Teaching Electricity in SBAE: Training Experiences and Teacher Perceptions

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Introduction

To address climate and emission concerns, agricultural manufacturers are increasing the development of electrically operated equipment. The global electric tractor market is estimated at a value of $590 million and is expected to grow to $3.3 billion by 2032 (DBMR, 2024; Farokhi Soofi et al., 2022). This places even greater importance on basic electrical competence in the agricultural workforce. Lee and Mamerow (2019) found that the experiences and beliefs of educators in STEM fields have a great effect on student outcomes and career decisions. Therefore, it is imperative that School-Based Agricultural Education (SBAE) teachers support students entering the agricultural industry by teaching basic electrical skills (Kornegay et al., 2025). Moreover, there has been a decline in formal electrical training for SBAE educators that may negatively impact their ability to effectively teach their students the electrical skills they need to be successful (Hainline & Wells, 2019).

SBAE teachers who are not highly competent or lack self-efficacy may avoid teaching electricity in the laboratory altogether, leading to insufficient student electrical skills (Hainline & Wells, 2019). Increasingly, the lack of electrical courses and training has created a great knowledge deficit among agricultural educators, and electrical skills are now ranked among the highest skills in need for further professional development among agricultural educators (Schultz et al., 2014). Despite the growing industry demand, SBAE teachers may not pursue further post-secondary electricity education if they do not perceive the skillset as important, especially when financial cost is a barrier (Aguilar et al., 2025; Smalley, 2024). Therefore, examining the relationship between post-secondary electrical training experiences and SBAE teachers' perceived importance of teaching electrical skills is warranted.

The purpose of this study was to evaluate the relationship between the quantity of SBAE teachers' prior post-secondary electrical training experiences and perceived importance of teaching selected electrical skills before and after an electricity workshop. Four objectives guided the study: 1) Determine the relationship between prior post-secondary electrical training and teachers' perceived importance of teaching electrical safety skills before and after the workshop, 2) Determine the relationship between prior post-secondary electrical training and teachers' perceived importance of teaching electrical switches and receptacles before and after the workshop, 3) Determine the relationship between prior post-secondary electrical training and teachers' perceived importance of teaching electrical connections before and after the workshop, and 4) Determine the relationship between prior post-secondary electrical training and teachers' perceived importance of teaching electrical testing methods before and after the workshop.

Theoretical Framework

This study was undergirded by the Theory of Planned Behavior (TPB; Ajzen, 1991). TPB was appropriate because SBAE teachers' perceived importance of teaching electrical skills reflects an attitudinal belief that may influence whether electricity is prioritized in instruction. Although this study did not directly measure instructional intention or behavior, perceived importance provides insight into one factor that may shape teachers' willingness to include electrical content in SBAE programs. Human Capital Theory (HCT; Becker, 1964) served as a secondary lens by framing electrical training as an investment in technical competence that may relate to teachers' perceived instructional value of electrical skills.

Methods

To recruit participants, a mass email was distributed through the American Association of Agricultural Education (AAAE) and the National Association of Agricultural Education (NAAE) listservs three months prior to the application deadline. This email contained essential information about the Agricultural Mechanics Academy. Applicants were required to submit demographic data, details about their institution, years of teaching experience, courses taught, and responses to three reflective questions. Over four years, 20 applicants were selected for a combined total of 80 participants. Preference was given to those with less post-secondary agricultural mechanics training, with consideration to the higher number of agricultural mechanic courses they would be responsible for teaching during the upcoming school year.

A paper-based questionnaire was developed using a literature review. For validity, it was reviewed by a panel of experts consisting of five with SBAE experience and five with industry training experience. It was then revised accordingly. Post hoc reliability analyses were conducted using first year data ($\alpha = 0.869–1.000$), with reliability subsequently established for each year of AMA. The survey instrument was administered pre- and post-AMA with the purpose of identifying changes perceptions after the introduction of additional training. SBAE teachers ($n = 80$ across all four years) who attended the electricity training were asked to rate the importance of teaching 28 electrical skills from the four electricity constructs (Electrical Safety, Electrical Switches, Electrical Connections, and Electrical Testing) using a five-point Likert-type scale. Eighty participants completed both pre- and post-survey questionnaires.

Results

Of the participants in AMA, nearly two-thirds were female and nearly two-thirds were early-career SBAE teachers under 30 years of age. The mean years of teaching experience was 4.36, with a standard deviation of 5.76. Further, the mean years of experience teaching electricity was 0.68 (SD = 1.32) and the mean credit hours of agricultural mechanics instruction at the post-secondary level was 3.49 (SD = 5.28). We found that 73% of participants were traditionally certified teachers through a teacher education program, and 60% had no prior electricity experience. Under objective one, only the Post-Importance vs. Quantity results for 1) using a test light and 2) using a receptacle tester had a *p*-value of less than 0.05. These two skills were nested in the Electrical Safety construct. For the three remaining objectives, the correlations were negligible or weak in both pre and post AMA surveys. Further, several results were found to have moved in the negative direction for perceived importance.

Conclusions/Implications/Recommendations

No results suggested statistical significance for any of the four objectives. The results of this study do *not* support a conclusion that AMA decreased SBAE teacher perceptions of electrical importance. However, from the perspective of TPB, there are insufficient data to determine teacher intentions for teaching more electrical concepts in the classroom. Further, the lack of significant correlation suggests that the quantity of electrical experience is not a primary indicator of perceived importance. We recommend that future studies should not only examine quantity, but also the quality of training in electrical skills for SBAE teachers. We recommend teacher education programs review industry demand and pre-service teacher needs regarding electrical skills. We also recommend follow up and longitudinal studies to assess the impact of AMA on SBAE teachers and behavioral changes.

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