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Exploring Pre-service Teachers' Training Needs Related to Technical Agriculture, Teaching and Classroom Management

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Abstract

Agricultural education teacher preparation programs constantly attempt to keep pace with 21st-century agriculture and provide relevant pedagogical and content training for pre-service teachers. The National Research Council urged land-grant universities to focus on the needs and demands of students. This study aimed to identify Iowa State University pre-service teachers' training needs related to the General Program Standards for Agricultural Education. The General Program Standards for Agricultural Education, developed by the Iowa Governor's Council on Agricultural Education, served as a guide for assessing the areas of pre-service teachers' training needs. The survey instrument was comprised of 37 items; 29 items served to assess the training needs of the pre-service teachers, seven multiple choice and short-answer items sought to determine the demographic (i.e., age, academic classification, and biological sex) and background characteristics (i.e., engagement in secondary-based agricultural education, interest in teaching various content areas) of the pre-service teachers.

Introduction/Conceptual Framework

Dating back to the 19th century, the foundation of vocational education can be rooted in the preparation of young adults for the workforce. Barlow (1976) noted that in 1776 the customary preparation for the workforce included (1) apprenticeship, (2) fundamentals of occupation taught from parents, or (3) observation and imitation. According to Wonacott (2003), as the new century unfolded, the focus of vocational education broadened to include the acquisition of technical skills and the development of personal qualities for career success. Rojewski (2002) noted that many questions remain in the curriculum of Career and Technical Education (CTE) and as ongoing reform efforts take place, educators will need to evaluate these unanswered questions. To be successful in the implementation of changes to CTE preparation programs, educators must be open-minded toward change and serve as mediators between the philosophical questions of "what is" and "what should be" (Rojewski, 2002).

Barrick (1989) defined agricultural education as "the scientific study of the principles and methods of teaching and learning as they pertain to agriculture" (p. 26). Providing further insight into his definition of agricultural education, he posited six premises associated with the discipline of agricultural education. These premises included (1) a real-world application, (2) theory drives the practice, (3) links technical areas of agriculture to humanistic disciplines, (4) building blocks for education in agriculture, (5) not a multi-discipline, and (6) requires self-examination, most likely meaning improvement upon undergraduate coursework.

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Classroom and laboratory instruction, a component of the predominant three-circle model of agricultural education, is the opportunity to provide learning experiences within a high school setting. According to Talbert et al., (2006) these activities are designed by the agricultural education teacher to incorporate a variety of teaching strategies and instructional content. Agricultural educators are prepared to instruct students to use practical, hands-on skills (McKim & Saucier, 2011). Roberts et al., (2007) conducted research focusing on the characteristics of successful agricultural educators. The results specified preservice teachers believe a successful teacher should be well-versed in content knowledge. In addition, the results specifically identified critical knowledge areas of content specialization. Until educators have reached year three of their teaching career, they are considered beginning teachers (Myers et al., 2005). Identifying the priorities of the teacher education program is crucial in determining the professional development needs of preservice teachers (Birkenholz & Harbstreit, 1987; Myers et al., 2005; Snider et al., 2021).

Teacher educators and university officials work to retain the relevance of their curriculum and maintain a quality of education, yet some students experience content and conditions that fail to keep pace with changing times (National Research Council, 2009). The National Research Council (NRC) strongly encouraged academic institutions to keep pace with 21st-century agriculture and to reinvigorate the land-grant university and undergraduate agricultural education programs. The NRC recommended that land-grant universities should "take advantage of what today's students are demanding" (2009, p. 20). The NRC's sentiment of the need to address students' needs is widely expressed in educational literature (Boud, 1988; Bullock et al., 2021; Cercone, 2008; Daffron & Caffarella, 2021). Additional research has reported levels of concern with beginning teachers (Myers et al., 2005; Warnick et al., 2007). An area identified by Stair et al. (2012) was the beginning teacher's use of classroom management and lack of subject matter expertise. Hillison (1977) has also indicated pre-service teachers face a variety of struggles before entering the profession.

