Pre-service Agricultural Education Teachers PCK Development in Agricultural Mechanics

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Introduction

Pedagogical content knowledge (PCK), first coined by Shulman (1986), is the individualized knowledge teachers have of how to teach their specialized content area, blending both their content knowledge (the what) with their pedagogical knowledge (the how). This knowledge allows teachers to break down complex topics to make them more understandable to learners (Berry et al., 2015). PCK develops with time and experience (Grossman, 1990) but can begin at the pre-service level. While research has been conducted in PCK development specific to school-based agricultural education (SBAE) pre-service teachers (Argueta, 2018; McGuire, 2022; Schoeffling et al., 2025; Stewart, 2017; and Wooditch et al., 2018), there is limited research specifically in agricultural mechanics PCK. The purpose of this study was to examine the PCK of pre-service teachers within the context of an agricultural mechanics teaching methods course at a Midwestern university for a single wood working unit. This research study aligns with the advancing public knowledge of AFNR systems research value from the AAAE research agenda (AAAE, 2023). The central research question that guided the study was: What is the PCK development of pre-service SBAE teachers in agricultural mechanics?

Conceptual Framework

This research study was guided by the Hill et al. (2008) mathematics PCK framework. This framework breaks down PCK into two distinct domains: subject matter knowledge and PCK. Subject matter knowledge, also known as content knowledge, includes common content knowledge, specialized content knowledge, and horizon content knowledge. PCK includes knowledge of content and students (KCS; how students learn and understand content), knowledge of content and teaching (KCT; instructional strategies and tools), and knowledge of content and curriculum (KCC; sequencing and structure of curriculum). Together these two domains and six areas represent the various facets of knowledge that teachers may have that contribute to their overall PCK. While created for mathematics, this model was transferable to agricultural education as a framework for breaking apart the complex knowledge base of PCK into separate subgroups for nuanced exploration.

Methods

A qualitative case study approach was utilized to answer the research question guided by Hancock and Algozzine (2011). The bounds of the case were a single unit of wood working within an agricultural mechanics teaching methods course in which fifteen students were enrolled for the fall 2025 term. Data sources included observations with field notes of the entire wood working unit, which lasted two and half weeks and totaled ten hours of instruction. At the completion of the unit, individual semi-structured interviews with eight of the fifteen students enrolled in the course were conducted. All eight students who participated in the interviews were seniors, female, and had taken one previous course in agricultural mechanics content at the university level. All data sources were managed using Nvivo software and analyzed in three phases: initial codes, categories, and themes. Trustworthiness of the study was enhanced through triangulation of multiple data sources, rich, thick description in the form of participant quotes, and member checking (Tracy, 2010). The researchers identify as pragmatists, and one is a graduate student who took the course previously and the other is a teacher educator. Efforts were made to bracket personal experiences (Creswell, 2013).

Results

Theme 1: Pre-service teachers demonstrated substantial growth in agricultural mechanics content knowledge. Participants indicated that, through the agricultural mechanics course, they felt they had grown in content knowledge. Autumn shared, "I know other schools that do not have mechanics going into teaching, and I would be completely lost without having that. I'm very grateful that we have the opportunity to grow even when it is hard." This growth was witnessed by the researchers during observations of the course. At the beginning, students were not confident in their abilities to create a skill sheet, model, or even facilitate student usage of a particular tool. By the end of the unit, each created a well-crafted skill sheet which laid out the tool and how to use it and included a grading rubric for assessment. Each student modeled how to use their tool through a class demonstration without mishaps.

Theme 2: Pre-service teachers demonstrated budding growth in agricultural mechanics PCK. Through interviews and observations, there was evidence that PCK was beginning to blossom in all three subareas for many of the participants. Most participants indicated that they would consider student learning preferences, questions to monitor comprehension of material, and the utilization of pretests to determine prior knowledge, demonstrating KCS. Kathryn shared, "I think at first simply trying to have a conversation about it and asking them some leading questions about what they have done in the past." Participants indicated that they would use a vast array of different curricular resources, most focusing on asking their professional network and using pre-written curriculum, with an emphasis on safety considerations prior to delving into the specifics of woodworking, demonstrating KCC. Finally, KCT, the most heavily impacted of the three subareas, was evident through observations as students discussed the best ways to teach specific tools and expressed the need for the skill sheet as a teaching tool.

Theme 3: Lack of confidence remained a barrier for pre-service teacher PCK development. One pervasive theme was an overarching lack of confidence and experience in the subject matter, which impeded PCK development. Leah shared, "I think it's overall just like the biggest challenge is the confidence of knowing, I can teach this, I can show these kids how to do it, and I can help them when they have questions." It is important to note that all the participants who chose to participate in interviews were female. Bailey stated, "I guess for being a female, you can feel like sometimes it's a male dominated area and so it can be overwhelming." Another factor that played into their lack of confidence was participants believed the students will be more knowledgeable in the mechanics than they are. Jade shared, "And when I think about how maybe I haven't used a certain piece of equipment as much as what I assume some students have used, and so that makes me feel less confident."

Conclusions/Implications

The findings revealed there was strong growth for pre-service teachers in agricultural mechanics content knowledge, the foundation of PCK. Pre-service teachers were able to begin PCK development within the context of agricultural mechanics through the course in each of the three subareas from the Hill et al. (2008) framework. However, a lack of confidence in agricultural mechanics acted as a barrier to further development of PCK. Recommendations for practice include continuing microteaching as a part of the agricultural mechanics course. Recommendations for further research include interviews with the course instructor in addition to the pre-service teachers and observations and interviews of additional units within the course.

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