

**Examining the Impact of a Small Gas Engine Workshop on SBAE Educators' Perceived
Knowledge to Teach Small Gas Engines**

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

Texas State University & Montana State University

Introduction

School-based Agricultural Education (SBAE) teachers are expected to possess proficient knowledge and skills in agricultural mechanics (Wells & Hainline, 2021). Therefore, due to a lack of training at the post-secondary level, professional development is needed to improve knowledge and skills (Trickett et al., 2023). Darling-Hammond et al. (2017) suggested that professional development and training opportunities enable educators to enhance their content knowledge. SBAE educators have reported increased confidence in their knowledge when they are given opportunities prior to teaching in the classroom, such as experiences related to the coursework they are expected to teach (Burriss et al., 2010; Stripling & Roberts, 2012). Wood et al. (2024) reported that 15% of alternatively certified SBAE teachers indicated a need for further professional development in pedagogical content knowledge (PCK). In contrast, half of the teachers with traditional certifications expressed a need for content-specific training. This suggests that while only a small portion of alternatively certified teachers in agricultural education stated that they need training just as much as traditionally certified teachers in content knowledge, there is still a need for training among them (Wood et al., 2024). Based on these findings, they recommended that pre-service PCK be enhanced through various professional development opportunities (Wood et al., 2024).

Conceptual Framework

For this study we utilized Shulman's (1986) Pedagogical Content Knowledge (PCK) to frame our study. Shulman (1986, 1987) indicated that a teacher can use their PCK to teach when they are past the understanding level of their content area, as well as possess the capability to structure and deliver the subject in a form suitable to students' interests including the capabilities of the students based on any difficulties and preconceptions they have encountered. This framework is used to show how educators are increasing their knowledge past the understanding level to better teach the material to students. Based on PCK, participants in this study are seeking training to improve their knowledge of small gas engines. By improving their knowledge, they are able to provide a better learning experience for SBAE students.

Purpose and Objectives

The purpose of the study was to determine if the Briggs & Stratton small gas engine workshop had an impact on SBAE teachers' perceived knowledge to teach small gas engines. This study aligns with the AAAE (2023) research value *Increasing Prosperity Through Innovation in AFNR Systems*. This value ensures the development of a workforce that contain skills to help improve AFNR systems is important. By training educators to have improved knowledge of specific content areas such as small gas engines, they can provide better educational opportunities to students who will in turn become the new workforce. Our objectives for this study are to determine the impact of the small gas engine workshop on SBAE teachers' knowledge to teach: 1) inspection and testing, 2) repair, and 3) theories and safety.

Methodology

For this study, researchers determined SBAE teachers' perceived knowledge of small gas engines and the influence an industry-based workshop had on that knowledge. This training took part in three days of a 10-day training. Industry partners supplied the workshop with industry

trainers, tools and other equipment, and curriculum. To conduct this study, a paper-based survey was created as a pre-test and post-test that focused on three constructs: 1) inspection and testing, 2) repair, and 3) theories and safety. Five industry experts and five educational experts reviewed this survey for face and content validity. A total of 81 participants participated in this study and they rated 50 different small gas engine skills according to their perceived knowledge to teach.

Results/Findings

Based on the pre-test, SBAE teachers’ knowledge of all three constructs to teach small gas engines rated as little knowledge. There was an increase in mean difference from the pre-survey and post-survey for all three constructs. The change in the mean differences resulted in all three constructs showing an increase in SBAE educators’ knowledge to teach small gas engines to above average. The inspection and testing construct had the lowest pre-test and post-test scores (Pre- 1.75, Post- 3.67). The repair construct saw the greatest change in mean difference (MD = 2.03). The theory and safety construct had the highest mean score in both the pre-test and post-test scores. The grand mean score for each construct is shown in table one.

Table 1
Construct Scores for Knowledge to Teach Small Gas Engines (n=81)

Small Gas Engine Construct	Pre-Test		Post-Test		MD	t	p	df	Cohen’s d
	M	SD	M	SD					
Inspection/Testing	1.75	0.69	3.67	0.71	1.92	21.23	*<.001	69	0.753
Repair	1.86	0.85	3.90	0.66	2.03	18.08	*<.001	55	0.849
Theory/Safety	2.07	0.91	4.01	0.79	1.95	17.96	*<.001	77	0.939

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

Conclusions/Implications/Recommendations

Based on the grand mean scores for knowledge to teach small gas engines, the participants indicated that the industry-based workshop helped improve their current Pedagogical Content Knowledge (PCK) in small gas engines. Our study aligns with Trickett et al. (2023), who found that pre-service educators are not receiving the knowledge and skills needed to teach agricultural mechanics, particularly small gas engines, at the post-secondary level. Our study suggests that SBAE teachers’ knowledge of teaching small gas engines prior to attending the small gas engine workshop was very low and increased as a result of the workshop. All 50 variables in the three constructs —inspection and testing, repair, and theory and safety — showed a positive effect on SBAE teachers’ knowledge of teaching small gas engines, with 46 of 50 skills being statistically significant. Overall results for this study indicate that the small gas engine workshop was crucial in providing SBAE teachers with new knowledge, as well as enhancing their existing knowledge. Results of our study indicate that this workshop was statistically significant in providing knowledge of small gas engines to SBAE teachers.

References

- American Association for Agricultural Education (AAAE). (2023). AAAE Research Values.
- Burris, S., McLaughlin, E., McCulloch, A., Brashears, T., & Frazee, 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
- Darling-Hammond, L., Hyler, M. E., & Gardner, M. (2017). *Effective teacher professional development*. Learning Policy Institute.
https://static1.squarespace.com/static/56b90cb101dbae64ff707585/t/5ade348e70a6ad624d417339/1524511888739/NO_LIF~1.PDF
- Shulman, L.S. (1986). Those who understand: Knowledge growth in teaching. *Educational Researcher, 15*(2), 4-14.
- Shulman, L. S. (1987). Knowledge and teaching: Foundations of the new reforms. *Harvard Educational Review, 57*(1), 1-22.
- 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>
- Wood, M., Sorensen, T., & Rubenstein, E. (2024). Assessing the Pedagogical Content Knowledge of School-Based Agricultural Education Teachers and Determining their Individualized Need for Professional Development by Licensure Type. *Journal of Agricultural Education, 65*(2), 54–70. <https://doi.org/10.5032/jae.v65i2.119>