Addressing Professional Development Needs of Middle School-Based Agricultural Education Teachers Through CASE AgXplore Training

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Introduction

In 1992, middle schools across the United States offered agricultural education programs serving 52,968 students (Rossetti, 1992). Nearly 30 years later, that number more than doubled. Around 2020, 442 teachers exclusively taught middle school agricultural education courses to 107,856 students (Jones et al., 2020). Jones et al. (2020) recommended a high-quality teacher is needed at the middle school level to enhance middle school agricultural education programs. Teaching agriculture at the middle school level is markedly different than teaching high school (Talbert et al., 2007). Because middle school is a critical time for youth development, curriculum and instruction should be developed differently than approaches taken in elementary and high school (Golden et al., 2014). Where middle school agricultural education is concerned, there is a serious need for curriculum support (Rayfield & Croom, 2010). The Curriculum for Agricultural Science Education (CASE) worked to address the curricular needs through the AgXplore (AgX) Middle School curriculum materials training (CASE, n.d.). The purpose of this study was to explore middle school-based agricultural education teachers (MSTs) familiarity with agricultural topics, pedagogical content knowledge, and self-efficacy before and after participating in the AgX training. The research questions were: (RQ1) how does MST familiarity with agricultural topics differ before and after attending AgX training; (RQ2) how does MST pedagogical content knowledge differ before and after attending AgX training; and, (RQ3) how does MST self-efficacy differ before and after attending AgX training?

Theoretical Framework

This study is grounded in Bandura's Social Cognitive Theory (SCT), with a specific emphasis on the concept of self-efficacy. According to SCT, an individual's self-efficacy, or belief in their ability to succeed in specific situations, significantly influences their behavior and motivation in social contexts (Bandura, 1986). This research examines the relationship between MSTs' self-efficacy and their exposure to agricultural topics, pedagogical content knowledge enhancement, and professional development experiences. The researchers posit that AgX training enhances self-efficacy through mastery and vicarious experiences, thereby improving teaching effectiveness. By applying SCT theory, the researchers aim to illustrate how teacher professional development, like CASE AgX, plays a pivotal role in enhancing teachers' self-efficacy, highlighting the significance of such training in bolstering educators' confidence and capabilities in the classroom (Bandura, 1986).

Methodology

The population was MSTs attending an AgX training in January 2024 ($N = 20$). A questionnaire was designed based on agricultural content topics addressed in AgX curriculum and pedagogical strategies as well as dimensions of self-efficacy (items adapted from Sonmark et al., 2017) including motivational and instructional strategies, classroom management, and educational outcomes. Face and content validity were evaluated by a panel of experts ($N = 3$) experts in agriculture and STEM education with revisions made based on expert panel feedback. The survey, delivered before and after AgX, had three sections: familiarity with agricultural topics, pedagogical content knowledge, and self-efficacy. The Cronbach's alpha reliability coefficients for familiarity with agricultural topics were .93 (pre-) and .98 (post-); for pedagogical content

knowledge were .94 (pre-) and .98 (post-); and, for self-efficacy were .93 (pre-) and .94 (post-). Convenience sampling, in which all members of the target population are easily accessible, geographically proximate, available at a given time, or willing to participate (Etikan et al., 2016) was used and 20 MSTs (100%) completed the questionnaire. Most respondents were White (100%), female (75%), currently teaching at a middle school (95%) with an average of 8 years total teaching and an average of two years teaching at the middle school level. Data were analyzed by calculating standard descriptive statistics and conducting paired samples *t*-tests.

Results

RQ1. The comparison between the pre- ($M = 66.06$, $SD = 12.34$) and post-training ($M = 80.13$, $SD = 14.87$) data demonstrated a significant impact of the AgX training on teachers' content knowledge ($t(19)=2.35$, $p<0.05$) with a medium effect size (Cohen's $d = 0.53$)

RQ2. The comparison between the pre- ($M = 62.13$, $SD = 11.66$) and post-training ($M = 73.94$, $SD = 13.02$) data demonstrated a significant impact of the AgX training on teachers' pedagogical knowledge ($t(19)=2.66$, $p<0.05$) with a medium effect size (Cohen's $d = 0.60$).

RQ3. The comparison between the pre- ($M = 71.88$, $SD = 9.29$) and post-training ($M = 82.06$, $SD = 8.50$) data demonstrated a significant impact of the AgX training on teachers' self-efficacy ($t(19)=3.56$, $p<0.05$) with a large effect size (Cohen's $d = 0.80$).

Conclusions

The results of the *t*-tests reveal statistically significant improvements in familiarity with content knowledge, pedagogical content knowledge, and teacher self-efficacy after completing CASE AgX training, with all *p*-values being less than 0.05. The effect size, as measured by Cohen's *d*, indicates a moderate effect for both familiarity with content knowledge ($d = 0.53$) and pedagogical content knowledge ($d = 0.60$), suggesting noticeable improvements in these areas. The effect on teacher self-efficacy is particularly strong ($d = 0.80$), highlighting a substantial increase in teachers' beliefs in their abilities to motivate and educate students effectively. Therefore, we conclude that attending AgX had a meaningful impact on enhancing teachers' knowledge and confidence in teaching middle school agriculture. These results align with a study by Velez et al. (2013) revealing CASE training has been shown to improve teachers' personal science teaching efficacy.

Implications

The study's findings highlight the value of professional development programs aiming to enhance teachers' content knowledge, pedagogical skills, and self-efficacy. Educational institutions should prioritize such training to improve teacher effectiveness. Because this study only involved one cohort of AgX trainees, future research should replicate this study with other cohorts. Investigating before and after differences in more demographically diverse cohorts would enhance understanding of the AgX intervention. A follow-up study with this cohort should investigate implementation of AgX and a longitudinal study is recommended to assess the long-term impacts on teacher development. Englin (2023) reported middle school agriculture teachers are concerned about their ability to effectively teach middle school students. Results of the current study suggest AgX may be a viable approach for addressing those concerns; however, these findings are not generalizable to a larger population, as sampling is a limitation.

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