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Assessing the Learning Needs of Student Teachers in Texas Regarding Management of the Agricultural Mechanics Laboratory: Implications for the Professional Development of Early Career Teachers in Agricultural Education

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Skills needed to manage a laboratory are essential knowledge for all school–based, agriculture teachers who instruct agricultural mechanics curriculum (Saucier, Terry, & Schumacher, 2009). This research investigated the professional development needs of Texas agricultural education student teachers regarding agricultural mechanics laboratory management. Data were collected with a mailed questionnaire to determine student teachers' perceptions of the importance of 70 agricultural mechanics laboratory management competencies and their self–assessed ability to perform those competencies. The Borich (1980) Needs Assessment Model was used to assess and evaluate the professional development needs of these student teachers. The study found that these student teachers were in need of professional development in many areas of laboratory management, such as diagnosing malfunctioning laboratory equipment, repairing laboratory equipment, and administering first aid.

Keywords: agricultural mechanics, laboratory management, preservice teachers

Introduction

Educational laboratories are an integral part of many agricultural education programs, providing students an opportunity to learn by doing (Sutphin, 1984). Moreover, a complete school–based, agricultural education program consists of three essential and interdependent components: classroom and laboratory instruction; Supervised Agricultural Experience (SAE) projects; and membership in the National FFA Organization (Phipps, Osborne, Dyer, & Ball, 2008). Specialized facilities, such as laboratories, are often an integral element used for each of these three components to further enrich student learning experiences (McKim & Saucier, 2011).

Laboratories are essential educational tools for agricultural mechanics programs—providing a venue for students to develop skills and knowledge used in agricultural mechanics (Phipps et al., 2008). It is estimated that 40% to 66% of instructional time, in many agricultural education programs, involves agricultural mechanics education (Phipps et al., 2008; Saucier, Schumacher, Funkenbusch, Terry, & Johnson, 2008; Shinn, 1987). More recently, McKim and Saucier (2011) confirmed the earlier estimates, reporting that, on average, teachers taught four classes per semester that included agricultural mechanics competencies. As such, it is reasonable to posit that a great deal of instructional time is spent in the agricultural mechanics laboratory (Johnson & Schumacher, 1989; Saucier et al., 2009) and that the laboratory is essential in maximizing student learning (Bear & Hoerner, 1986). With the amount of instructional time spent in agricultural mechanics laboratories across the United States, it is critical that agriculture teachers receive agricultural mechanics laboratory management education (Harper, 1983; McKim & Saucier, 2011; Saucier et al., 2008; Saucier, Tummons, Terry, & Schumacher, 2010).

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 (McKim & Saucier, 2011; Saucier et al., 2008). According to the National Standards for Teacher Education in Agriculture (American Association for Agricultural Education, 2001), Standard 2C identified that teacher education programs should be "designed so that teacher candidates attain competence in basic principles, concepts, and experiential practices in agricultural science and natural resources" (p. 3.) One of the four areas identified is agricultural and mechanical systems, i.e., agricultural mechanics. In a study of the competencies and traits of successful agricultural science teachers by Roberts, Dooley, Harlin, and Murphrey (2007), results indicated that preservice and in–service teachers identified that a successful teacher should be well–rounded with both a content specialization and a broad knowledge about the field of agriculture. Moreover, respondents expressed that specific needs related to content specialization (i.e., agricultural mechanics), were critical areas of knowledge.

Several studies noted that school–based, agricultural educators did not receive adequate laboratory safety education prior to beginning their teaching careers or after accepting a teaching position (Dyer & Andreasen, 1999; Foster, 1986; Rosencrans, 1996; Swan, 1992). Burris, Robinson, and Terry (2005) found that teacher educators believed that the instruction of agricultural mechanics to preservice teachers was important, but the level of preparation that students received was less than adequate for the future duties that they would encounter as secondary agricultural educators. Furthermore, Burris et al. suggested that resources allocated to prepare preservice teachers were inadequate, considering the level of importance that teacher educators placed on the preparation of agricultural mechanics related skills.

Barrick and Powell (1986) found that first year agriculture teachers rated managing laboratory learning as a highly important ability for agriculture teachers; however, their level of knowledge concerning the management of laboratory learning was low. In 1990, Johnson, Schumacher, and Stewart concluded that Missouri's school–based, agriculture teachers had professional development needs in the area of agricultural mechanics laboratory management and had the greatest professional development needs in the area of safety. These findings were supported by similar subsequent studies conducted in Nebraska (Schlautman & Silletto, 1992), Louisiana (Fletcher & Miller, 1995), Missouri (Saucier et al., 2009), and Wyoming (McKim & Saucier, 2011).

Conceptual Framework

The model for teacher preparation in agricultural education (Whittington, 2005) served as the conceptual framework for this study. The model (see Figure 1) is based on the philosophical foundations of agricultural teacher education, experiential learning (Dewey, 1938), problem–based teaching (Lancelot, 1944), social cognition (Bandura, 1986), and reflective practice (Schön, 1983). Coursework aligned with the National Council for Accreditation of Teacher Education (NCATE) standards, Interstate New Teachers Assessment and Support Consortium (INTASC) principles, Praxis criteria for licensure, and the American Association for Agricultural Education (AAAE) standards, guides preservice teachers preparation, which includes the necessary knowledge, skills, and disposition for entry into the teaching profession.

Because many preservice programs require less than three hours of agricultural mechanics coursework for teacher certification (Hubert & Leising, 2000), it is important to understand teachers' professional development needs in the area of agricultural mechanics laboratory management, so future professional development educational opportunities can be planned, delivered, and evaluated. Due to the limited amount of research in the area of agricultural mechanics laboratory management and the continual need for research regarding teachers' professional development needs (Osborne, 2007), a current assessment of professional development needs of Texas entry–phase agriculture teachers was warranted.

