

Student Teachers' Views on their Competence to Teach the National AFNR Career Pathways: Implications for the Preparation of Preservice Teachers in Agricultural Education

Carley S. Snider¹, Dr. J. Shane Robinson², Dr. M. Craig Edwards³, and Dr. Robert Terry, Jr.⁴

Abstract

This exploratory study assessed the perceived levels of importance and competence of student teachers in agricultural education regarding their ability to teach across the National Agriculture, Food, and Natural Resources (AFNR) Career Pathways. Using a congruent, parallel mixed-methods design, data were collected from 16 student teachers through questionnaires, interviews, and researcher field notes. Descriptive statistics and eclectic coding were used to explain the quantitative and qualitative findings. Though the study's findings should not be generalized, such were examined using a needs assessment model to identify the competence needs of student teachers in regard to teaching across the eight National AFNR Career Pathways. Student teachers perceived all pathways to be important to teach but varied in their perceptions of competence to do that. Recommendations are offered for additional research and future practice.

Keywords: agricultural education; national agriculture, food, and natural resources career pathways; student teachers

Author Note: Carley Snider <https://orcid.org/0000-0003-2339-2054>

J. Shane Robinson <https://orcid.org/0000-0001-9506-5752>

M. Craig Edwards <https://orcid.org/0000-0002-4436-4450>

Rob Terry, Jr. <https://orcid.org/0000-0003-4485-0149>

We have no conflicts of interest to disclose.

Correspondence concerning this article should be addressed to Shane Robinson, 100 ITLE, Oklahoma State University, Stillwater, OK 74078. Email: shane.robinson@okstate.edu

Introduction

Agriculture has been described as “the world’s oldest science” (Ricketts et al., 2006, p. 48). By definition, agriculture is a comprehensive science, which includes principles of the physical, chemical, and biological sciences related to food production (Dailey et al., 2001). The agricultural industry always has been and will continue to be an indispensable aspect of the economic, political, and social needs of the world (Newcomb et al., 2004). People’s need for food, fiber, and fuel has existed throughout time

¹ Carley S. Snider is a secondary agricultural education teacher at Talawanda High School at Butler Tech, Oxford, OH 45056, carleysnider1@gmail.com

² J. Shane Robinson is a professor of agricultural education and the associate director of the Institute for Teaching and Learning Excellence at Oklahoma State University, 304B PIO, Stillwater, OK 74078, shane.robinson@okstate.edu

³ M. Craig Edwards is a professor of agricultural education at Oklahoma State University, 464 Agricultural Hall, Stillwater, OK 74078, craig.edwards@okstate.edu

⁴ Rob Terry, Jr. is the Department Head and Roger Howell Memorial Professor of Agricultural Education for the Department of Agricultural Education, Communications and Leadership at Oklahoma State University, 448 Agricultural Hall, Stillwater, OK 74078, rob.terry@okstate.edu

(Doerfert, 2011). With this heavy reliance on the agricultural industry, it is imperative the public be knowledgeable about agriculture (Dale et al., 2017). However, the increased *modernization* and *urbanization* of society has created a disconnect between the agricultural industry and the general public (Powell & Agnew, 2011) due to a lack of hands-on, lived experiences related to agriculture (Turnbull, 2002). This disconnect has resulted in a subsequent decline in agricultural knowledge (Blackburn, 1999; Dale et al., 2017; Kovar & Ball, 2013) and caused the agricultural industry “to focus on ways to educate its consumer base more efficiently and more effectively” (Dale et al., 2017, p. 1).

One avenue for educating people about agriculture is through school-based agricultural education [SBAE] (The National Council for Agricultural Education, 2012). SBAE was established to combine the applied sciences of agriculture and education necessary to teach individuals about the agriculture, food, and natural resources (AFNR) industry and to provide students with the essential skills to achieve success in related career pathways and/or in post-secondary education (Barrick, 1989; Roberts & Ball, 2009). However, the agricultural industry is much more robust than traditional, production enterprises, which means agricultural education teachers must be more well-versed in teaching a variety of higher-level content than ever before.

