Gearing Up for Green: Faculty Perceptions of Preservice Teacher Preparation in Renewable Energy

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Introduction

Non-hydroelectric renewable energy sources are projected to be the fastest-growing forms of energy generation in the U.S. and the domestic production and use of biofuels is expected to increase through 2050 (U.S. EIA, 2021). Additionally, the Bureau of Labor Statistics (2021) indicated wind turbine service technicians and solar photovoltaic installers rank first and third, respectively, as occupations with the highest projected growth by 2029. Consequently, as energy production continues to diversify, the need for skilled workers in renewable energy systems is increasing (BLS, 2021).

The unique position of school-based agricultural education (SBAE) at the intersection of knowledge and application makes for an ideal environment to deliver renewable energy education, particularly in solar energy, wind energy, and biofuels (Acker et al., 2008; Franklin, 2020). Similarly, the AFNR Career Pathway Content Standards for Power, Structural, and Technical Systems (PSTS) (National Council for Agricultural Education, 2015) include standards to develop students' academic and career success in renewable energy. Despite the perception of renewable energy as well-aligned with agricultural education, implementation is met with challenges in teacher knowledge and training. SBAE teachers have indicated a desire for professional development in renewable energy topics, which has positively impacted teacher perceptions of the subject (Han & Martin, 2015). To better understand the role of renewable energy in agricultural education, a need existed to determine the importance of related competencies and the level of related preparation preservice SBAE teachers are currently receiving. The purpose of this study was to determine the perceived training needs of preservice SBAE teachers in competencies related to renewable energy. This study aligns with Research Priority 3 of the AAAE National Research Agenda (Stripling & Ricketts, 2016).

Theoretical Framework

This study was grounded by Human Capital Theory (HCT) (Goode, 1959). According to HCT, a knowledgeable and skilled workforce is critical in maintaining a productive society (Becker, 1993). A primary resource in developing human capital is an education system that can effectively produce highly trained personnel to support developing industries (Goode, 1959). In this study, HCT supported the concept that the preparation of SBAE teachers in renewable energy must be sufficient to further the advancement of renewable energy in agriculture.

Methodology

The data collected for this study was part of a larger project describing the preparation of school-based agricultural education (SBAE) teachers in agricultural mechanics competencies. An instrument was sent to one agricultural education representative for each post-secondary institution in the contiguous United States that offered a four-year undergraduate degree program designed to certify new SBAE teachers ($N = 98$). A total of 76 participants provided usable data for this study, yielding a response rate of 77.6%. Faculty members were asked if renewable energy content was included in the SBAE curriculum in their state and to identify their perceived level of importance of five renewable energy competencies, as well as the level of preparation they believe their preservice teachers receive on the same five competencies. IBM SPSS v. 27 was used to generate descriptive statistics. Additionally, SPSS and a researcher-developed calculator were utilized to facilitate Narine & Harder's (2021) Ranked Discrepancy Model for analysis of discrepancies between perceived levels of importance and preparation.

Findings

Of the responding faculty members, 36.9% (*f* = 31) indicated renewable energy content is included in their states' secondary agriculture curriculum. Overall, frequencies revealed that most participants perceived the renewable energy content to be at least somewhat important and that graduates from many programs are not prepared in the content area. Frequencies for perceived importance and preparation and a ranked discrepancy score (RDS) for the individual competencies can be found in Table 1.

Table 1. Renewable Energy Competencies (*n* = 76)

		%						
Competency		1	2	3	4	5	RDS[2]	RDS Rank
Maintain and repair solar photovoltaic system components	Imp.[1]	18.4	14.5	**39.5**	23.7	3.9	-64.47	1
	Prep.[1]	**57.9**	22.4	15.8	3.9	0.0		
Install solar photovoltaic system components	Imp.[1]	18.4	14.5	**39.5**	23.7	3.9	-61.84	2
	Prep.[1]	**55.3**	23.7	13.2	7.9	0.0		
Explain the production of biofuels	Imp.[1]	13.3	10.7	34.7	**36.0**	5.3	-60.81	3
	Prep.[1]	**42.7**	18.7	24.0	13.3	1.3		
Explain the use of wind turbines for energy generation	Imp.[1]	15.8	9.2	**36.8**	31.6	6.6	-60.53	4
	Prep.[1]	**44.7**	23.7	22.4	7.9	1.3		
Apply safety practices associated with renewable energy systems	Imp.[1]	13.2	3.9	22.4	**32.9**	27.6	-51.32	5
	Prep.[1]	**35.5**	18.4	18.4	18.4	9.2		

