge, participants were assessed to see if there was a difference in their science literacy skills after participating in the competition. By having students participant in pre- and post-test questionnaires, researchers were able to examine participants' science knowledge, value of science, self-efficacy for science literacy, and personal epistemology of science. Our findings show no significant difference in students' literacy skills after completing the challenge. It is recommended for Pennsylvania 4-H to study if and how they can modify the training and competition logistics to increase the science literacy skills in youth participants. Further, it is recommended future qualitative research probe coaches and competitors for the impact of the competition on science literacy skill development in the quest for a more scientifically literate population (NRC, 2007).

References

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