Today, the range of issues and subject matters important to agriculture has broadened, and the educational system to provide skilled individuals to fill the needed occupations has scrambled to keep pace. The crucial areas of expertise now encompass not just those trained in production agriculture but also food and nutrition, natural resources, and the know-how to maintain and improve the physical and scientific infrastructure that underlies modern agriculture, including an increased role for information technology with the emergence of ‘big ag data’. (Mercier, 2015, p. 1)

This range of curricular issues is often faced during the student teaching internship (Rice & Kitchel, 2016). Student teaching in agricultural education provides an opportunity for pre-service teachers to practice their teaching and develop self-efficacy under the guidance of an expert (McKim & Velez, 2017). The student teaching internship has been shown to have a positive impact on the self-efficacy of aspiring teachers in various states and in different formats (Knobloch, 2006). Although the entire pre-service program is intended to develop the self-efficacy of aspiring teachers, the culminating impact on a teacher’s self-efficacy is the student teaching internship (Stripling et al., 2008), even when compared to that of inservice teachers with up to three years of professional classroom teaching experience (Swan et al., 2011). Such findings are important because as teachers acquire more self-efficacy, their commitment to and satisfaction with their careers increase (Blackburn & Robinson, 2008; Knobloch & Whittington, 2003). Often, preservice teachers plan lessons around content for which they were most familiar (Wang & Knobloch, 2006), and this familiarity is largely dependent on their prior knowledge and experience (Rice & Kitchel, 2020). Therefore, understanding how student teachers perceive the importance of competence to teach AFNR standards has implications for how and what they teach.

To support the efforts of SBAE to align content to the changing agricultural industry, The National Council for Agricultural Education (2015) recommended a curricular framework for meeting the broad aim of agricultural education, as shown in Figure 1. This framework was designed to expose students to diverse areas of agriculture and to develop their technical knowledge through eight career pathway areas. SBAE students are required to identify a career pathway that resonates with their interests, to identify various skills and competencies to complete per the AFNR performance indicator, and to explain how the framework improved their AFNR knowledge and understanding (Swafford, 2018). This shift in curricula and expectations occurred to reflect changes in the agricultural industry, the perspectives of agriculturists, and the viewpoints of SBAE students (Martin & Enns, 2017), while meeting the needs of U.S. society in the 21st century (DiBenedetto et al., 2018). Therefore, the need

exists to prepare high quality SBAE teachers to meet these curricular expectations (Duncan & Ricketts, 2008), and it is imperative that teachers be efficacious in teaching such content.

Figure 1

Curriculum Framework of the National AFNR Content Standards (The National Council for Agricultural Education, 2015)



“Competent, qualified teachers are the backbone of high quality instruction at any level” (Leiby et al., 2013, p. 180). To improve the effectiveness of SBAE teachers, research is needed to identify teachers’ current deficiencies in their knowledge and competence levels as classroom instructors (Clemons et al., 2018; Findlay & Drake, 1989). Researchers have been called to assess the needs of SBAE teachers prior to their entering the teaching profession (Clemons et al., 2018; Sorensen et al., 2018). Although research is clear regarding student teachers’ perceived self-efficacy for *how* they teach or their pedagogical choices, less is understood about the perceived self-efficacy for *what* they teach, i.e., content, especially as related to the eight National AFNR Career Pathways (see Figure 1).

Theoretical Framework

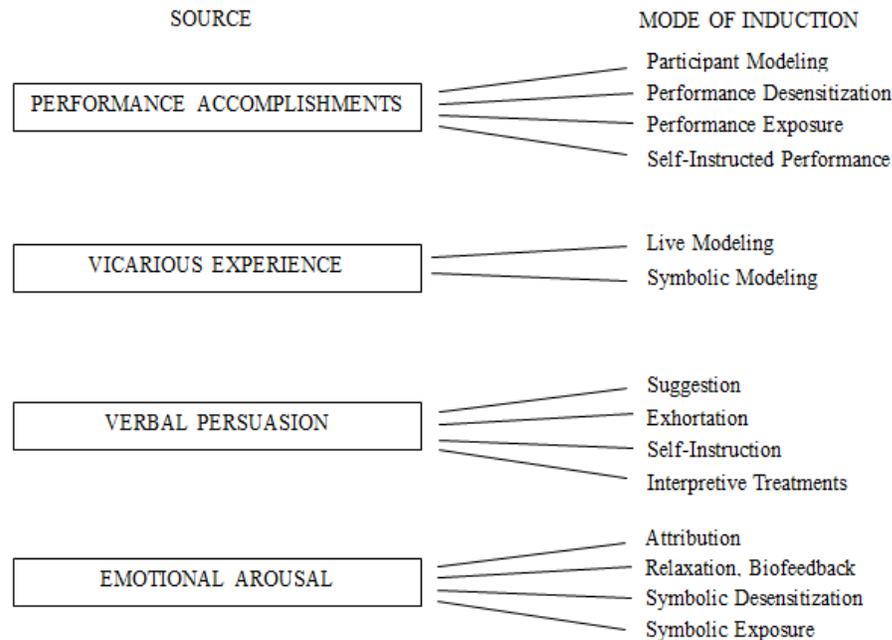
This exploratory study was undergirded in Bandura’s (1994) self-efficacy theory. Self-efficacy is defined as “people’s beliefs about their capabilities to produce designated levels of performance that exercise influence over events that affect their lives” (Bandura, 1994, p. 1). Bandura (1977) asserted that self-perceived efficacy could result in an individual’s ability to successfully execute a behavior, complete a task, or produce a desired outcome. “Self-efficacy also determines how well knowledge and skills are learned” (Whittington et al., 2006, p. 28). The belief an individual has about his or her ability to perform a task may increase the likelihood of producing a competent result (Stripling et al., 2008).

