Investigating the Effects of a Small Gas Engine Workshop on SBAE Educators' Perceived Ability to Teach Small Gas Engines

Sarah Parks, Dr. Ryan Anderson & Dr. Dustin Perry

Texas State University & Montana State University

Introduction

It has been recommended that school-based agricultural education (SBAE) teachers who lack the knowledge and skills in agricultural mechanics improve these skills through effective professional development opportunities due to the popularity of the agricultural mechanics pathway in SBAE (Wells & Hainline, 2021). Trickett et al. (2023) found that because of the lack of offerings in agricultural mechanics at the post-secondary level creating ill-prepared educators in this field of study. It has been suggested that SBAE teachers have a higher level of confidence in their knowledge and skills when opportunities are presented to them prior to entering the classroom such as experiences and training that are related to coursework they are covering in classes (Burris et al., 2010; Stripling & Roberts, 2012). Darling-Hammond et al. (2017) has proposed that opportunities such as professional development and trainings can allow for educators to improve their knowledge and skills in their content areas. This has led to Wells and Hainline (2021) stating that by attending any professional development opportunities available, SBAE teachers can improve their teaching skills for instruction in the classroom.

Conceptual Framework

Robert and Ball's (2009) content-based model for teaching agriculture was used to frame this study. This framework focuses on determining agricultural industry needs. Once these needs are determined, educators gain competence in technical knowledge and skills within the curriculum created from industry needs to provide improved instruction. These two steps lead to agricultural instruction and skill acquisition needed to provide instruction to skilled workers (students). For this study, we focused on the skills needed to teach small gas engines to SBAE students. Participants in this study were looking to improve their skills to better their abilities to teach their students small gas engines. We utilized Briggs & Stratton instructors to provide the instruction and curriculum to aid the participants in gaining knowledge and skill acquisition.

Purpose and Objectives

The purpose of this study was to determine if the industry-based small gas engine workshop had an impact on SBAE teachers' perceived ability to teach small gas engines. This study aligns with the AAAE (2023) research value *Increasing Prosperity Through Innovation in AFNR Systems.* This value focused on the importance of improving workforce skills to strengthen the AFNR system. Educators who are trained in specific content areas such as small gas engines can improve their ability to teach small gas engines to SBAE students. Our objectives for this study were to determine the impact of the workshop on SBAE teachers' ability to teach small gas engines: 1) inspection and testing, 2) repair, and 3) theories and safety.

Methodology

This study focused on exploring the impact of a small gas engine training on teachers' ability to teach small gas engines. Over four years, this study was conducted during the first three days of a 10-day training. This training and all materials needed were supported by an industry-based partner. To conduct the pre- and post-test data collection, a paper-based survey was created. Industry experts and educational experts were utilized to test for face and content validity. Eighty-one total participants completed these surveys rating themselves based on their perceived ability to teach small gas engines.

Results

According to the pre-test, SBAE teachers reported their ability to teach small gas engines at little ability. There was an increase in mean difference scores from the pre-test to post-test for all three constructs. The change in the mean differences resulted in all three constructs providing an increase in SBAE teachers' ability to teach small gas engines. The inspection and testing construct had the lowest pre-test and post-test scores (Pre- 1.67, Post-3.50). The repair construct saw the greatest change in mean difference scores (MD = 2.08). The theory and safety construct has the highest mean score in both the pre-test and post-test scores (Pre- 1.86, Post- 3.91). All three constructs were rated at above average ability in the post-test. To determine if all three constructs were statistically significant, a single-tailed t-test was conducted. If the p-value is "$p < .05$", then it is considered statistically significant. Based on these p-values, all three constructs can be determined to be statistically significant. All three constructs saw a large effect size as well, ranging from (D = 0.78-0.92). The grand mean score for each construct is shown in table one.