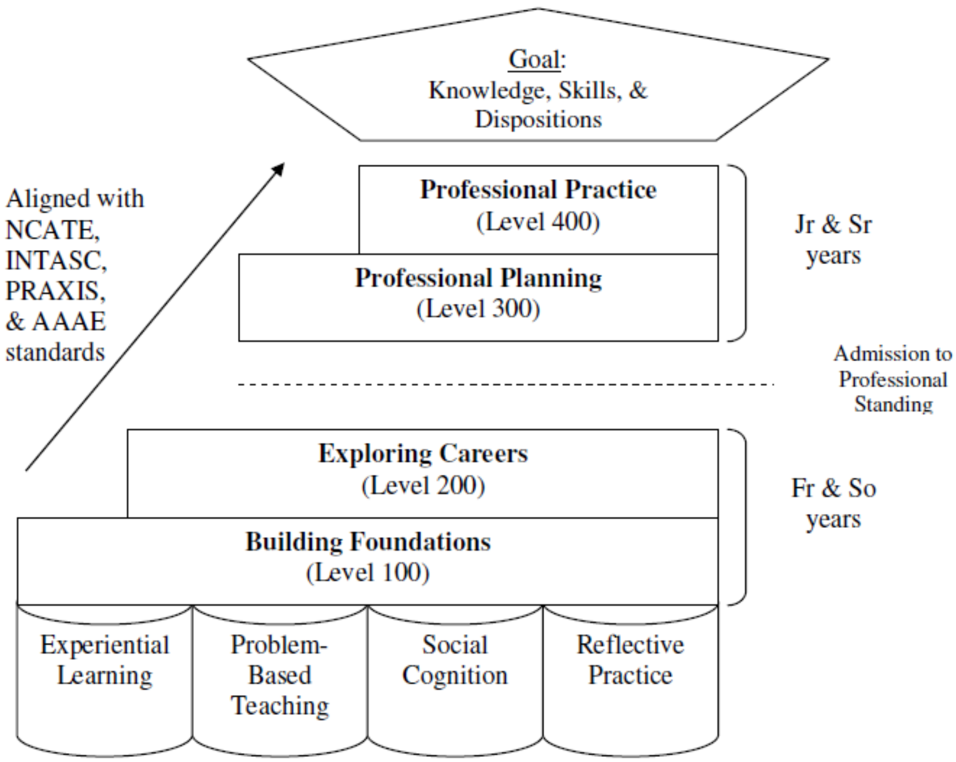

Figure 1. The model for teacher preparation in agricultural education (Whittington, 2005, p. 94). *Note:* Years in College: Fr= Freshman year, So = Sophomore year, Jr = Junior year, Sr = Senior year

Purpose and Research Questions

Agricultural mechanics courses continue to be one of the most popular and frequently offered school–based, agricultural education courses in Texas (Texas Education Agency, 2009). However, a study to determine the competence and professional development needs of Texas school–based, agricultural education student teachers was not evident in recent literature. Therefore, the purpose of this study was to determine the professional development needs of agricultural education student teachers in Texas. Two research questions guided this study:

What were the personal and professional characteristics of school–based, agricultural education student teachers in Texas?

What were the professional development needs of agricultural education student teachers in Texas, regarding competencies related to the management of the agricultural mechanics laboratory?

Methods and Procedures

This descriptive study measured perceptions of school–based, agricultural education student teachers in Texas, regarding agricultural mechanics laboratory management competencies. The population for this study was Texas student teachers who completed an agricultural science teacher certification program during the spring of 2009 (N = 98). The frame for the population was obtained by contacting the agricultural education faculty member in charge of the preservice teacher education program at each of the 10 certifying institutions in Texas. The frame included 98 students from nine institutions that completed a school–based, agricultural education student teaching practicum in Texas during the spring of 2009; one university was omitted because no students were enrolled in the student teaching practicum at that institution during the spring of 2009.

The *Agricultural Mechanics Laboratory Management Competencies Instrument* developed by Johnson et al. (1990) served as the data collection instrument for this study as modified by Saucier, Terry, and Schumacher (2009). The first section, of the two part instrument, consisted of a double–matrix containing 70 statements representing agricultural mechanics laboratory management competencies. Subjects were asked to respond to each statement twice on a 5–point, summated rating scale, once rating the perceived importance of each competency and once rating the individual's ability to perform each competency. The second section sought to identify selected personal and professional characteristics of the subjects such as age, gender, and agricultural mechanics experience.

Johnson and Schumacher's (1989) data collection instrument included 50 competencies that were developed with input from a national panel of agricultural mechanics education experts through a modified Delphi technique and was reported to be valid. In 1990, Johnson et al. added a five–point summated rating scale with a double–matrix format to Johnson and Schumacher's (1989) instrument to determine if discrepancies existed between the perceived importance of each competency and the perceived ability of the individual to perform each competency. A later study, conducted by Saucier et al. (2009), expanded Johnson et al. 50–competency double–matrix instrument to 70 competencies by splitting multiple–component competencies into single–component competencies.

Dillman's (2007) data collection protocol served as the guide for the design and format of the data collection instrument used in this study. The booklet–type, paper questionnaire was distributed to a panel of experts to assess face validity. The panel of eight experts consisted of faculty members from two Land–Grant Universities, all of whom were considered experts in the areas of agricultural education, agricultural mechanics, instrument development, and research methodology. Content validity of the instrument was assessed in a previous study (Saucier et al., 2009) and was determined to be valid by a panel of experts. Because this study used the same competencies previously determined to be valid in the study conducted by Saucier et al., the instrument's constructs were considered to be valid.