[1]*Note: Importance (Imp.) Scale: 1= Not Important, 2 = Of Little Importance, 3 = Somewhat Important, 4 = Important, 5 = Very Important. Preparedness (Prep.) Scale: 1 = Not Prepared, 2 = Poorly Prepared, 3 = Somewhat Prepared, 4 = Prepared, 5 = Very Prepared*

[2]*Note: The real values for RDS range from -100 to 100, with negative values representing a deficit in perceptions of preparation when compared to perceptions of importance.*

Conclusions/Implications

The findings of this study indicate that teacher educators have mixed views on the importance of renewable energy in SBAE and perceive graduates from their teacher preparation programs to be poorly prepared to teach renewable energy concepts. Considering current labor market data related to renewable energy (BLS, 2021; U.S. EIA, 2021), these findings are potentially troubling for the future of renewable energy in agriculture. In practice, greater educational exposure to solar, wind, and biofuels and applications of renewable energy in agriculture is recommended for preservice teachers. Additionally, further research on the perceptions of preservice and in-service SBAE teachers in renewable energy and potential avenues for professional development on the topic is recommended.

References

Acker, D., & the members of the National 25x'25 Agriculture and Forestry Steering Committee. (2008). Research and education priorities in agriculture, forestry and energy to achieve the 25x'25 renewable energy vision [Guest Position Paper]. *NACTA Journal, 52*(1), 55-59. https://www.nactateachers.org/index.php/vol-52-num-1-march-2008-sp-1885004761/219-research-and-education-priorities-in-agriculture-forestry-and-energy-to-achieve-the-25x25-renewable-energy-vision-guest-position-paper

Becker, G. S. (1993). *Human capital: A theoretical and empirical analysis with special reference to education* (3rd ed.). The University of Chicago Press.

Bureau of Labor Statistics. (2021). *Occupational outlook handbook*. United States Department of Labor. https://www.bls.gov/ooh/

Franklin, E. A. (2020). Alternative energy sources: Is the topic suitable for school-based agricultural education? *The Agricultural Education Magazine, 92*(6), 14-15. https://www.naae.org/profdevelopment/magazine/archive_issues/Volume92/2020%2005%20--%20May%20June.pdf

Goode, R. B. (1959). Adding to the stock of physical and human capital. *The American Economic Review, 49*(2), 147-155. https://www.jstor.org/stable/1816110

Han, G., & Martin, R. A. (2015). Perceptions of agriculture teachers regarding education about biomass production in Iowa. *Journal of Agricultural Education, 56*(3), 1-15. https://doi.org/10.5032/jae.2015.03001

Narine, L. K., & Harder, A. (2021) Comparing the Borich model with the ranked discrepancy model for competency assessment: A novel approach. *Advancements in Agricultural Development, 2*(3), 96-111. https://doi.org/10.37433/aad.v2i3.169

National Council for Agricultural Education. (2015). *AFNR career cluster content standards: Power, structural, and technical systems career pathway.* https://ffa.app.box.com/s/n6jfkamfof0spttqjvhddzolyevpo3qn/file/294153974176

Stripling, C. T., & Ricketts, J. C. (2016). Research Priority 3: Sufficient scientific and professional workforce that addresses the challenges of the 21st century. In T. G. Roberts, A. Harder & M. T. Brashears (Eds.), *American Association for Agricultural Education national research agenda: 2016-2020*. http://aaaeonline.org/National-Research-Agenda

United States Energy Information Administration (2021). Annual energy outlook 2021 narrative. United States Department of Energy. https://www.eia.gov/outlooks/aeo/pdf/AEO_Narrative_2021.pdf