Predicting Science Citizenship in School-Based Agricultural Education

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Introduction

Global society has major scientific challenges to solve over the coming decades including climate change and food insecurity. Therefore, a general population that is scientifically literate and civically engaged is imperative in order to effectively mitigate and adapt to climate change. While there is a dearth of literature regarding science citizenship in SBAE, there is great potential to further develop science literacy and civic engagement with this audience. Within Research Priority 7 of the AAAE National Research Agenda, this research aligns with Research Priority Question 2: How can teaching, research, and extension programs in agricultural leadership, education, and communication address complex interdisciplinary issues? (Roberts et al., 2016). The following questions guided the study: (1) how scientifically literate are secondary agricultural education students, (2) to what extent are secondary agricultural education students civically engaged, (3) to what extent do secondary agricultural education students engage in science citizenship, and (4) which variables of science literacy and civic engagement best predict secondary agricultural education students' engagement in science citizenship in Pennsylvania?

Theoretical Framework

Pancer's (2015) Integrative Theory of Civic Engagement serves as the theoretical framework of this study. The theory proposes that civic engagement occurs on two levels: the individual level and the systems level (Pancer, 2015). For example, on the individual level people become civically engaged due to initiating factors such as values and social influence, whereas factors that initiate civic engagement at the systems level include the presence of accessible organizations (Pancer, 2015; Bobek et al., 2009). Science literacy is a broad term with many definitions that include various components such as science knowledge, attitudes towards science, and science-related skills and behaviors (DeBoer, 2000; Laugksch, 2000). The National Academies of Science, Engineering, and Medicine (2016) reasons a democratic society functions better when its citizens are scientifically informed. Youth civic engagement is defined as, "working to make a difference in the life of one's community … through both political and non-political processes" (Ehrlich, 2000, p. vi). Youth engagement in civic activities is beneficial for both the individual and their communities (Bobek et al., 2009; Pancer, 2015).

Methods

This study was approved by the Institutional Review Board of The Pennsylvania State University. An agriculture program not included in the main study was selected to participate in a pilot study to determine reliability. The target population of this study was secondary (9^{th} – 12^{th} grade) agricultural education students in the state of Pennsylvania. To obtain a representative sample of the target population, proportionate stratified random sampling of agriculture programs by Pennsylvania regions was utilized. An initial email solicitation was sent out to each of the agriculture teachers of the 20 randomly selected programs. When teachers declined participation another school in the region was randomly selected to participate. A total of 39 programs were asked to participate in the study, and data was collected from 10 programs for a total of (n = 197) students. The researcher personally visited each program and administered the survey online via Qualtrics. The questionnaire was adapted from three separate

instruments to collect quantitative data regarding science literacy, general civic engagement, and science citizenship (Fives et al., 2014; Bobek et al., 2009; Flanagan et al., 2007).

Results

Table 1 displays the results of the descriptive analysis. The regression model was found to be a significant predictor of students' science citizenship, F (8,178) = 30.53, $p < .001$. The science literacy and civic engagement constructs were found to explain 57.8% ($R^2 = .578$) of the variance in students' science citizenship. The standardized coefficients (β) show that Civic Skills Efficacy ($\beta = .37$, $p < .001$) and Civic Participation ($\beta = .25$, $p < .001$) are the strongest predictors of students' science citizenship.

Table 1. *Descriptive Analysis*

Measure	*M*	*SD*	α
Science Literacy			
Science Knowledge	10.88	4.20	
Value of Science	3.44	.79	.86
Science Skills	3.79	.66	.83
Science Beliefs	4.07	.68	.90
Civic Engagement			
Civic Duty	3.98	.60	.87
Civic Skills Efficacy	3.24	.90	.86
Neighborhood Social Connections	3.35	.77	.82
Civic Participation	2.77	.80	.78
Science Citizenship			
Competence for Civic Action	3.32	.90	.92
Political Voice	2.67	1.05	.86
Critical Consumer of Political Information	2.91	1.15	.86
Total Science Citizenship	2.97	.82	

Conclusions/Recommendations

The results indicate that students' science knowledge score was low ($M = 10.88$, 57.3%). Participants scored low on the science knowledge component of the survey because they lacked the critical thinking skills to answer the problems. MLR revealed that civic skills efficacy, civic participation, value of science, science skills, and civic duty were all significant predictors of science citizenship. Civic skills efficacy and civic participation were the strongest predictors. These results are consistent with other studies (Manganelli et al., 2014). When students have civic experience, their self-efficacy increases, thus making it more likely they will participate in other ways. Students' value of science was also a significant predictor of science citizenship because if someone does not believe science is useful, they are not going to invest time or effort into science citizenship.

Recommendations for practice include: (1) incorporating civic education components that focus on civic skills efficacy into SBAE, and (2) providing more opportunities for students to become civically engaged regarding issues that are important to them in their communities.

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