Reliability for the data collection instrument was determined by conducting a pilot test, using 34 student teachers who completed a school–based, agricultural education student teaching practicum at four Texas universities during the fall of 2008. Cronbach's alpha coefficients were calculated for the scales (importance and ability), yielding coefficients of .98 and .99 (n = 34) respectively. The Cronbach's alpha coefficients for the five constructs included laboratory and equipment maintenance; laboratory teaching; program management; tool, equipment, and supply management; and laboratory safety, and ranged from .86 to .94 (n = 34). Using the data collected for this study during the spring of 2009 (n = 54), *post hoc* Cronbach's alpha coefficients were calculated for the scales (importance and ability), yielding coefficients of .98 and .98 (n = 54) respectively. The Cronbach's alpha coefficients for the five constructs ranged from .89 to .93 (n = 54).

Questionnaires were distributed to school–based, agricultural education student teachers (N = 98), at the conclusion of the spring 2009 teaching practicum semester, by the agricultural education faculty member who directed preservice teacher education at each of the nine institutions in Texas. Due to scheduling issues at one university, questionnaires were mailed directly to the subjects after making initial contact with each of the student teachers by telephone or electronic mail. All of the other completed questionnaires were returned, in bulk, by the agricultural education faculty member at the other eight institutions. Due to the bulk return of the instruments by each institution, procedures for addressing nonresponse bias were not practical; thus, no additional efforts were made to address nonresponse bias. Therefore, the findings of this study were limited to those individuals who responded. A final response rate of 58.16% (n = 57) was achieved.

Data were analyzed using SPSS version 17.0. Research question one sought to investigate the personal and professional characteristics of school–based, agricultural education student teachers in Texas; therefore, descriptive statistics were reported. The Borich

(1980) Needs Assessment Model was used to determine where discrepancies existed for research question two. Mean weighted discrepancy scores (MWDS) were calculated for each competency using the MWDS calculator add–on for SPSS (McKim & Pope, 2010). Competencies were separated by construct, and then ranked from high to low using the MWDS; competencies with the highest MWDS indicated areas in need of the most improvement (Borich, 1980).

Findings/ Results

Of the 57 respondents, 31 were female (55.40%). The age of the agricultural education student teachers in Texas ranged from 21 to 48 years, with an median age of 22.00 (Mean = 24.04; Mode = 22.00; *SD* = 4.86). The majority (*n* = 50; 89.30%) of the respondents self–identified themselves as being of White ethnicity followed by Hispanic/Latino (*n* = 5; 8.90%) and Native American (*n* = 1; 1.80%). No respondents self–identified themselves as being African–American or Asian–American. Respondents also indicated they were members of 4–H (*n* = 22; 38.60%) and the National FFA Organization (*n* = 49; 87.50%) during their youth. Almost one–half (*n* = 28; 49.10%) of the respondents indicated they were from a community with a population of less than 10,000. One–third of the respondents (*n* = 19; 33.30%) had participated in an agricultural mechanics related Supervised Agricultural Experience. Furthermore, the average student teacher had completed 9.69 (*SD* = 4.15) university semester credit hours in agricultural mechanics coursework. Forty (70.18%) of the student teachers were pursuing a bachelor's degree and 16 (28.10%) were pursuing a master's degree. Additionally, 24 (42.10%) respondents were pursuing a teaching certificate as undergraduates and 32 (56.14%) were pursuing post–baccalaureate certification.

Based on the construct definitions provided by Saucier et al. (2009), the agricultural mechanics laboratory management constructs were ranked from highest to lowest MWDS (see Table 1). Laboratory and Equipment Maintenance and Laboratory Safety were the constructs with the highest MWDS and, therefore, had the greatest need of education. Saucier et al. defined Laboratory and Equipment Maintenance (see Table 2) as "all maintenance activities that an agriculture teacher must perform to keep the laboratory and equipment in working order" (p. 183). Laboratory Safety (see Table 3) was defined as "all activities that an agriculture teacher must perform to maintain a safe laboratory learning environment" (p. 184). Additionally, Laboratory Teaching (see Table 4) was defined as "all educational activities that are conducted in the laboratory by the agriculture teacher to ensure academic and vocational success" (p.185). Program Management (see Table 5) was defined as "all activities that are conducted by the agriculture teacher to plan, guide, assess, and evaluate the agricultural mechanics program" (p. 186). Tool, Equipment, and Supply Management (see Table 6) was the construct with the lowest MWDS, and therefore, had the least need of in–service education. Tool, Equipment, and Supply Management included "all activities that are conducted by the agriculture teacher to ensure that all tools, equipment, and supplies are secured and in proper quality and quantity to facilitate the learning process" (Saucier et al., 2009, p. 186).

