Do I have the Tools to Teach? Investigation of the Relationship Between Importance and the Tools available to Teach Electricity

Jewlyann Cruz & Dr. Ryan Anderson
Texas State University

Introduction

School-Based Agricultural Education (SBAE) provides students with the technical and problem-solving skills necessary to be successful in modern agriculture. Within SBAE, the agricultural mechanics instructional area includes welding, construction, power systems, and electricity playing a pivotal role in developing of students' technical skills and their safety awareness (McKim & Saucier, 2011). However, SBAE teachers enter the classroom with limited postsecondary training in agricultural mechanics particularly in the area of electricity (Kornegay, 2025). These shortcomings lead to gaps in both lab management and teachers' confidence in delivering instruction (McKim & Saucier, 2011; McCubbins et al., 2016). Research has indicated that a lack of access to tools and equipment, with insufficient training, can negatively affect teachers' ability to effectively deliver hands-on instruction while maintaining a safe learning environment (McCubbins et al., 2016). As electrical systems evolve with the agricultural industry, teachers must be properly trained and equipped to teach these skills effectively.

Theoretical Framework

This study was guided by the Human Capital Theory, which emphasized the value of investing in education and training to enhance individual productivity, professional competence, and long-term economic outcomes. Schultz (1961) and Becker (1962) argued that education and skill development are the investments of human capital that result in personal and societal benefit. (Schultz 1961; Becker 1962) With SBAE, the theory is supported with the basis that postsecondary training in an SBAE-based curriculum, such as electricity, directly contributes to teacher effectiveness, instructional quality, and overall readiness for the workforce. By strengthening teachers' technical proficiency and confidence, investment in postsecondary and professional development opportunities strengthens the agricultural education systems' ability to meet the evolving demands of the agricultural industry.

The Agriculture Teacher Education and Agricultural Industry Partnership Model (Wells et al., 2021) provided the conceptual framework for this study. This model highlights the importance of integrating technical skill development, academic preparation, and continuous professional learning through collaboration between teacher education programs and agricultural industry partners. The collaboration ensures that teachers remain current with technological advancements, safety standards, and emerging practices in agricultural mechanics and electrical systems. Connecting this model to our study highlights the importance SBAE teachers place on electricity and tools available, which combined would help better prepare teachers, improve student skills, and support the growing skills gap in the workforce.

Purpose

The purpose of this study was to investigate the relationship between the tools available and importance to teach electricity in SBAE. This research aligns with the American Association of Agricultural Education's *National Research Values* related to advancing public knowledge of agriculture, food, and natural resources (AFNR) systems (AAAE, 2023) by providing instruction to help individuals make informed decisions and prepare them for skilled agricultural work. By connecting to the *National Research Values*, this study evaluates whether the level of importance to teach electricity has an impact on the perceived amount of tools available.

Methods

This study sought to determine the impact of an electricity workshop on SBAE teachers perceived importance of teaching electricity (i.e., electrical safety and tools, switches, and receptacles, making electrical connections, and electrical testing). Before and following the Agricultural Mechanics Academy (AMA), one-and-a-half days were dedicated to electricity. A paper-based questionnaire was developed, reviewed by a panel of experts consisting of five with SBAE experience and five with industry training experience, then revised accordingly. SBAE teachers (n=80) who attended the electricity training were asked to rate the importance of teaching 29 electrical skills from the four electricity constructs.

Results

The majority of workshop participants were *female* (*f* = 49, 61%) and identified as *white/non-Hispanic* (*f* = 70, 88%). A large portion of the participants had completed a university based *traditional teaching certification* (*f* = 58, 73%) and taught *agriculture* in the secondary level (*f* = 72, 90%) with a majority working in in *rural schools* (*f* = 45, 56%) and lacked prior experience *teaching electricity* (*f* = 48, 60%). They also completed an average of 3.49 credit hours (SD = 5.28) of post-secondary coursework in agricultural mechanics curriculum. There were statistically significant relationships between all but two items in the tools available prior to the workshop and the importance to teach after attendance.

Table 1
Spearman Rho Correlations Between tools available and Importance to Teach Switches and Receptacles

	Pre-Importance		*Post Importance*	
Switches & Receptacles	*Pre Tools*	*Post Tools*	*Pre Tools*	*Post Tools*
Identifying types of switches	.039	-.029	.217	.021
Identifying types of receptacles	.019	-.150	.344*	.086
Testing switches	.081	-.019	.323*	.200
Testing receptacles	.062	-.093	.334*	.176
Wiring a single-pole switch	.229*	.026	.310*	.113
Wiring a dimmer switch	-.047	-.033	.241*	.189
Wiring a three-way switch	.108	-.027	.242*	.167
Wiring a four-way switch	-.012	.065	.255*	.245*
Wiring a double-pole switch	.095	-.030	.188	.222*
Wiring standard receptacles	.159	-.026	.336*	.174
Wiring ground fault circuit interrupter (GFCI)	.139	.023	.352*	.216
Wiring split-wire receptacles	-.004	-.043	.739*	.187

*Note. *p < .05*

Conclusion

This study exposed the limited electricity training of SBAE teachers, with a majority having minimal postsecondary training and nearly 60% lacking prior teaching experience. The gaps present instructional and safety issues, presenting the need for structured, hands-on training and professional development opportunities. Using Human Capital theory, investing in teacher technical training can increase instructional effectiveness, student skill development, and workforce readiness. Future research should examine how these improvements translate into practices in the classroom and the effects if any on student outcomes.

References

Becker, G. S. (1962). Investment in human capital: a theoretical analysis. *Journal of Political Economy*, *70*(5), 9–49. http://www.jstor.org/stable/1829103

Kornegay, K., Anderson, R., & Paulsen, T. (2025). Teaching and Learning of Electricity in Agricultural Education: a Literature Review. *Journal of Agricultural Education. 66(4), 1-19.* https://doi.org/10.5032/jae.v66i4.3211.

McCubbins, O., Anderson, R. G., & Paulsen, T. H. (2017). Examining the Relationship between the Perceived Adequacy of Tools and Equipment and Perceived Competency to Teach Agricultural Mechanics. *Journal of Agricultural Education*, *58*(2), pp. 268–283. https://doi.org/10.5032/jae.2017.02268

McCubbins, O., Anderson, R. G., Paulsen, T. H., & Wells, T. (2016). Teacher-Perceived Adequacy of Tools and Equipment Available to Teach Agricultural Mechanics. *Journal of Agricultural Education*, *57*(3), 223-236. doi: 10.5032/jae.2016.03223

McKim, B. & Saucier, R. (2011). Agricultural Mechanics Laboratory Management Professional Development Needs of Wyoming Secondary Agriculture Teachers. *Journal of Agricultural Education*, *52*(3), 75-86. doi: 10.5032/jae.2011.03075

Schultz, T. W. (1961). Investment in human capital. *The American Economic Review*, *51*(1), 1–17. http://www.jstor.org/stable/1818907

Wells, T., Hainline, M. S., Rank, B.D., Sanders, K.W., & Chumbley, S. (2021). A regional study of the agricultural mechanics knowledge and skills needed by school-based agricultural education teachers. *Journal of Agricultural Education, 62*(2), 148-166. https://doi.org/10.5032/jae.2021.02148