Based on previous literature, instructors at the post-secondary level should be cognizant of the autonomy and self-directedness of adult learners and strive to provide relevant coursework aligning with the needs and desires of learners (Cercone, 2008; Daffron & Caffarella, 2021; du Toit-Brits & van Zyl, 2017; Fidishun, 2000; Lieb, 1991). According to Cercone (2008) "instructors should actively involve the participants in the learning process and be facilitators for this process" (p. 144). Echoing this sentiment, Boud (1988) posited "no learner can be effective…if he or she cannot make decisions for themselves about what they should be learning and how they should be learning it" (p. 17). A study conducted by Stair et al. (2012) focused on pre-service teachers in an introduction to teaching agricultural education courses. The study found pre-service teachers in the course had an 87% self-concern, senior-level students' self-concern in the methods class dropped down to 60%, and by the time they were in their first year of teaching, their concerns were 48% self, 7% task, and 45% impact concerns. To accommodate pre-service teachers a focus needs to be placed on transitioning them through a preparation program as individual learners who have varied development (Pigge & Marso, 1997).

The concept of self-directed learning serves as a central tenet of Andragogy, an educational concept advanced by Knowles (1980). Knowles indicated that as students mature, their self-concept transitions from being dependent to being self-directed. Loeng (2020) noted that self-directed learning is comprised of many elements such as the control of learning "willingness to reflect, critical judgment, and necessary knowledge of alternatives" (p. 10). To accommodate self-directed learners at the post-secondary level, they must take part in determining what content and skills they need. Conceptually framed by the concept of Andragogy, this study sought to determine the training needs of agricultural education pre-service teachers at Iowa State University. The needs expressed by the pre-service teachers will be used to guide the development and implementation of the new curriculum, augmentation of the existing curriculum, and provide a platform to evaluate the relevancy of the curriculum in the teacher

preparation program. These considerations will foster the self-directed nature of the agricultural education pre-service teachers—thus enhancing the likelihood of providing relevant training for the pre-service teachers (Waters & Haskell, 1989).

Purpose and Objectives

This study sought to determine the training needs of Iowa State agricultural education pre-service teachers based on the General Program Standards for Agricultural Education put forth by the Iowa Governor's Council on Agricultural Education. The following objectives served to guide this study on the pre-service training needs of agricultural education pre-service teachers:

1. Determine the professional characteristics and AFNR contexts teaching interest (e.g., academic classification/grade level) of agricultural education pre-service teachers.
2. Determine the teacher preparation training needs of agricultural education pre-service teachers related to teaching and classroom management by overall and grade level.
3. Determine the teacher preparation training needs of agricultural education pre-service teachers related to technical agriculture by overall and grade level.
4.

Methods and Procedures

Population

A census was attempted on all Iowa State University agricultural education pre-service teachers ($N = 97$). This target population included undergraduate and graduate students who were pursuing teaching licensure in agricultural education. Regarding the academic classification breakdown of the pre-service teachers who responded to the instrument ($n = 69$, 71.13% response rate), nine (13.05%) were freshmen, eight (11.59%) were sophomores, 26 (37.68%) were juniors, 21 (30.43%) reported being seniors, and five (7.25%) were currently in graduate school. The average age of the pre-service teachers was 20.70 ($SD = 2.77$) and 70.40% ($n = 50$) of the pre-service teachers were female.