Table 1
Competency Constructs Ranked by $\bar{x}_{\text{MWDS}}$

Rank	Competency Construct	$\bar{x}_{\text{MWDS}}$
1	Laboratory and Equipment Maintenance	2.61
1	Laboratory Safety	2.61
3	Laboratory Teaching	1.80
4	Program Management	1.53
5	Tool, Equipment, and Supply Management	1.52

Table 2

Mean Weighted Discrepancy Scores for Competencies Related to the Laboratory and Equipment Maintenance Construct (*n* = 57)

Rank	*Competency*	*MWDS*	*Importance*			*Ability*		
			M	*SD*	*Mo*	*M*	*SD*	*Mo*
1	Diagnosing malfunctioning agricultural mechanics lab equipment	5.31	4.34	0.79	5	3.12	0.82	3
2	Making major agricultural mechanics lab equipment repairs	4.77	4.47	0.73	5	3.40	1.18	3
5	Modifying facilities to accommodate students with disabilities	3.29	4.43	0.73	5	3.69	1.05	3
9	Modifying equipment to accommodate students with disabilities	3.01	4.36	0.72	5	3.67	1.07	3
10	Developing a maintenance schedule for agriculture mechanics equipment	2.87	4.38	0.70	5	3.72	0.97	3
19	Utilizing technical manuals to order replacement/repair parts for agricultural mechanics lab equipment	2.58	4.16	0.81	5	3.53	1.01	3
24	Making minor agricultural mechanics lab equipment repairs	2.33	4.22	0.75	4	3.67	1.00	4
27	Performing routine maintenance of agricultural mechanics lab equipment (e.g., adjust belt tension, lubricate moving parts, and dress grinding wheels)	2.28	4.28	0.72	4	3.74	1.04	4
32	Developing a procedure to insure proper agricultural mechanics lab clean up	2.08	4.47	0.66	5	4.00	0.90	4
33	Installing stationary power equipment (e.g., assembling equipment, connecting to a power source, and performing preliminary adjustments)	2.06	3.98	0.83	4	3.47	1.13	3
36	Making minor repairs to the agricultural mechanics laboratory facility	1.89	4.05	0.74	4	3.59	1.04	3

(continues)

Rank	*Competency*	*MWDS*	*Importance*			*Ability*		
			M	*SD*	*Mo*	*M*	*SD*	*Mo*
37	Constructing welding booths, work benches, and storage areas	1.87	3.95	0.81	4	3.44	1.02	3
40	Developing a file of service/operator manuals for agricultural mechanics lab equipment	1.77	4.10	0.85	4[a]	3.67	0.91	4
41	Maintaining a file of service/operator manuals for agricultural mechanics lab equipment	1.75	4.07	0.84	4[a]	3.64	0.85	3
57	Arranging for a professional service person to make major equipment repairs (e.g., replace switches bearings)	1.25	4.18	0.74	4	3.84	0.97	3
	$\overline{x}_{\mathrm{MWDS}}$ for laboratory and equipment maintenance	2.61						

Note [a] Multiple modes exist, the smallest value is shown; Importance Scale: 1 = No Importance, 2 = Below Average Importance, 3 = Average Importance, 4 = Above Average Importance, 5 = Utmost Importance; Ability Scale: 1 = No Ability, 2 = Below Average Ability, 3 = Average Ability, 4 = Above Average Ability, 5 = Exceptional Ability.

Table 3

Mean Weighted Discrepancy Scores for Competencies Related to the Laboratory Safety Construct (*n* = 57)

Rank	*Competency*	*MWDS*	*Importance*			*Ability*		
			M	*SD*	*Mo*	*M*	*SD*	*Mo*
3	Administering first aid	3.80	4.81	0.44	5	4.02	0.82	4
6	Developing an accident reporting system	3.24	4.74	0.52	5	4.07	1.18	4[a]
7	Correcting hazardous laboratory conditions	3.12	4.64	0.61	5	3.97	1.05	4
8	Maintaining the agricultural mechanics laboratory in compliance with OSHA standards	3.12	4.52	0.66	5	3.83	1.07	4
12	Maintaining healthy environmental conditions in the laboratory	2.85	4.47	0.66	5	3.83	0.97	4
13	Properly installing and maintaining safety devices and emergency equipment (e.g., fire extinguishers, first aid supplies, and machine guards)	2.85	4.51	0.78	5	3.88	1.01	5
18	Conducting regular safety inspections of the laboratory	2.58	4.53	0.66	5	3.97	1.00	5
20	Safely handling hazardous materials	2.55	4.78	0.50	5	4.24	1.04	5
23	Providing students safety instruction	2.34	4.84	0.45	5	4.36	0.90	5
26	Promoting laboratory safety by color coding equipment/marking safety zones/posting appropriate safety signs and warnings	2.29	4.43	0.73	5	3.91	1.13	5
29	Documenting student safety instruction	2.13	2.13	0.65	5	4.13	1.04	4[a]
31	Selecting protective equipment for student use (e.g., safety eyewear)	2.11	4.71	0.56	5	4.26	1.02	5

(continues)

Rank	Competency	MWDS	Importance			Ability		
			M	*SD*	*Mo*	*M*	*SD*	*Mo*
35	Maintaining protective equipment for student use (e.g., safety eyewear)	1.91	4.62	0.56	5	4.21	0.91	5
48	Arranging equipment in the agricultural mechanics lab to enhance safety/ efficiency/learning	1.58	4.28	0.82	5	3.91	0.85	4
	$\overline{x}_{\mathrm{MWDS}}$for laboratory safety	2.61						

Note [a] Multiple modes exist, the smallest value is shown; Importance Scale: 1 = No Importance, 2 = Below Average Importance, 3 = Average Importance, 4 = Above Average Importance, 5 = Utmost Importance; Ability Scale: 1 = No Ability, 2 = Below Average Ability, 3 = Average Ability, 4 = Above Average Ability, 5 = Exceptional Ability.