Bandura (1977) outlined four sources of efficacy: performance accomplishments, vicarious experience, verbal persuasion, and emotional arousal, as shown in Figure 2. This study focuses on *performance accomplishments* and *vicarious experience*. Performance accomplishments are the abilities and achievements of an individual that impacts his or her perception of efficacy and are based on personal experiences of mastery (Bandura, 1977). “Success raises mastery expectations; repeated failures lower them” (Bandura, 1977, p. 195). Performance accomplishments influence efficacy

through four modes of induction: participant modeling, performance desensitization, performance exposure, and self-instructed performance (Bandura, 1977). Expectations of efficacy are also derived from vicarious experience, which is composed of the experiences an individual has had and the experiences of those around the individual (Bandura, 1977). Vicarious experience affects efficacy through two modes of induction: live modeling and symbolic modeling. The performance accomplishments and vicarious experience sources of efficacy are especially useful when measuring self-perceived competence because such are based on an individual's experiences and beliefs (Bandura, 1977).

Figure 2

Bandura's (1977) Model of Sources of Efficacy Information



Purpose and Objectives

The purpose of this study was to determine the perceived levels of importance and performance competence held by SBAE student teachers at Oklahoma State University regarding their ability to teach across the eight National AFNR Career Pathways (The National Council for Agricultural Education, 2015; see Figure 1). "Training programs can apply the Borich (1980) Needs Assessment Model by defining what is as the measured behaviors, skills, and competencies of the trainee and what should be as the goals of the training program" (Borich, 1980, p. 39). To align with Borich's (1980) Needs Assessment Model, the teacher education program in agricultural education at Oklahoma State University was viewed as the training program, and the trainees were the participating student teachers ($N = 16$) experiencing their student teaching internship during the Spring 2019 semester. The study assessed the participants' perceived levels of importance and self-perceived performance competence to teach across the eight National AFNR Career Pathways. Three objectives guided the study.

1. Describe the agricultural education student teachers' self-perceived levels of importance to teach across the eight National AFNR Career Pathways.
2. Describe the agricultural education student teachers' self-perceived levels of performance competence to teach across the eight National AFNR Career Pathways.

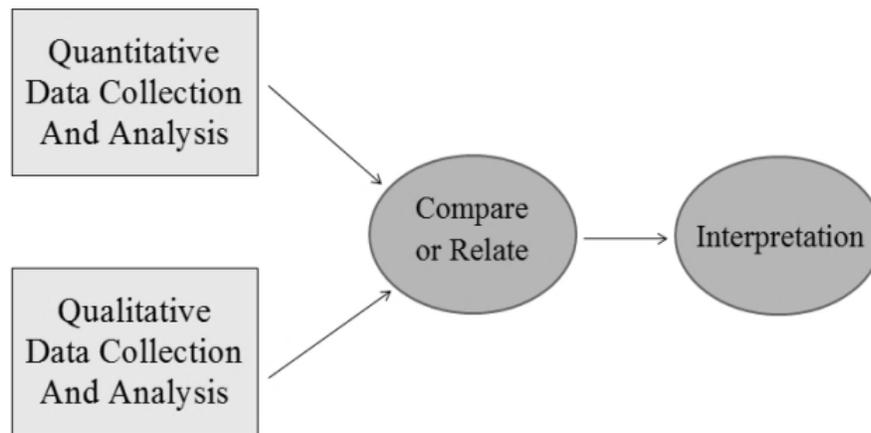
3. Prioritize the eight National AFNR Career Pathways in need of competence enhancement using the Borich (1980) Needs Assessment Model.

