Research

An Examination of the Agricultural Mechanics Professional Development Needs of Texas School-Based Agricultural Science Teachers

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Introduction

Agricultural education provides students with knowledge about agriculture, food, and natural resources, along with a wide variety of skills. The basic core of agricultural education consists of three intra-curricular components; classroom instruction, experiential learning through supervised experiences, and leadership activities. When these three components are actualized, they provide a context for learning necessary content and life skills to prepare students for adulthood (Dailey, Conroy & Shelley-Tolbert, 2001). Specialized facilities, such as laboratories, are often an integral element used for each of these three components to further enrich student learning experiences (Saucier & McKim, 2011). One of the subjects taught within agricultural education, is agricultural mechanics. It is estimated that 40% to 66% of instructional time, in many agricultural education programs, involves agricultural mechanics education (Saucier & McKim, 2011). Due to this, it is imperative for agricultural educators to be well-versed in agricultural mechanics. Well prepared and knowledgeable agriculture teachers can guide agricultural education students safely and effectively in the development of practical, hands-on skills and agricultural mechanics education (Saucier & McKim, 2011). Skilled teachers are critical to student achievement. Therefore, the need to provide effective professional development is essential for improving student learning (Sorensen, Lambert & McKim, 2014).

Conceptual Framework

To guide this study, the Borich Needs Assessment Model (1980) was used. The fundamental concept of the Borich needs assessment model is to allow teaching and research to be developed based on the most needed area first (Saucier, & Langley, 2017). More specifically this model enables "researchers/evaluators to purposefully prioritize teaching and/or research competencies so participants can receive training in the most needed area first, and in each successively less urgent area (competency), if time and funding permit the extension of a training and professional development session" (McKim, 2013). The Borich Needs Assessment Model allows researchers to create a Mean Weighted Discrepancy Score (MWDS) by comparing scaled measurements of importance, knowledge, ability to perform, and ability to teach others to perform.

Methodology

The purpose of this quantitative study was to determine the agricultural mechanics professional development needs of Texas, school-based agricultural science teachers and their personal, professional, and program demographic characteristics. To guide this study, the following research questions were utilized: (1) What are the personal, professional, and program demographic characteristics of Texas agricultural science teachers who taught agricultural mechanics related curriculum? (2) What are the agricultural mechanics skill professional development needs of Texas, school-based agricultural science teachers who taught agricultural mechanics related curriculum? The population for this study were all (N = 1,754) Texas, school-

based agricultural science teachers during the 2014-2015 academic school year. A panel of experts (n = 7) with experience in agricultural education and agricultural mechanics were used to evaluate an online instrument for face and content validity. Based upon their suggestions, the instrument was revised and a pilot test (n = 17) was then used to ensure reliability. A reliability analysis (Cronbach's alpha coefficient) of the scales of measurement was conducted (Importance = .916, Ability to Perform = .936, & Ability to Teach = .937) and the instrument was deemed reliable (Ary, Jacobs, & Sorenson, 2010). A random sample (n = 315) of the population was conducted based on recommendations from Krejcie & Morgan (1970). Usable responses were collected from 154 teachers with a response rate of 48.89%. To ensure generalizability of the results to the population, *Method 1 – Comparing Early to Late Responders* (Linder, Murphy, & Briers, 2001) was utilized which indicated no differences existed between the groups. Scaled data was analyzed using the Borich (1980) Needs Assessment Model and IBM SPSS Statistics 22.

Results

Respondents indicated that they were 41 years of age on average (M = 41.79; SD = 11.33) with the majority of teachers being of white ethnicity (f = 126; 81.8%), married (f = 105; 68.2%), and having children at home (f = 102; 66.2%). Teachers indicated that they teach on average 4 (M = 3.89; SD = 1.86) agricultural mechanics courses during the school year, with 51.3% of programs that offered an industry supported certification program for students (f = 79), the agricultural mechanics laboratory they taught in was over 4400 ft² in size (M = 4,430.07 ft²; SD = 4,585.07 ft²), and the majority of laboratories were 16 or more years of age (f = 77; 50.0%).

Within the *Performance Competence*, the top three agricultural mechanics skill areas that teachers indicated they need professional development in were: *Modern Machinery Technology* (MWDS = 1.60), *Hydraulics* (MWDS = 1.58), and *Pneumatics* (MWDS = 1.43). The bottom three competencies needing professional development in this competence were: *Oxygen/Fuel Brazing* (MWDS = 0.64), *Oxygen/Fuel Welding* (MWDS = -1.09), and *Fencing* (MWDS = -1.52). When evaluating the *Consequence Competence*, the top three agricultural mechanics skill areas needing professional development were: *Hydraulics* (MWDS = 1.84), *Modern Machinery Technology* (MWDS = 1.70), and *Pneumatics* (MWDS = 1.69). The bottom three competencies needing professional development were: *Oxygen/Fuel Brazing* (MWDS = -0.60), *Oxygen/Fuel Welding* (MWDS = -0.97), and *Fencing* (MWDS = -1.36).

Conclusions, Implications, & Recommendations

The majority of teachers indicated that they were mid-career, in their early 40's, of white ethnicity, and male, who taught four classes of agricultural mechanics during a school year. Across both the performance and consequence competence, teachers indicated a professional development need in the majority of the agricultural mechanics skill areas. However, across both competences, the skill areas of Modern Machinery Technology, Hydraulics, and Pneumatics arose to the top. Additionally, the skill areas of Oxygen/Fuel Brazing, Oxygen/Fuel Welding, and Fencing were always the least needed for professional development. Implications from this research are very important to the longevity of mid- career teachers and the overall welfare of students who work and learn in an agricultural mechanics laboratory. By understanding the knowledge and ability levels of these experienced teachers, adequate and timely professional

development opportunities can and should be enacted. To retain these teachers in an industry that typically loses many teachers after their third year, stakeholders (agricultural education faculty, state agricultural education supervisors, and local school administrators) should consider in-service opportunities, salary/ workplace improvements, and pre-service education advancements.

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