An Examination of the Agricultural Mechanics Professional Development Needs of the 2016 National FFA Agricultural Technology and Mechanical Systems Career Development Event FFA Advisors

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An Examination of the Agricultural Mechanics Professional Development Needs of the 2016 National FFA Agricultural Technology and Mechanical Systems Career Development Event Qualifying FFA Advisors

Introduction

Parr, Edwards, and Leising (2008) noted that across the U.S., agricultural mechanics curriculum instructed at the secondary level has exposed students to the application of knowledge and skills in real world situations often found in business and industry. Furthermore, a review of literature found that agricultural mechanics gives students hands on, educational learning opportunities that use a variety of technologies (Wells, Perry, Anderson, Shultz, & Paulsen, 2013). Across the U.S., there is a shortage of agricultural science teachers, especially in high school agricultural education programs that offer agricultural mechanics courses (Wolf, 2011). Due to the dwindling number of qualified agricultural science teachers nationwide, the education of secondary agricultural students could be negatively affected by a shortage of qualified teachers who can instruct this unique curriculum area (Saucier, McKim, & Tummons, 2012). As high school agricultural programs continue to grow, public education will need more well-rounded teachers that are efficient in all areas of agriculture, especially in agricultural mechanics (Burris, Robinson, & Terry, 2005). With such a high demand for employees with agricultural mechanics skill sets in industry, agricultural mechanics curriculum can play a definitive roll in bridging the gap for entry level employees with pre-existing skill sets, therefore, also increasing the need for agricultural mechanics teachers (Wells et al.).

Conceptual Framework

To guide this study, the Borich Needs Assessment Model (Borich, 1980) was used. 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, p. 1). Borich (1980) identified three dimensions within the needs assessment model that would allow a better understanding of the needs of teachers that included: *Knowledge Competence*, *Performance Competence*, and *Consequence Competence*. Furthermore, a comparison of scaled measures: importance, knowledge, ability to perform, and ability to teach others to perform, can be compared to create a Mean Weighted Discrepancy Score (MWDS), which allows insight into these dimensions. The MWDS also allows researchers the ability to prioritize training for teachers based upon these dimension areas.

Purpose

The purpose of this mixed method census was to determine the agricultural mechanics professional development needs of FFA advisors who had a qualifying team at the 2016 National FFA Agricultural Technology and Mechanical Systems (ATMS) Career Development Event (CDE) and their personal, program, and professional demographics. The following research questions guided this study.

Research Questions

1. What are the personal, professional, and program demographic characteristics of 2016 National FFA Agricultural Technology and Mechanical Systems (ATMS) Career Development Event (CDE) Qualifying FFA Advisors?

2. What are the agricultural mechanics professional development needs of 2016 National FFA Agricultural Technology and Mechanical Systems (ATMS) Career Development Event (CDE) Qualifying FFA Advisors?

Methods

The population for this mixed method census were all (*N* = 44) FFA advisors who had a qualifying team at the 2016 National FFA Agricultural Technology and Mechanical Systems (ATMS) Career Development Event (CDE). A census was conducted with usable responses received from 40 teachers (93.02%). The data collection instrument was developed based upon a review of literature. The instrument was then reviewed for face and content validity by a panel of experts (*N* = 5) with experience in secondary agricultural education and changes to the instrument were made based upon their recommendations. A pilot test (*N* = 19) was conducted with Texas agricultural science teachers who attended an agricultural mechanics professional development workshop during the fall 2016 semester. A reliability analysis (Cronbach's alpha coefficient) of the scales of measurement was conducted (Importance = .926, Knowledge = .930, Ability to Perform = .929, Ability to Teach Others to Perform = .936) and were deemed reliable (Ary, Jacobs, & Sorensen, 2010). Scaled data was analyzed using the Borich (1980) Needs Assessment Model, Microsoft Excel, and IBM SPSS Statistics 22.

Findings

For research question one, researchers found that teachers were on average 43 years of age (*M* = 42.74; *SD* = 10.91), mostly of a white ethnicity (*f* = 38; 92.7%), were mostly male (*f* = 37; 90.2%), and had on average 18 years of teaching experience (*M* = 18.28; *SD* = 11.27). Furthermore, more than half of these teachers (*f* = 22; 53.7%) had earned a master's degree and did not have a separate budget at their program for only agricultural mechanics courses (*f* = 24; 58.5%). In their programs, teachers noted that they had on average a Personal Protection Equipment (PPE) budget of $500.87 (*SD* = $494.89), a hand tool budget of $333.82 (*SD* = 306.22), a power tool budget of $1,342.92 (*SD* = 1712.08), and a budget for consumables of $3,426.26 (*SD* = $3,466.33). In terms of agricultural mechanics laboratories, the majority of teachers noted (f = 28; 68.3%) that their laboratories were 16 or more years old. Teachers also reported that their agricultural mechanics laboratory's condition (1 = unusable, unsafe and a 10 = usable, safe) were on average a 7.82 (*SD* = 1.94). Finally, during the 2015-2016 academic school year, teachers reported on average 3.54 (*SD* = 3.61) student injuries that occurred in the agricultural mechanics laboratory.