Instrumentation

A modified Borich Needs Assessment Model was used in this study to assess the training needs of pre-service teachers. According to Borich, "the process of identifying training needs can be conceptualized as a discrepancy analysis that identifies the two polar positions of *what is* and *what should be*" (1980, p. 39). Like other previous studies in agricultural education (Duncan et al., 2006; Garton & Chung, 1997; Joerger, 2002), the needs assessment in this study evaluated the needs constructs associated with secondary agricultural education. The General Program Standards for Agricultural Education, developed by the Iowa Governor's Council on Agricultural Education, was cross-walked with agricultural education needs constructs from previous studies (Garton & Chung, 1997; Joerger, 2002), to develop the instrument used in this study. In the *technical agriculture* category, the subject areas (i.e., agribusiness, agricultural issues, agricultural mechanics, agronomy, animal sciences, biotechnology, horticulture, and natural resources) listed on the instrument reflected the content that was currently taught in the state.

The survey instrument was comprised of 36 items. Twenty-nine items served to assess the training needs of the pre-service teachers (i.e. IEP's, articulation agreements, teaching in a laboratory, etc.), Seven multiple-choice and short-answer items sought to determine the demographic (i.e., age, academic classification, and sex assigned at birth) and background characteristics (i.e., engagement in secondary-based agricultural education, and interest in teaching various content areas) of the pre-service teachers.

The needs assessment survey instrument items pertaining to *teaching and classroom management* ($n = 20$) and *technical agriculture* ($n = 9$) were coupled with a pair of five-point scales. The two scales assessed the teacher's perceived importance associated with each topic (1 = *Not Important*, 2 = *Slightly*

Important, 3 = *Moderately Important*, 4 = *Important*, 5 = *Very Important*) and their perceived level of knowledge of the topic (1 = *I have no knowledge on this issue*, 2 = *Slightly Knowledgeable*, 3 = *Moderately Knowledgeable*, 4 = *Knowledgeable*, 5 = *Very Knowledgeable*). The scale items were grouped on the instrument by category (i.e., *teaching and classroom management* and *technical agriculture*) to enhance readability (Dillman et al., 2009).

Cronbach's alpha coefficients were calculated to assess the reliability of the instrument. Specifically, alpha coefficients were assessed for importance and knowledge items associated with each category (i.e., Teaching/Classroom Management and Technical Agriculture) based on recommendations from Field (2018) and Cronbach (1951). The analysis yielded the following alpha coefficients: Teaching and Classroom Management (Importance [$\alpha = .97$], Knowledge [$\alpha = .94$]) and Technical Agriculture (Importance [$\alpha = .92$], Knowledge [$\alpha = .84$]). The calculated alpha coefficients were at a tolerable level for establishing reliability (Ary et al., 2010). The instrument was sent to two agricultural teacher educators to assess content validity and bolster readability. The two-panel members were intentionally selected based on their expertise in research methodology and experience in leading teacher education programs. One panel member was an associate professor at a regional university in a southern state, and the other panel member was an associate professor at a Midwestern land-grant institution. Each panel member was asked to assess the appropriateness of each item on the instrument and provide suggestions for refinement. Both panel members deemed the items to be appropriate. Changes were made to enhance readability and eliminate a double-barreled item.

Data Collection

The pre-service teachers were recruited via email using the Qualtrics Survey Platform upon receiving IRB approval. The recruitment email provided a description of the needs assessment process and information regarding participation in the study. Moreover, the email included a link, which connected the pre-service teachers to the Qualtrics survey instrument. Three subsequent reminder emails were sent to the non-respondents, in five-day increments (Yun & Trumbo, 2000) to encourage their participation in the study. After the four iterations of recruitment emails, 69 (71.10% response rate) of the 97 pre-service students participated in the study.

Data Analysis

The IBM's Statistical Package for Social Sciences (SPSS©), Version 25 was used to analyze descriptive statistics (i.e., percentages and frequencies) for the first research objective. The second and third research objectives, which sought to determine teacher preparation training needs (related to *teaching and classroom management* and *technical agriculture*) of agricultural education pre-service students, were analyzed by calculating the mean weighted discrepancy score (MWDS) for each item. McKim & Saucier's (2011) MWDS calculator was used to calculate the omnibus and academic classification-specific (i.e., freshman, sophomore, junior, senior, graduate) MWDS, thus reducing user error associated with data entry.