Methodology

A convergent, parallel mixed-methods (Creswell, 2012) design was used in this study because it allowed the researchers to simultaneously collect quantitative and qualitative data, conduct an analysis by comparing and relating data, and conclude interpretations based on both data types (see Figure 3). Quantitative data were collected via questionnaires, and qualitative data were gathered through personal interviews, observations, and researcher field notes (Ary et al., 2002; Gall et al., 2003). Collecting and analyzing both sets of data resulted in a more complete understanding of the phenomenon of interest (Creswell, 2012). To collect data, the lead researcher visited each field placement site to personally interview the student teachers.

Figure 3

Creswell's (2012) Convergent, Parallel Mixed-Methods Design



To address Objectives 1 and 2, a researcher-developed questionnaire was distributed to the participants ($N = 16$). DiBenedetto et al. (2018) recommended that a cohesive and consistent instrument be created, assessed, and utilized nationwide to determine the curricular needs of preservice SBAE teachers. The instrument was developed using questions in accord with Bandura's (1994) Teacher Self-Efficacy Scale and Tschannen-Moran's and Woolfolk-Hoy's (2001) Teachers' Sense of Efficacy Scale. The questionnaire was designed to assess the participants' perceptions of their levels of importance and competence to teach across the eight National AFNR Career Pathways. Nie et al. (2012) found Tschannen-Moran's and Woolfolk-Hoy's (2001) scale to have "good internal consistent reliability" (p. 415) with a Cronbach's alpha of .87. The response scale used in this study mirrors those developed by Bandura (1994) and Tschannen-Moran and Woolfolk-Hoy (2001). A 9-point scale was employed to assess the participants' perceived importance and competence. The scale consisted of 1 = *Nothing*, 3 = *Very little*, 5 = *Some*, 7 = *Quite a bit*, and 9 = *A great deal*.

To further address Objectives 1 and 2, interviews were conducted using a semi-structured interview protocol with questions designed to not "get a simple yes and no answer, but [rather to] describe an episode, a linkage, an explanation . . . to evoke good responses" (Stake, 1995, p. 65). As part of a larger study, we asked the student teachers' cooperating teachers about the importance of teaching each career pathway, and we assessed the student teachers about their competence to teach

each pathway. However, only findings pertaining to student teachers' competence to teach the pathways were included in this report. Ten questions were asked of the student teachers to examine their experiences and related perceptions of competence associated with teaching across the National AFNR Career Pathways (see Figure 1). Examples of questions include but are not limited to the following: What courses were taught in your program? What is the community demand for the pathways? How have your experiences impacted your competence to teach certain pathways, and how has it changed over time?

To ensure the participants' anonymity, pseudonyms were used for the purpose of reporting the qualitative findings. Interviews were digitally recorded, transcribed verbatim by the lead researcher to enhance the reconstruction of the student teachers' accounts, and sent to respondents to confirm the accuracy of transcriptions as a form of member checking (Stake, 1995). The lead researcher recorded field notes in a reflective journal at each of the school sites visited for triangulation purposes, which assisted in developing a comprehensive interpretation of the data. After verbatim transcription of the interviews, the coding procedures described by Saldaña (2016) were used to interpret the data. Data were coded using the *eclectic coding strategy*, a hybrid coding method suited for explorative research (Saldaña, 2016). The lead researcher used a hybrid of in vivo, pattern, and descriptive coding to conduct three levels of coding based on Saldaña's (2016) recommendations. Eclectic coding allowed the researcher to employ more than one coding strategy to create comprehensive themes from the data (Saldaña, 2016).

To address Objective 3, the Borich (1980) Needs Assessment Model was employed. The model takes two ratings, i.e., importance and competence, into account to determine where discrepancies exist. The discrepancies that may exist between participants' self-perceived levels of importance and performance competence are considered an informative measure if assessing the educational learning needs of agricultural education teachers (Clemons et al., 2018). Borich (1980) noted great value can be yielded by determining the existing discrepancies, between *is* and *ought* (or what should be), to emphasize the needs for competence enhancement.