Table 4

Mean Weighted Discrepancy Scores for Competencies Related to the Laboratory Teaching Construct (n = 57)

Rank	Competency	MWDS	Importance			Ability		
			M	*SD*	*Mo*	*M*	*SD*	*Mo*
11	Enforcing a student discipline policy	2.87	4.67	0.61	5	4.05	0.85	5
21	Identifying equipment required to teach agricultural mechanics skills	2.55	4.34	0.64	4	3.76	0.92	4
22	Identifying supplies required to teach agricultural mechanics skills	2.41	4.24	0.73	4[a]	3.67	0.93	3
30	Developing educational projects/activities for students	2.12	4.24	0.68	4	3.74	0.98	3[a]
34	Maintaining a student discipline policy	2.04	4.55	0.68	5	4.10	0.85	5
43	Identifying tools required to teach agricultural mechanics skills	1.69	4.30	0.71	5	3.86	0.96	3[a]
49	Developing a rotational plan to move students through agricultural mechanics skill areas	1.46	4.03	0.88	5	3.67	0.83	3
51	Selecting current references/technical manuals	1.37	3.89	0.82	4	3.52	0.81	3
53	Developing objective criteria for evaluation of student projects activities	1.31	4.16	0.70	4	3.82	0.85	3
59	Identifying current references/technical manuals	1.22	3.88	0.85	3	3.53	0.83	3
66	Designating work stations for each skill area (e.g., cold metal, arc welding, small engines, and electricity)	0.80	3.86	0.87	4	3.66	0.76	3[a]
	$\overline{x}_{MWDS}$ for laboratory teaching	1.80				0.92		

Note. [a] Multiple modes exist, the smallest value is shown; Importance Scale: 1 = No Importance, 2 = Below Average Importance, 3 = Average Importance, 4 = Above Average Importance, 5 = Utmost Importance; Ability Scale: 1 = No Ability, 2 = Below Average Ability, 3 = Average Ability, 4 = Above Average Ability, 5 = Exceptional Ability.

Table 5

Mean Weighted Discrepancy Scores for Competencies Related to the Program Management Construct ($n = 57$)

Rank	*Competency*	*MWDS*	*Importance*			*Ability*		
			M	*SD*	*Mo*	*M*	*SD*	*Mo*
14	Updating agricultural mechanics course offerings	2.84	3.95	0.81	3[a]	3.23	0.89	3
16	Developing an agricultural mechanics laboratory budget	2.63	4.36	0.69	5	3.76	0.98	3
17	Developing a written statement of agricultural mechanics lab policies/ procedures	2.59	4.41	0.65	5	3.83	0.90	4
28	Operating within the constraints of an agricultural mechanics budget	2.21	4.28	0.70	4	3.76	0.92	3
38	Planning an agricultural mechanics public relations program	1.80	4.02	0.78	4	3.57	0.88	3
44	Planning student recruitment activities for the agricultural mechanics program	1.66	4.00	0.86	5	3.59	0.84	4
45	Developing a student discipline policy	1.63	4.50	0.76	5	4.14	0.89	5
46	Developing computer based lab management reports	1.63	4.10	0.81	4	3.71	0.96	4
47	Conducting an agricultural mechanics public relations program	1.60	3.96	0.87	4	3.56	1.07	3
50	Implementing student recruitment activities for the agricultural mechanics program	1.40	4.05	0.80	4	3.71	0.97	3
55	Maintaining computer based student academic records	1.31	4.14	0.72	4	3.83	0.88	4
61	Estimating time required for students to complete projects/activities	0.98	4.07	0.84	4	3.83	0.92	3

(continues)

Rank	Competency	MWDS	Importance			Ability		
			M	*SD*	*Mo*	*M*	*SD*	*Mo*
62	Maintaining a file of educational projects/activities	0.90	3.93	0.90	4	3.66	1.00	3
63	Developing a file of educational projects/activities for students	0.90	3.93	0.90	4	3.67	0.93	3
68	Developing a system to document achievement of student competencies	0.54	3.93	0.80	4	3.81	0.83	3
70	Developing a procedure to bill students for materials used in project construction	-0.19	3.67	0.87	3	3.72	0.77	4
	$\overline{x}_{\text{MWDS}}$ for program management	1.53						

Note [a] Multiple modes exist, the smallest value is shown; Importance Scale: 1 = No Importance, 2 = Below Average Importance, 3 = Average Importance, 4 = Above Average Importance, 5 = Utmost Importance; Ability Scale: 1 = No Ability, 2 = Below Average Ability, 3 = Average Ability, 4 = Above Average Ability, 5 = Exceptional Ability.

Table 6
Mean Weighted Discrepancy Scores for Competencies Related to the Tool, Equipment, and Supply Management Construct (*n* = 57)

Table 3

Rank	*Competency*	*MWDS*	*Importance*			*Ability*		
			M	*SD*	*Mo*	*M*	*SD*	*Mo*
4	Safely disposing of hazardous materials (e.g., flammables, acids, and compressed gas cylinders)	3.68	4.74	0.52	5	3.97	1.01	5
15	Safely storing hazardous materials	2.80	4.78	0.56	5	4.19	0.91	5
25	Recognizing characteristics of quality tools/equipment	2.31	4.19	0.74	4	3.64	0.97	3[a]
39	Equipping work stations for each skill area (e.g., cold metal, arc welding, small engines, and electricity)	1.77	3.95	0.78	4	3.50	0.94	3
42	Preparing bid specifications for equipment/tools/supplies	1.71	3.89	0.86	4	3.46	0.98	3
52	Developing procedures for efficient storage/distribution of consumable supplies	1.33	4.07	0.84	4	3.74	0.79	4
54	Storing protective equipment for student use (e.g., safety eyewear)	1.31	4.47	0.71	5	4.17	0.80	5
56	Developing an adequate inventory of laboratory consumable supplies	1.25	4.03	0.73	4	3.72	0.93	3
58	Developing procedures to facilitate the storage/checkout/security of tools/equipment	1.23	4.14	0.79	5	3.79	0.87	3
60	Developing an identification system to deter tool/equipment theft	1.16	4.21	0.74	4	3.93	0.82	4