Mean Weighted Discrepancy Score Formula

$$\text{MWDS} = \frac{(\text{importance rating} - \text{knowledge rating}) \times \text{importance rating}}{\text{number of observations}}$$

The Borich needs assessment model was utilized in this study to determine pre-service teachers' training needs. According to Borich (1980), "The process of identifying training needs can be conceptualized as a discrepancy analysis that identified the two polar positions of what is and what should be" (p. 39). The areas that have the greatest average discrepancies, as a result, will serve as the highest priorities for training/revisions (Borich, 1980). Areas with lower MWDS would be interpreted as being covered sufficiently and additional training would not need to be needed.

Findings

Objective One

The first research objective was to determine the professional characteristics and AFNR contexts teaching interests of agricultural education pre-service teachers. The average student reported four years (n = 54, 78.3%) of involvement in school-based agricultural education (SBAE) (see Table 1).

Table 1

Background Characteristics of the Education Pre-service Teachers (n = 69)

	f						*%*
Characteristic	Fr (n = 9)	So (n = 8)	Jr (n =26)	Sr (n =21)	Gr (n =5)	*Total*	
Years involved in SBAE							
4	8	6	22	16	2	54	78.3
3	0	1	1	3	1	6	8.7
1	1	1	3	0	0	5	7.2
0	0	0	0	2	2	4	5.8

The AFNR pathways with the highest overall reported interest to teach were animal systems (n = 55, 77.5%), plant systems (n = 43, 60.6%), agribusiness systems (n = 33, 46.5%), and natural resource systems (n = 28, 39.4%; see Table 2).

Table 2

Pre-service Teachers' Interest Related to Teaching Agricultural Food, and Natural Resources (AFNR) Pathways (n = 69)

	f						*%*
Pathway	Fr	So	Jr	Sr	Gr	Total	
Animal Systems	9	7	20	16	3	55	77.5
Plant Systems	7	2	16	15	3	43	60.6
Agribusiness Systems	5	2	13	12	1	33	46.5
Natural Resource Systems	5	2	9	8	4	28	39.4
Food Products and Processing Systems	5	1	8	9	2	25	35.2
Power, Structural and Technical Systems	1	2	6	10	0	19	26.8
Environmental Service Systems	3	1	7	4	1	16	22.5
Biotechnology Systems	5	0	6	2	0	13	18.3

When observing teaching interest in the various AFNR pathways, by academic classification, freshmen (n = 9), sophomores (n = 7), juniors (n = 20), and seniors (n = 16) reported the highest frequency of interest related to teaching animal systems content. The AFNR pathway with the highest frequency of interest for graduate students was natural resource systems (n = 4). The pre-service teachers reported the lowest levels of interest associated with the environmental service systems (n = 16, 22.5%) and biotechnology systems (n = 13, 18.3%) AFNR pathways.

Objective Two

The second objective sought to determine the training needs of pre-service teachers related to *teaching and classroom management* by grade level and overall. The MWDS served to indicate the

training need (i.e., overall and by academic classification) associated with each topic. From an overarching standpoint, the *teaching and classroom management* topics which pre-service teachers reported the largest perceived levels of training needs were proper implementation of IEPs for students with disabilities (MWDS = 9.01), developing articulation agreements with local community colleges (MWDS = 8.40), teaching in an agricultural mechanics laboratory (MWDS = 8.28), developing a variety of agricultural curriculum (MWDS = 7.89). Conversely, the topics with the lowest indicated levels of training needs were proper supervision of students to ensure safety (MWDS = 5.42), providing guidance to students interested in post-secondary education (MWDS = 5.08), and using technology in teaching (MWDS = 3.45; see Table 3).

