Assessing Agricultural Mechanics Professional Development Needs of Iowa School-based Agricultural Education Teachers: A Pilot Study

Trent Wells
Southern Arkansas University
MSC 9418, Agriculture (AGR) 208
Magnolia, AR 71753
ktwells@saumag.edu

Mark S. Hainline
Iowa State University
223A Curtiss Hall
Ames, IA 50011
mhainlin@iastate.edu

Thomas H. Paulsen
Morningside College
Buhler Rohlfs Hall (BR) 108
Sioux City, IA 51106
paulsent@morningside.edu

Scott W. Smalley
Iowa State University
217C Curtiss Hall
Ames, IA 50011
smalle16@iastate.edu

Kevin W. Sanders
Iowa State University
227 Curtiss Hall
Ames, IA 50011
kws@iastate.edu

Assessing Agricultural Mechanics Professional Development Needs of Iowa School-based Agricultural Education Teachers: A Pilot Study

Introduction & Conceptual Framework

School-based agricultural education (SBAE) programs require leadership from effective teachers. An important characteristic of effective agricultural education teachers is appropriate agricultural subject matter knowledge (Eck, Robinson, Ramsey, & Cole, 2019). This knowledge can be developed through personal experience, pre-service training, or in-service professional development (PD). PD can be useful for helping SBAE teachers grow professionally (Grieman, 2010); however, identifying relevant PD needs is important (Smalley, Hainline, & Sands, 2019). Many SBAE teachers desire PD in agricultural mechanics subject matter (Smalley et al., 2019). Additionally, scholars (Hainline & Wells, 2019) have indicated additional research to understand the technical agricultural mechanics needs of SBAE teachers which should be undertaken.

Our study was conceptually framed through Roberts and Ball's (2009) content-based model for teaching agriculture. This model is comprised of several elements (i.e., *Agricultural Industry*, *Educators Competent in Technical Agriculture*, *Industry-Validated Curricula*, and *Agricultural Instruction and Skill Acquisition*) that inform the development of a *Skilled Worker* over time. Our interest was the *Educators Competent in Technical Agriculture* component of this model. SBAE teachers must have agricultural subject matter knowledge to be effective (Eck et al., 2019). Understanding SBAE teachers' PD needs is vital to facilitating professional changes that impact students' opportunities (Smalley et al., 2019).

Purpose

Our pilot study was conducted for two purposes: (1) validate an instrument for assessing technical agricultural mechanics PD needs of SBAE teachers and (2) describe technical agricultural mechanics PD needs of Iowa SBAE teachers. Our study aligns with Research Priority 3 of the American Association for Agricultural Education National Research Agenda: Sufficient Scientific and Professional Workforce that Addresses the Challenges of the 21st Century (Stripling & Ricketts, 2016).

Methods

We developed our questionnaire and distributed it via Qualtrics to all 287 SBAE teachers in Iowa during the Fall 2019 semester. We used Borich's (1980) needs assessment model to structure our questionnaire. Respondents were asked to rate their perceived importance of and competence to teach each item. Each technical agricultural mechanics item was included based on previous research (Hainline & Wells, 2019). Prior to data collection, a panel of seven agricultural teacher educators with previous experience teaching agricultural mechanics examined our questionnaire. Each panel member was asked to assess the face validity and content validity of our questionnaire and provide specific recommendations to improve our questionnaire. Items were modified per the panel members' recommendations. Our final questionnaire consisted of 65 technical agricultural mechanics items (e.g., electrical wiring, etc.) and seven teacher demographics questions. Demographics data were not reported in this abstract.

We used five points of contact to invite and remind SBAE teachers to participate in our study (Dillman, Smyth, & Christian, 2014). We offered each teacher a chance to win one of five $20 gift cards as an incentive for participation. The first item in our questionnaire asked whether a respondent taught agricultural mechanics coursework in an SBAE program during the past three years. If the respondent answered in the negative, his / her response was recorded and the questionnaire was subsequently closed. We used IBM® Statistical Package for the Social Sciences (SPSS®) Version 25 software and the Excel-Based MWDS [mean weighted discrepancy scores] Calculator (McKim & Saucier, 2011) to analyze data. Seventy SBAE teachers responded to our questionnaire, resulting in a response rate of 24.4%. To evaluate non-response error, we conducted a *t*-test to compare early and late responders' (Lindner, Murphy, & Briers, 2001) responses on competence scale items. No statistically significant differences ($t(68) = .22$, $p = .83$) were found between the two groups. MWDS were calculated for all 65 technical agricultural mechanics items. The MWDS served as a means to rank the technical agricultural mechanics items—signifying the areas of greatest PD needs. We assessed the reliability of the questionnaire by conducting a post-hoc reliability analysis. The Cronbach's alpha reliability coefficients for the *Importance* ($\alpha = .97$) and *Competence* scales ($\alpha = .98$) were considered adequate using George and Mallery's (2003) interpretations.