(continues)

Rank	Competency	MWDS	Importance			Ability		
			M	*SD*	*Mo*	*M*	*SD*	*Mo*
64	Ordering equipment/tools/supplies	0.82	3.91	0.76	4	3.71	0.89	3
65	Conducting shop inventory (e.g., tools/ equipment/ consumable supplies)	0.80	4.26	0.69	4	4.07	0.93	4
67	Maintaining an adequate inventory of consumable supplies	0.77	4.00	0.71	4	3.81	0.83	3
69	Silhouetting tool/ equipment cabinets	0.32	3.68	0.95	3[a]	3.60	0.98	3
	$\overline{x}_{\text{MWDS}}$ for tool, equipment, and supply management	1.52						

Note [a] Multiple modes exist, the smallest value is shown; Importance Scale: 1 = No Importance, 2 = Below Average Importance, 3 = Average Importance, 4 = Above Average Importance, 5 = Utmost Importance; Ability Scale: 1 = No Ability, 2 = Below Average Ability, 3 = Average Ability, 4 = Above Average Ability, 5 = Exceptional Ability.

Conclusions and Discussion

Research Question One

The typical school–based, agricultural education student teacher in Texas was female (55%), 22 years of age, of White ethnicity, and from a rural community with less than 10,000 residents. As a youth, she was likely a member of the National FFA Organization, but not a member of the Texas 4–H. In addition, she completed almost 10 university semester credit hours of agricultural mechanics coursework. Most of the student teachers were not pursuing a master's degree and were becoming certified to teach while completing their undergraduate degree.

The characteristics of the student teachers in this study were similar to the first–year teachers in Texas studied by Burris, McLaughlin, McCulloch, Brashears, and Fraze (2010) who reported the following characteristics: gender (male = 51.2%, female = 48.8%), ethnicity (Caucasian = 90.2%), and education (bachelor's degree = 78.6%, master's degree = 21.4%). In their study, Burris et al. compared self–efficacy of first– and fifth–year agriculture teachers in Texas and reported that efficacy beliefs were stable across career stages of those teachers, with the exception of content efficacy related to agricultural mechanics and technology.

Knowing the results of the Burris et al. (2010) study, the question remains whether preservice agriculture teachers were fully aware of the extent of their knowledge base or their ability (or inability) to teach. Roberts, Harlin, and Ricketts (2006) reported that student teachers' levels of teaching efficacy were highest at the beginning of the student teaching practicum and changed through the semester, but rebounded by the end of the semester. Based upon a review of literature in the agricultural education field of study, little research was found that investigated the levels of agricultural mechanics teaching efficacy, for early career agriculture teachers, between the end of the student teaching practicum and the end of the first year of teaching. However, in this study, student teachers were questioned at the conclusion of their student teaching practicum, in some cases merely weeks before assuming the role of an in–service agriculture teacher.

Given the similar characteristics of the student teachers in this study and the study conducted by Burris et al. (2010), along with the close proximity of the preservice to in–service transition, the student teachers in this study were likely similar to the first–year in–service teachers in the study of Burris et al. Nonetheless, it is possible that changes in levels of teaching efficacy may occur between the end of the student teaching practicum and the end of the first year of teaching. Perhaps a more important issue is that a beginning agriculture teacher's first year of in–service is likely to be difficult, regardless of the quality of their preservice preparation (Harlin, Roberts, Dooley, & Murphrey, 2007; Joerger, 2002; Mundt, 1991).

Research Question Two

Texas school–based, agricultural education student teachers had the highest professional development education needs in the construct areas of laboratory and equipment maintenance and laboratory safety. These student teachers also had professional development needs in the areas of laboratory teaching, program management, and tool, equipment, and supply management. The five specific agricultural mechanics laboratory management topics in which teachers had the highest need for professional development education were diagnosing malfunctioning agricultural mechanics laboratory equipment, making major agricultural mechanics laboratory equipment repairs, administering first aid, safely disposing of hazardous materials (e.g., flammables, acids, and compressed gas cylinders), and modifying facilities to accommodate students with disabilities.

The model for teacher preparation in agricultural education (Whittington, 2005) posits that through coursework, preservice teachers are guided to the goal of knowledge, skills, and disposition acquisition for entry into the teaching profession. However, because the goal is founded upon the philosophical foundations of agricultural teacher education, experiential learning (Dewey, 1938), problem–based teaching (Lancelot, 1944), social cognition (Bandura, 1986), and reflective practice (Schön, 1983), it is reasonable to assume that each of the four components of the *foundation* must be well established and stable to construct a well built and dependable *structure*—if not, the *structure* might fall, or in this case, the early career teacher may fail. Furthermore, when a deficiency of competence is identified, restructuring or remediation should be considered, and arguably, be guided by results of needs assessments.

Although, it is important to understand teachers' professional development needs (Myers, Dyer, & Washburn, 2005), clearly identifying the in–service needs of beginning teachers has been difficult, even through the use of various instruments and designs (Birkenholz & Harbstreit, 1987; Joerger, 2002; Myers, et al., 2005), and from various perspectives (Garton & Chung, 1997). The majority of previous studies (Fletcher & Miller, 1995; Johnson et al., 1990; McKim & Saucier, 2011; Saucier et al., 2008; Saucier et al., 2009; Swan, 1992) focused on in–service needs in the area of agricultural mechanics laboratory management; few, if any, focused on preservice needs in the area of agricultural mechanics laboratory management. Although it is important to acknowledge limiting factors of this study, such as response rate and response bias, this study has provided an initial indication of needs in the area of agricultural mechanics laboratory management for preservice teachers, i.e., individuals on the *cusp* of being entry–year professionals.