Table 3

Pre-service Teachers' Perceived Training Needs Related to Teaching and Classroom Management, Using the Borich Needs Assessment Model (n = 69)

	MWDS					
Item	Fr	So	Jr	Sr	Gr	Total
Proper implementation of IEPs for students with disabilities.	11.36	5.33	9.04	8.76	11.04	9.01
Developing articulation agreements with local community colleges.	11.36	4.24	9.48	7.59	7.60	8.40
Teaching in an agricultural mechanics laboratory.	12.35	2.65	9.59	7.11	8.28	8.28
Developing a variety of agricultural curricula.	10.86	3.80	8.72	6.54	10.00	7.89
Teaching in a land laboratory.	13.16	2.65	7.08	7.67	8.80	7.67
Teaching in horticulture/greenhouse facility.	8.89	2.65	8.10	6.60	5.04	6.88
Motivating students to learn.	11.95	1.22	6.31	6.86	8.64	6.80
Organizing and supervising teaching laboratory.	10.37	2.20	7.42	5.33	10.12	6.77
Developing performance-based assessment instruments.	10.79	2.76	6.69	6.10	7.68	6.70
Determining the content that should be taught in specific courses.	10.62	3.67	6.75	6.89	3.2	6.66
Teaching students decision-making skills.	9.78	1.84	7.05	5.45	9.2	6.52
Providing career exploration activities in agricultural education.	11.41	2.37	7.80	4.99	3.68	6.48
Teaching students problem-solving skills.	8.49	3.06	6.68	5.39	11.00	6.45
Managing student behavior problems.	7.09	3.80	6.62	7.03	3.20	6.21
Conducting parent/teacher conferences.	7.04	1.65	6.33	5.45	10.40	5.95
Locating and selecting student references and materials.	9.62	2.20	6.28	4.84	7.13	5.85
Assessing and evaluating student performance.	10.12	1.71	6.69	4.75	2.52	5.69
Proper supervision of students to ensure safety.	7.96	1.22	4.31	6.19	10.00	5.42
Providing guidance to students interested in post-secondary education.	9.02	1.71	4.84	5.04	4.80	5.08
Using technology in teaching.	9.11	1.71	1.71	3.37	5.52	3.45

Note. MWDS = Mean Weighted Discrepancy Score. Importance Scale: 1 = *Not Important*, 2 = *Slightly Important*, 3 = *Moderately Important*, 4 = *Important*, 5 = *Very Important. Knowledge* Scale: 1 = *I have no knowledge on this issue*, 2 = *Slightly Knowledgeable*, 3 = *Moderately Knowledgeable*, 4 = *Knowledgeable*, 5 = *Very Knowledgeable*.

Parallel to the overall highest-rated area of need, sophomores (MWDS = 5.33), seniors (MWDS = 8.76), and graduate students (MWDS = 11.04) indicated their largest area of training needs was related to the implementation of individualized education programs (IEP) for students with special needs. On the other hand, teaching in an agricultural mechanics laboratory was the highest reported need for freshmen (MWDS = 12.35) and juniors (MWDS = 9.59).

Objective Three

The third objective of this study was to determine the pre-service teachers' training needs regarding *technical agriculture* topics by grade level and overall. Overall, the highest-rated area of need for the pre-service teachers was "teaching knowledge and skills in biotechnology" (MWDS = 9.03), and the lowest-rated need area was "teaching knowledge and skills in the animal sciences" (MWDS = 3.54). When breaking down the needs by academic classification, teaching biotechnology was the highest indicated area of need for sophomores (MWDS = 8.77) and juniors (MWDS = 9.68). freshmen (MWDS = 13.00) and seniors (MWDS = 8.05) reported their highest training need was associated with teaching agricultural mechanics (see Table 4).