Results, Conclusions, Implications, & Recommendations

MWDS ranged from 4.71 to 0.06 with 22 items above 3.00. Sixty-one items (94%) were rated as *Important* while 69% ($n = 45$) of the respondents rated themselves at best *Somewhat Competent.* The top five technical agricultural mechanics items are ranked below.

Table 1

Technical Agricultural Mechanics Professional Development Needs by MWDS

			Importance		Competence	
Item	*n*	*MWDS*	*M*	*SD*	*M*	*SD*
Principles of diesel engine operational theory	68	4.71	3.96	0.72	2.76	1.31
Use of computer numerical control (CNC) systems	68	4.67	3.74	0.80	2.49	1.14
Procedures for troubleshooting small engines	70	4.58	4.27	0.72	3.20	1.35
Principles of vehicle powertrain operational theory	68	4.54	3.76	0.76	2.56	1.25
Procedures for agricultural equipment operation	70	4.29	4.17	0.78	3.14	1.30

Note. Importance Scale: 1 = *Not important*, 2 = *Of little importance*, 3 = *Somewhat important*, 4 = *Important*, 5 = *Very important*; Competence Scale: 1 = *Not competent*, 2 = *Little competence,* 3 = *Somewhat competent*, 4 = *Competent*, 5 = *Very competent*

Our pilot study yielded an instrument for assessing the technical agricultural mechanics PD needs of SBAE teachers. We also found Iowa SBAE teachers perceived they lack the competence necessary to teach several agricultural mechanics items. Because teachers must exhibit expertise in order to successfully mentor novice students (Roberts & Ball, 2009), focused PD is needed. Ranked MWDS scores reported in our study should inform prescribed PD for teachers in Iowa, which can ensure requisite technical knowledge vital for facilitating the professional changes needed to prepare students for the 21st century (Smalley et al., 2019).

References

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

Dillman, D. A., Smyth, J. D., & Christian, L. M. (2014). *Internet, phone, mail, and mixed-mode surveys: The tailored design method* (4th ed.). Hoboken, NJ: John Wiley & Sons, Inc.

Eck, C. J., Robinson, J. S., Ramsey, J. W., & Cole, K. L. (2019). Identifying the characteristics of an effective agricultural education teacher: A national study. *Journal of Agricultural Education, 60*(4), 1-18. doi:10.5032/jae.2019.04001

George, D., & Mallery, P. (2003). *SPSS for Windows step by step: A simple guide and reference. 11.0 update* (4th ed.). Boston, MA: Allyn & Bacon.

Grieman, B. C. (2010). Continuing professional development. In R. M. Torres, T. Kitchel, A. L. Ball (Eds.) Preparing and advancing teachers in agricultural education (pp. 180-201). Columbus, OH: Curriculum Materials Service, The Ohio State University.

Hainline, M. S., & Wells, T. (2019). Identifying the agricultural mechanics knowledge and skills needed by Iowa school-based agricultural education teachers. *Journal of Agricultural Education, 60*(1), 59-79. doi:10.5032/jae.2019.01059

Lindner, J. R., Murphy, T. H., & Briers, G. E. (2001). Handling nonresponse in social science research. *Journal of Agricultural Education, 42*(4), 43-53. doi:10.5032/jae.2001.04043

McKim, B. R., & Saucier, P. R. (2011). An Excel-based mean weighted discrepancy score calculator. *The Journal of Extension, 49*(2). Retrieved from https://www.joe.org/joe/2011april/pdf/JOE_v49_2tt8.pdf

Roberts, T. G., & Ball, A. L. (2009). Secondary agricultural science as content and context for teaching. *Journal of Agricultural Education, 50*(1), 81-91. doi:10.5032/jae2009.01081

Smalley, S. W., Hainline, M. S., & Sands, K. (2019). School-based agricultural education teachers' perceived professional development needs associated with teaching, classroom management, and technical agriculture. *Journal of Agricultural Education, 60*(2), 85-98. doi:10.5032/jae.2019.02085

Stripling, C. T., & Ricketts, J. C. (2016). Research priority 3: Sufficient scientific and professional workforce that addresses the challenges of the 21st century. In T. G. Roberts, A. Harder, & M. T. Brashears. (Eds.), *American Association for Agricultural Education national research agenda: 2016-2020.* Gainesville, FL: Department of Agricultural Education and Communication.