Within the *Knowledge Competence*, the top three agricultural mechanics skill areas that teachers indicated they needed professional development in were: *Electricity* (MWDS = 2.24), *Gas Metal Arc Welding* (GMAW; MWDS = 1.80), and *Metal Fabrication* (MWDS = 1.68). The bottom three competencies needing professional development were: *Hardfacing* (MWDS = -0.60), *Soldering* (MWDS = -0.87), and *Painting and Preservation* (MWDS = -1.60). The top three needed professional development needs within the *Performance Competence* were: *Gas Metal Arc Welding* (GMAW; MWDS = 4.61), *Electricity* (MWDS = 2.12), and *Safety/Laboratory Management* (MWDS = 1.69). The three lowest ranked professional development needs in this competence were: *Oxygen Fuel Cutting & Welding* (OFCW; MWDS = -0.51), *Soldering* (MWDS = -1.22), and *Painting and Preservation* (MWDS = -1.60). When evaluating the Consequence Competence, the top three competencies that had the greatest need for professional development were: *Electricity* (MWDS = 2.35), *Planning and Estimation* (MWDS = 2.12), and *Metal*

Fabrication (MWDS = 2.01). The three competencies with the lowest need for professional development in this competence were: *Oxygen Fuel Cutting & Welding* (OFCW; MWDS = -0.41), *Painting and Preservation* (MWDS = -1.18), and *Soldering* (MWDS = -1.22).

Conclusions, Implications, & Recommendations

The majority of the white, male teachers who responded in this census were in their early 40's and had 18 years of teaching experience. These teachers taught in older agricultural mechanics laboratories that were somewhat in usable and safe conditions with budgets for all aspects of teaching agricultural mechanics in a laboratory setting. Across all three-competence areas, teachers indicated a need for professional development. The most frequent skill areas included: electricity, GMAW, and metal fabrication. Implications from this research could be useful when assessing the overall ATMS CDE team score and using the teachers professional development needs as a predictor of success. Furthermore, this study could also provide insight into the professional development needs of expert U.S. agricultural mechanics teachers and provide some upper echelon base line data. By understanding the knowledge, performance, and consequence competence of these teachers, adequate and timely professional development opportunities could be structured and offered to keep these mid-career teachers in the classroom and an industry that is struggling to retain qualified teachers.

References

Ary, D., Jacobs, L.C., & Sorensen, C. K. (2010). *Introduction to research in education*. Wadsworth: Belmont, CA.

Borich, G. D. (1980). A needs assessment model for conducting follow-up studies. *Journal of Teacher Education, 31* (3), 39-42. doi: 10.1177/002248718003100310

Burris, S., Robinson, J. S., & Terry, R., (2005). Preparation of pre-service teachers in agricultural mechanics; *Journal of Agricultural Education*, *46*(3), 23-34. doi: 10.5032/jae.2005.03023

McKim, B. R., (2013). *Assessing knowledge performance, and consequence competence with the Borich Needs Assessment Model*. College Station, TX; Texas A&M University, Digital Media Research and Development Laboratory.

Parr, B. A., Edwards, M. C., & Leising, J. G., (2008). Does a curriculum integration intervention to improve the mathematics achievement of students diminish their acquisition of technical competence? An experimental study in Agricultural Mechanics, *Journal of Agricultural Education*, *49*(1), 61-71. doi: 10.5032/jae.2008.01061

Saucier, P. R., McKim, B. R., & Tummons, J. D. (2012). A Delphi approach to the preparation of early–career agricultural educators in the curriculum area of agricultural mechanics: Fully qualified and highly motivated or status quo*? Journal of Agricultural Education, 53*(1), 136-149. doi: 10.5032/jae.2012.01136

Wells, T., Perry, D. K., Anderson, R. G., Shultz, M. J., & Paulsen, T. H., (2013). Does prior experience in secondary agricultural mechanics affect preservice agricultural education Teachers' intentions to enroll in post-secondary agricultural mechanics. *Journal of Agricultural Education*, *54*(4), 222-237. doi: 10.5032/jae.2013.04222

Wolf, K. J. (2011). Agricultural education perceived teacher self–efficacy: A descriptive study of beginning agricultural education teachers. *Journal of Agricultural Education, 52*(2), 163–176. doi: 10.5032/jae.2011.02163