Discrepancy scores were calculated by subtracting the mean competence rating from the mean importance rating for each preservice teacher regarding each of the eight National AFNR Career Pathways. A weighted discrepancy score was then calculated by multiplying the individual discrepancy scores by the mean importance rating for each pathway. Next, mean weighted discrepancy scores (MWDS) were calculated by finding the sum of the weighted discrepancy scores for each pathway and dividing that by the number of participants ($N = 16$). The pathways were ranked according to the respective sizes of the MWDS.

Findings and Interpretations

Objective 1 – Self-Perceived Importance

To address Objective 1, mean scores were calculated to report the perceptions of SBAE student teachers in this study regarding the importance to teach across the eight National AFNR Pathways, as shown in Table 1. Overall, the student teachers in this study perceived Food Products and Processing Systems ($M = 8.16$, $SD = 1.15$) as the pathway with the highest level of importance to teach. In contrast, student teachers perceived Biotechnology Systems ($M = 7.11$, $SD = 1.54$) as the pathway with the lowest level of importance to teach. In all, student teachers perceived the importance to teach each of the eight National AFNR Pathways as between *quite a bit* and *a great deal* (see Table 1).

Table 1

Student Teachers' Perceptions of Levels of Importance to Teach across the Eight National AFNR Career Pathways using Mean Scores (N = 16)

Pathways	<i>M</i>	<i>SD</i>
Food Products and Processing Systems	8.16	1.15
Animal Systems	8.09	1.11
Power, Structural, and Technical Systems	8.06	1.26
Plant Systems	7.86	1.43
Natural Resources Systems	7.52	1.46
Environmental Service Systems	7.47	1.67
Agribusiness Systems	7.39	1.47
Biotechnology Systems	7.11	1.54

Note. 1 = None At All, 3 = Very Little, 5 = Some, 7 = Quite A Bit, 9 = A Great Deal.

Objective 2 – Self-Perceived Competence

To address Objective 2, mean scores were calculated to report the perceptions of SBAE student teachers in this study regarding their performance competence to teach across the eight National AFNR Career Pathways, as shown in Table 2. Overall, the student teachers perceived Animal Systems ($M = 6.94$, $SD = 1.52$) as the pathway for which they held the highest level of competence to teach. In contrast, student teachers perceived Power, Structural, and Technical Systems ($M = 4.83$, $SD = 2.26$) as the pathway for which they held the lowest level of competence to teach. Student teachers' self-perceived competence to teach the pathways ranged from more than *very little* to less than *quite a bit* (see Table 2).

Table 2

Student Teachers' Perceptions of their Performance Competence to Teach across the Eight National AFNR Career Pathways using Mean Scores (N = 16)

Pathways	<i>M</i>	<i>SD</i>
Animal Systems	6.94	1.52
Plant Systems	6.14	2.07
Food Products and Processing Systems	6.09	1.63
Natural Resources Systems	5.95	1.59
Environmental Service Systems	5.33	1.91
Agribusiness Systems	5.06	1.76
Power, Structural, and Technical Systems	4.83	2.26
Biotechnology Systems	4.33	2.18

Note. 1 = None At All, 3 = Very Little, 5 = Some, 7 = Quite A Bit, 9 = A Great Deal.

During the study's semi-structured interviews, one persistent theme emerged: *Experience Leads to Competence*. Experience was predominately described as that which was acquired prior to attending college. However, some student teachers admitted that they needed more educational experiences and courses in certain areas to feel competent to teach various career pathways. In addition, some students admitted that their interest was an important component to feeling competent to teach content. Some said that the reason they failed to have experiences or take courses in certain subject

areas was due to their lack of interest. Therefore, subthemes of *Experience Leads to Competence* included Education and Interest.

Regarding the Agribusiness Systems pathway, student teachers noted varying competence to teach it and related that to their experience or lack thereof. "It's a little bit of a lack of experience," said Ms. Kay about her competence to teach the pathway. Ms. Kay indicated that her experience with Agribusiness was lacking. As a result, she did not feel competent to teach it. Other student teachers responded similarly and expressed a lack of competence resulting from a deficit of experiences related to the pathway. At first during his interview, Mr. Jerry noted: "I feel confident to teach it [the Agribusiness Systems pathway];" however, he later admitted, "[i]t would be something I would need a lot of refreshing on to feel really competent to pass on knowledge." Mr. Ellis, however, recognized his competence in Agribusiness Systems and related it to his experience in farming. Making decisions every day, such as purchasing and maintaining equipment, estimating yield, observing markets, and selling goods, led to his competence to teach Agribusiness to students. He stated: "[A]ctually owning my own farm, encompasses a lot of it [his agribusiness knowledge]."