Table 4

Pre-service Teachers' Perceived Training Needs Related to Technical Agriculture, Using the Borich Needs Assessment Model (n = 69)

	MWDS					
Teaching knowledge and skills in…..	F	So	J	Sr	Gr	Total
biotechnology	12.04	8.77	9.68	7.74	5.76	9.03
agricultural mechanics	13.00	3.31	9.10	8.05	4.00	8.23
Integrating current advances in agriculture technology into the curriculum.	11.64	7.41	6.69	4.90	9.2	7.07
agribusiness	7.22	4.90	6.68	5.88	8.8	6.52
agronomy	9.63	4.29	6.11	5.06	3.04	5.83
natural resources	9.15	4.90	5.52	4.57	3.2	5.47
horticulture	9.62	4.73	6.19	4.32	0.72	5.43
Teaching about public issues regarding agriculture.	6.22	6.73	5.49	3.68	5.76	5.18
animal sciences	6.74	1.14	4.35	2.07	3.52	3.54

Note. MWDS = Mean Weighted Discrepancy Score. Importance Scale: 1 = *Not Important*, 2 = *Slightly Important*, 3 = *Moderately Important*, 4 = *Important*, 5 = *Very Important. Knowledge* Scale: 1 = *I have no knowledge on this issue*, 2 = *Slightly Knowledgeable*, 3 = *Moderately Knowledgeable*, 4 = *Knowledgeable*, 5 = *Very Knowledgeable*.

The freshmen students' lowest training need was "teaching about public issues regarding agriculture" (MWDS = 6.22) while graduate students reported teaching horticulture (MWDS = 0.72) was their lowest-need area associated with *technical agriculture*. Sophomores (MWDS = 1.14), juniors (MWDS = 4.35), and seniors (MWDS = 2.07) reported their lowest area of needs were associated with teaching animal science.

Conclusions

This study evaluated the training needs of Agricultural Education pre-service teachers, based on the National Quality Program Standards for Agricultural Education predicated by the Iowa Council on Agricultural Education. While the findings of this study provide a snapshot of the training needs of preservice teachers, the failed census in the research study was a limitation. Moreover, the lack of a

probabilistic sample served as a limitation to support statistical inference of the findings and the results of this study should not be generalized beyond the students who were involved in this study. Aside from the aforementioned limitations, the findings from this study provide baseline data for purposes of comparison for future studies that incorporate generalizable samples. The instrument which was developed for this study builds on previous needs assessments in agricultural education (Duncan et al., 2006; Garton & Chung, 1997; Joerger, 2002) by integrating new updates and nomenclature predicated by the National Council for Agricultural Education and cross-walked the items with general program standards. The needs assessment instrument developed in this study can be leveraged by other teacher preparation programs to determine the training needs of their agricultural education pre-service teachers.

Students had a considerable amount of previous formal education related to agriculture at the secondary level, yet the teacher preparation program served as their primary source of formal education at the post-secondary level.

When asked about content areas of teaching interest (e.g., animal systems, plant systems power, structural and technical systems, natural resource systems), pre-service teachers reported a wide array of interest. Animal systems, plant systems, agribusiness systems, and natural resource systems were the content areas with the highest reported levels of teaching interest. Conversely, power, structural and technical systems, environmental service systems, and biotechnology systems were the content areas in which pre-service teachers reported the lowest level of interest in teaching. In alignment with their reported teaching interest, the two highest perceived areas of technical agriculture needs were teaching knowledge and skills in biotechnology and agricultural mechanics. The pre-service teachers' high indication of importance on these two items (i.e., biotechnology and agricultural mechanics) imply their understanding of the importance of these topics in the school-based agricultural education program. Moreover, the pre-service teachers' expressed needs coincided with Roberts et al.'s (2007) statement that pre-service teachers believe a successful agricultural education teacher should be well-versed in agricultural content knowledge. Houck and Kitchel (2010) recommended evaluating pre-service teachers' base content knowledge to determine their specific curricular needs. This connects with the concept of self-directed learning with roots in andragogy (Knowles, 1980) as the pre-service teacher has identified an area of need the individual is taking the initiative in their learning decisions. This identified need is then the preservice teacher's responsibility to continue their cognitive development.