Implications and Recommendations

When considering agricultural mechanics professional development needs of preservice teachers, or the soon to be early career first–year inductee, the results of this study are not unlike the results of recent studies (McKim & Saucier, 2011, Saucier et al., 2008) of in–service teachers in some states. The construct areas of laboratory and equipment maintenance and laboratory safety were the areas of greatest need. In addition, the findings of Burris et al. (2010) appear to establish a trend of needs related to agricultural mechanics in teacher preparation in agricultural education. It is recommended that agricultural mechanics coursework be integrated into teacher preparation in agricultural education programs and focus on areas related to laboratory and equipment maintenance and laboratory safety. It is likely that agricultural mechanics could support a deeper understanding of each of the four foundational areas and serve as a *conduit* to reaching the goal of the model for teacher preparation in agricultural education, while addressing the needs of early career agriculture teachers.

Although it is simple to recommend adding coursework or replacing existing coursework in teacher preparation programs, implementing those changes may be difficult, in some cases, because of undergraduate credit hour limitations in place at many institutions. Therefore, teacher educators must engrain the concept of self–directed learning (Knowles, Holton, & Swanson, 2005) in their students, so that when needs are identified, teachers understand that it is their obligation to remediate or expand their knowledge and abilities, i.e., to become lifelong learners. Furthermore, entities and individuals responsible for revising NCATE standards and INTASC principles must address the outcomes of multiple needs assessments in numerous states that indicate a need for agricultural mechanics training in teacher preparation programs in agricultural education. If not, little chance exists that the professional development needs of in–service teachers related to agricultural mechanics will differ from those noted throughout more than 30 years of research on this phenomenon.

The results of this study provide support to conduct additional comparative research of preservice and in–service professional development needs in the area of agricultural mechanics laboratory management, or expand the work presented by Burris et al. (2010) to include preservice teachers. Also, further research should be conducted to determine if preservice professional development needs in the area of agricultural mechanics laboratory management affect teacher satisfaction, retention rates, or the proportion of preservice teachers who transition to in–service positions.

Future research in the realm of agricultural mechanics education should be explored. In fact, little research has been conducted in this area of instruction over the past 30 years. Agricultural mechanics courses remain a popular option for many secondary students, therefore, require highly qualified agricultural educators who are technically and pedagogically competent. Are teacher education programs across the nation developing teachers who are technically competent in the area of agricultural mechanics? Research should be conducted to answer this question and to determine the skills and pedagogical competencies needed by beginning teachers to safely instruct agricultural mechanics curriculum at the secondary level. Furthermore, recognizing that knowledge and technology related to the management of agriculture education laboratories is constantly evolving, the researchers recommend that a comprehensive assessment of agricultural mechanics laboratory management in–service needs of teachers be conducted every five years and be tracked longitudinally.

References

American Association for Agricultural Education. (2001). *National standards for teacher education in agriculture.* Retrieved from http://aaaeonline.org/files/ncatestds.pdf

Bandura, A. (1986). *Social foundations of thought and action: A social cognitive theory*. Englewood Cliffs, NJ: Prentice Hall

Barrick, K. R., & Powell, R. L. (1986). Assessing needs and planning inservice education for first year vocational agricultural teachers. *Proceedings of the 13th Annual National Agricultural Education Research Meeting,* 42–47, Dallas, TX.

Bear, W. F., & Hoerner, T. A. (1986). *Planning, organizing and teaching agricultural mechanics*. St. Paul, MN: Hobar Publications.

Birkenholz, R. J., & Harbstreit, S. R. (1987). Analysis of the inservice needs of beginning vocational agriculture teachers. *Journal of Agricultural Education, 28*(1), 41–49. doi:10.5032/jaatea.1987.01041

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., McLaughlin, E. K., McCulloch, A., Brashears, T., & Fraze, S. (2010). A comparison of first and fifth year agriculture teachers on personal teaching efficacy, general teaching efficacy and content efficacy. *Journal of Agricultural Education, 51*(1), 22–31. doi:10.5032/jae.2010.01022

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

Dewey, J. (1938). *Experience and education*. New York, NY: Collier Books.

Dillman, D. A. (2007). *Mail and internet surveys: The tailored design method* (2nd ed.). Hoboken, NJ: John Wiley and Sons, Inc.

Dyer, J. E., & Andreasen, R. J. (1999). Safety issues in agricultural education laboratories: A synthesis of research. *Journal of Agricultural Education, 40*(2), 46–52**.** doi:10.5032/jae.1999.02046

Fletcher, W. E., & Miller, A. (1995). An analysis of the agriscience laboratory safety practices of Louisiana vocational agricultural teachers. *Proceedings of the 44th Annual Southern Agricultural Education Research Meeting, 44*, 149-157.

Foster, R. (1986). Anxieties of agricultural education majors prior to and immediately following the student teaching experience. *In Seeking Solutions for Tomorrow's Challenges: Proceedings of the 13th Annual National Agricultural Education Research Meeting, 8,* 34-40.

Garton, B. L., & Chung, N. (1997). An assessment of the inservice needs of beginning teachers of agriculture using two assessment models. *Journal of Agricultural Education, 38*(3), 51–58. doi:10.5032/jae.1997.03051

Harlin, J. F., Roberts, T. G., Dooley, K. E., & Murphrey, T. P. (2007). Knowledge, skills, and abilities for agricultural science teachers: A focus group approach. *Journal of Agricultural Education, 48*(1), 117–126. doi:10.5032/jae.2007.01086

Harper, J. G. (1983). *Correlation analysis of selected variables influencing safety attitudes of agricultural mechanics students* (Unpublished doctoral dissertation). The Ohio State University, Columbus, OH.