Table 1

Pre- and Post-Construct Scores for Ability to Teach Small Gas Engines (n = 81)

	Pre-Workshop		Post-Workshop						
Small Gas Engine Construct	M	SD	M	SD	MD	*t*	*p*	*df*	Cohen's D
Inspection/Testing	1.67	0.75	3.50	0.73	1.86	20.39	*<.001	70	0.78
Repair	1.73	0.83	3.80	0.70	2.08	18.46	*<.001	56	0.83
Theory/Safety	1.86	0.86	3.91	0.81	2.04	18.75	*<.001	73	0.92

*Note: 1 = No Ability; 2 = Little Ability; 3 = Moderate Ability; 4 = Above Average Ability; 5 = Excellent Ability; * = $p < 0.05$; MD = Mean Difference (pre-post); Cohen's d: <0.2= small effect; $0.2 \leq d < 0.5$= medium effect; ≥ 0.8 = large effect*

Conclusion/Implications/Recommendations

Based on our findings, it can be concluded that SBAE teachers found the industry-led workshop to be effective in improving their ability to teach small gas engines. Our study aligned with Clark et al. (2021), who recommend that those who teach in the agricultural mechanics content area should pursue further training to improve their skills if they are not adequately prepared at the post-secondary level. SBAE teachers attended this training to better improve their ability to teach small gas engines, and our study indicates this training did improve their ability to teach small gas engines. Results for all 50 variables in the three constructs: inspection and testing, repair, and theory and safety showed a positive increase from the pre-test scores to the post-test scores. Data collected in this study can be deemed as statistically significant and supplemental in providing material and practice to improve SBAE teachers' ability to teach small gas engines.

References

American Association for Agricultural Education (AAAE). (2023). AAAE Research Values.

Burris, S., McLaughlin, E., McCulloch, A., Brashears, T., & Fraze, S. (2010). A comparison of first and fifth year agriculture teachers on personal teaching efficacy, general teaching efficacy, and content efficacy. *Journal of Agricultural Education, 51*(1), 22-31. doi: 10.5032/jae.2010.01022

Clark, T. K., Anderson, R., & Paulsen, T. H. (2021). Agricultural Mechanics Preparation: How Much Do School Based Agricultural Education Teachers Receive?. *Journal of Agricultural Education*, *62*(1), 17–28. https://doi.org/10.5032/jae.2021.01017

Darling-Hammond, L., Hyler, M. E., & Gardner, M. (2017). *Effective teacher professional development*. Learning Policy Institute. https://static1.squarespace.com/static/56b90cb101dbae64ff707585/t/5ade348e70a6ad624d41 7339/1524511888739/NO_LIF~1.PDF

Mahmood, K. (2016). Do People Overestimate Their Information Literacy Skills? A Systematic Review of Empirical Evidence on the Dunning-Kruger Effect. *Communications in Information Literacy, 10* (2), 199-213. https://doi.org/10.15760/comminfolit.2016.10.2.24

Roberts, T. G., & Ball, A. L. (2009). Secondary agricultural science as content and context for teaching. J*ournal of Agricultural Education, 50(1)*, 81-91. https://doi.org/10.5032/jae2009.01081

Stripling, C. T., & Roberts, T. G. (2012). Preservice Agricultural Education Teachers' Mathematics Ability. *Journal of Agricultural Education*, *53*(3), 28–41. https://doi.org/10.5032/jae.2012.03028

Trickett, L., Byrd, A. P., Anderson, R. G., & Haynes, J. C. (2023). Preparing pre-service agricultural education teachers to teach agricultural mechanics: Are we doing enough?. *Journal of Agricultural Education*, *64*(3), 261–273. https://doi.org/10.5032/jae.v64i3.80

Wells, T., & Hainline, M. S. (2021). Examining Teachers' Agricultural Mechanics Professional Development Needs: A National Study. *Journal of Agricultural Education*, *62*(2), 217–238. https://doi.org/10.5032/jae.2021.02217