Based on the previous recommendations, the university teacher educators need to crosswalk the course curriculum requirements with the reported content area needs of the pre-service teachers. The Agricultural Education teacher certification curriculum is comprised of 128 required credit hours. Eight courses, representing 25 credit hours, are directly linked to the content in which students reported the highest content areas of teaching interest. Specifically, the pre-service teachers are required to take two animal science (i.e., AN S 1010 Working with Animals and An S 1140 Survey of the Animal Industry), three plant systems (i.e., AGRON 1810 Introduction to Crop Science, AGRON 1820 Introduction to Soil Science, and HORT 2210 principles of Horticulture), one agribusiness systems (i.e., ECON 2300 Farm Business Management, and one course related to natural resource management (i.e., NREM 1200 Introduction to Renewable Resources) courses to meet degree requirements. Contrariwise, only one three-credit course (i.e., AGEDS 4880 Methods of Teaching Agricultural Methods) serves as a degree requirement associated with the content areas (i.e., power, structural and technical systems, environmental service systems, and biotechnology systems) with the lowest reported areas of teaching interest. The reported training needs in the agricultural content areas mimicked the level of focus of the content areas in the curriculum requirements. It is implied that the lack of focus on certain content areas (e.g., agricultural mechanics) in the degree program directly or indirectly influenced the pre-service teachers' perceived competence with the underrepresented content. According to Rice and Kitchel (2015), pre-service teachers were generally dissatisfied with the majority of their agricultural content courses due to the lack of quantity, quality, and content transferability. This sentiment has been echoed by a myriad of

researchers who indicated a decline in technical agricultural content courses at the post-secondary level (Burris et al., 2005; Connors & Mundt, 2001; Edwards & Thompson, 2010; Snider et al., 2021). Aside from the technical agriculture content needs of pre-service teachers, the study sought to determine the pre-service teachers' needs associated with teaching and classroom management. The pre-service teachers expressed some level of need with every *teaching and classroom management* item. Furthermore, the levels of needs reported for the *teaching and classroom management* items varied between students of different grade classifications, but the ranking of the items was somewhat consistent among classifications. The breakdown of training needs by grade classification provided a snapshot of preparation needs for pre-service teachers at various points of the teacher preparation program. Understandably, the students' experiences in content and pedagogical courses varied based on their classification. At the time of this study, just over half (n = 11, 52.4%) of the seniors and one (20.0%) graduate student were engaged in their student teaching experience. Although these students had more experience in the teacher preparation program, and the increased perceptions of preparedness of pre-service teachers engaged in student teaching which has been put forth in previous literature (Brown et al., 2015), the overall training needs of seniors (MWDS range: 3.37 – 8.76) and graduate (MWDS range: 2.52 – 11.04) students were relatively high and consistent with the MWDS of the underclassmen.

The pre-service teachers reported the highest levels of perceived training needs on items related to working with special needs students (MWDS = 9.01), working with community colleges to develop articulation agreements (MWDS = 8.40), teaching in the agricultural mechanics laboratory (MWDS = 8.28), and developing curriculum (MWDS = 7.89). The reported training needs of the pre-service teachers are in agreement with previous research regarding the needs of pre-service and induction-phase in-service teachers: properly implementing IEPs for students with disabilities (Dormody et al., 2006; Garton & Chung, 1996; Sorensen et al., 2014; Touchstone, 2015); teaching in an agricultural mechanics laboratory (Burris et al., 2005; Garton & Chung, 1996; Saucier et al., 2014; Snider et al., 2021; Sorensen et al., 2014); and developing agricultural curriculum (Cannon et al., 2012; Joerger, 2002; Touchstone, 2015). The aforementioned *teaching and classroom management* topics represent the highest self-perceived training needs of the pre-service teachers and are an indication of the self-directed nature of the individuals. According to Knowles (1980), the responsibility of providing encouragement and student-centered learning experiences falls on the shoulders of the adult educator (e.g., teacher educator). Therefore, teacher educators should strive to provide further training for the pre-service teachers on the educational topics they deem important (e.g., biotechnology, agricultural mechanics, or working with special needs students).