Hubert, D., & Leising, J. (2000). An assessment of agricultural mechanics course requirements in agricultural teacher education programs in the United States. *Journal of Southern Agricultural Education Research*, *50*(1), 18–26.

Joerger, R. M. (2002). A comparison of the inservice education needs of two cohorts of beginning Minnesota agricultural education teachers. *Journal of Agricultural Education, 43*(3), 11–24. doi: 10.5032/jae.2002.03011

Johnson, D. M., & Schumacher, L. G. (1989). Agricultural mechanics specialists identification and evaluation of agricultural mechanics laboratory management competencies: A modified Delphi approach. *Journal of Agricultural Education, 30*(3), 23–28. doi:10.5032/jae.1990.02035

Johnson, D. M., Schumacher, L. G., & Stewart, B. R. (1990). An analysis of the agricultural mechanics laboratory management inservice needs of Missouri agriculture teachers. *Journal of Agricultural Education, 31*(2), 35–39. doi:10.5032/jae.1989.03023

Knowles, M. S., Holton III, E. F., & Swanson, R. A. (2005). *The adult learner*. San Diego, CA: Elsevier.

Lancelot, R. L. (1944). *Permanent learning: A study of educational techniques*. New York, NY: John Wiley & Sons.

McKim, B. R., & Pope, P. (2010). SPSS syntax for calculating mean weighted discrepancy scores. *Proceedings of the 2010 Western Region American Association of Agricultural Educators Research Conference, 29,* 355-358.

McKim, B. R., & Saucier, P. R. (2011). Agricultural mechanics laboratory management professional development needs of Wyoming secondary agriculture teachers. *Journal of Agricultural Education, 52*(3), 75-86. doi: 10.5032/jae.2011.03075

Mundt, J. P. (1991). The induction year – A naturalistic study of beginning secondary teachers of agriculture in Idaho. *Journal of Agricultural Education, 32*(1), 18–23. doi:10.5032/jae.1991.01018

Myers, B. E., Dyer, J. E., & Washburn, S. G. (2005). Problems facing beginning agriculture teachers. *Journal of Agricultural Education, 46*(3), 47–55. doi:10.5032/jae.2005.03047

Osborne, E. W. (Ed.) (2007). *National research agenda for agricultural education and communication: 2007–2010.* Gainesville: University of Florida, Department of Agricultural Education and Communication.

Phipps, L. J., Osborne, E. W., Dyer, J. E., & Ball, A. L. (2008). *Handbook on agricultural education in public schools* (6th ed.). Clifton Park, NY: Thomson Delmar Learning.

Roberts, T. G., Dooley, K. E., Harlin, J. F., & Murpherey, T. P. (2007). Competencies and traits of successful agricultural science teachers. *Journal of Career and Technical Education, 22,* 2.

Roberts, T. G., Harlin, J. F., & Ricketts, J. C. (2006). A longitudinal examination of teaching efficacy of agricultural science student teachers. *Journal of Agricultural Education, 47*(2), 81–92. doi:10.5032/jae.2006.02081

Rosencrans, C., Jr. (1996). *Perceptions of agricultural educators regarding the role of agricultural mechanization in the secondary agricultural education curriculum* (Unpublished doctoral dissertation). Iowa State University, Ames, IA.

Saucier, P. R., Schumacher, L. G., Funkenbusch, K., Terry, Jr., R., & Johnson, D. M. (2008, June). *Agricultural mechanics laboratory management competencies: A review of perceptions of Missouri agriculture teachers concerning importance and performance ability.* Paper presented at the 2008 Annual International Meeting of the American Society of Agricultural and Biological Engineers, Providence, RI.

Saucier, P. R., Terry, Jr., R., & Schumacher, L. G. (2009, February). *Laboratory management professional development needs of Missouri agriculture educators.* Paper presented at the 2009 Proceedings of the Southern Region of the American Association for Agricultural Education Conference, Atlanta, GA.

Saucier, P. R., Tummons, J. D., Terry, Jr. R., & Schumacher, L. G. (2010, February). *Professional development needs of Missouri agricultural educators.* Paper presented at the 2010 Southern Region of the American Association for Agricultural Education Conference, Orlando, FL.

Schlautman, N. J., & Silletto, T. A. (1992). Analysis of laboratory management competencies in Nebraska agricultural education programs. *Journal of Agricultural Education, 33*(4), 2–8. doi:10.5032/jae.1992.04002

Schön, D. A. (1983). *The reflective practitioner: How professionals think in action*. New York, NY: Basic Books.

Shinn, G. (1987). September – the time to improve your laboratory teaching. *The Agricultural Education Magazine, 60*(3), 16–17.

Sutphin, H. D. (1984). SOE: Laboratories. *The Agricultural Education Magazine, 56*(10), 4.

Swan, M. K. (1992, December). *An analysis of agricultural mechanics safety practices in agricultural science laboratories.* Paper presented at the American Vocational Association Convention*,* St. Louis, MO.

Texas Education Agency. (2009). 19 Texas administrative code (TAC) part II: Texas education agency. Retrieved from http://info.sos.state.tx.us/pls/pub/readtac$ext. ViewTAC?tac_view=2&ti=19

Whittington, M. S. (2005). The presidential address to the Association for Career and Technical Education Research: Using standards to reform teacher preparation in career and technical education: A successful reformation. *Career and Technical Education Research, 30*(2), 89–99.

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