Recommendations for Future Research and Practice

As previously discussed, understanding the pre-service teachers' interest related to teaching AFNR context was important. With pre-service students have significantly more interest at all grade levels in animal and plant systems. While significantly less had interest in power, structural and technical, environmental service, or biotechnology systems. Teacher educators should ensure students are being exposed to a variety of content areas. At this institution, the pre-service teachers are required to take eight agricultural content courses to meet degree program requirements. Aside from these required courses, students are allotted 15 hours of free electives and are given course options for other areas of their degree plan. To understand the extent of their training in technical agriculture content areas, educators must examine the full breadth of content courses the pre-service teachers are electing to take. The teacher educators should conduct degree audits on all students and determine if the course selections match the areas of need. Moreover, the teacher educators should consider developing a list of preferred or recommended electives to assist the pre-service teachers in selecting appropriate courses to hone their knowledge and skills in areas of reported deficiencies. Having a developed list could become significantly important for teacher education when advising and assisting their preservice students for advising

purposes and encourage students who may not have expertise in certain areas to gain skills set in a new content area. Educators should encourage students to focus on their areas of need rather than their areas of interest. Moreover, the results of this need assessment should serve as a guide for determining appropriate coursework for pre-service teachers. Based on the tenets of andragogy, educators should remind the pre-service teachers that the coursework recommendations are based on the self-reported results of the needs assessment, thus accommodating the self-directed nature of adult learners.

Aside from coursework, teacher educators should provide other forms of training outside of the classroom setting. This could be achieved by providing professional development events, which focus on the largest areas of need. Professional development events are commonly held for in-service teachers and community members. Professional development coordinators and teacher educators should explore ways to include the pre-service teachers in these training events. For example, pre-service teachers should be invited to participate in the annual agricultural mechanics professional development events held on campus. Participation in these events will assist in reinforcing the pre-service teachers' agricultural mechanics content knowledge, without requiring additional coursework. Outside of coursework and professional development it is instrumental for the individual to seek additional ways to gain professional experiences by obtaining internships, volunteering, and learning about areas of weaknesses to continue to enhance their knowledge.

In alignment with recommendations posited by Snider et al. (2021), teacher educators should strive to enhance the quality and quantity of early field-based experiences. Snider et al. (2021) stressed the importance of "preservice teachers acquiring agriculturally related work experience prior to student teaching" (p. 45). The teacher educators could help direct and encourage students to engage in experiences and internships which have an indirect/direct link with the content they will teach in the SBAE classroom. Teacher educators should also be strategic when placing student teachers in field experience placements. The student teachers should be placed in programs where they can obtain experience in reported areas of deficiencies (e.g., biotechnology, agricultural mechanics, agribusiness, or agronomy). Moreover, teacher educators should communicate these areas of need with the cooperating teacher and help to develop experience plans, which will meet the pre-service teachers' needs. Aside from the content focus of these field placements, educators should stress the importance of engaging in IEP meetings and working with community colleges to establish articulation agreements.

Regardless of the source of teacher training (i.e., coursework, professional development events, or field-based experiences), it is important educators, professional development entities, and cooperating teachers catalyze to ignite the pre-service teachers' interest in important agricultural content and pedagogical topics, thus providing a foundation for lifelong learning. Adding credence to this sentiment, Knowles (1980) posited that a test of "everything the adult educator does…is the extent to which the participants leave a given experience with heightened curiosity and with increased ability to carry on their own learning" (p. 28). Teacher educators from across the country can look at this study and consider the training needs of their pre-service teachers. This survey could be duplicated with their students and be considered statewide to assist in identifying the professional development needs of educators related to technical agriculture, teaching, and classroom management.

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