The Animal Systems Pathway was an area in which the student teachers perceived higher levels of competence. The theme of experience also emerged for students when discussing their competence in teaching Animal Science content. "That is definitely where I am most comfortable," said Ms. Faulk. Fourteen other student teachers shared Ms. Faulk's perspective and expressed competence, as derived from their backgrounds. "I've been around livestock all my life, in all different forms," said Ms. Cross. "I grew up showing livestock and we raised our own showing animals," added Ms. Clemons. And Ms. Baker shared: "That's what I did in high school, and that's what I've been around." However, as an outlier, Mr. Ellis admitted: "I really wasn't confident in it. I'm not animal science minded."

For the Biotechnology Systems Pathway, student teachers noted a lack of experience and education related to its content. Mr. Ellis stated: "I just haven't done enough to make myself feel confident teaching [it]." Ms. Maxon explained that the pathway was "just a little bit out of my comfort zone." And Ms. Baker expressed: "I'd need a lot more education on it before I could teach more than a lesson or two on the subject." The student teachers in this study perceived their competence regarding this pathway's content as low resulting from a lack of related knowledge and school- and work-related experiences.

Regarding the Environmental Service Systems Pathway, student teachers did not express great competence to teach its content. "I'm a little more uncomfortable because I don't have the experience," said Mr. Down. Ms. Pale added: "I am not very strong in it because I haven't had to teach it." "To be honest, I don't even know what all is encompassed by environmental services," Ms. Kay responded.

The self-perceived competence of student teachers to teach within the Food Products and Processing Pathway was also deemed on the lower end of their ability. To this point, Mr. Down shared: "It would be a weaker area of unfamiliarity." Ms. Gray added: "I'm not proficient in it." In fact, few student teachers shared any perspectives regarding the Food Products and Processing Systems Pathway. Instead, they made general statements similar to Mr. Down and Ms. Gray. The student teachers expressed lacking knowledge when discussing content related to Food Products and Processing Systems. Their lower levels of competence may have led them to have few thoughts related to Food Products and Processing Systems because the student teachers lacked experience related to the pathway's content, i.e., they had little awareness of it.

For the Natural Resources Systems Pathway, Ms. Baker indicated being somewhat competent to teach its content: "I feel like I have a good understanding of it, but it's just a matter of being confident enough that I can actually [explain] it to other people and teach it." Ms. Gray described an interest in Natural Resources stating that her competence was driven by "my love for the outdoors and

understanding more about certain parts of it.” Ms. Alex added: “I have some experience in those areas and even with my background,” when describing her competence. However, 10 student teachers perceived that the Natural Resources Systems content expectations potentially overlapped with the Environmental Service Systems curriculum. Similar to Ms. Baker’s position, other student teachers expressed that they possessed content knowledge and interest in Natural Resources Systems, but they lacked the related confidence to teach the pathway’s content. The student teachers in this study perceived moderate competence based on their interests and varied experiences related to Natural Resources Systems.

The student teachers expressed a mixed degree of competence regarding their ability to teach the Plant Systems Pathway. “[Plant Systems] is what I did in high school, and that’s what I’ve been around,” said Ms. Baker. “I grew up around agronomical plants,” said Ms. Hale. However, other student teachers did not express those same sentiments. Mr. Ellis added: “I’m uncomfortable with it just because I don’t have that experience.” Mr. Down said: “It is where I usually get lost . . . That’s where I lose a little bit of confidence.” In addition to Mr. Down and Mr. Ellis, other student teachers expressed a lack of competence and experience related to Plant Systems, which resulted in a wide variation of perceptions among the student teachers. Student teachers with prior work or academic experiences expressed a higher perceived level of competence to teach Plant Systems than did their counterparts who did not have such experience.

Competence in Power, Structural, and Technical Systems was also perceived at differing levels by the student teachers. “It isn’t high on my level of confidence,” said Ms. Maxon. “I can do assessment, but I can’t demonstrate what they’re supposed to do,” said Ms. Alex in regard to teaching the pathway’s content in the laboratory. However, Mr. Ellis expressed competence. He explained: “I enjoy doing that so I’m competent because I’ve been around it growing up.” And Mr. Nang stated: “I’ve had some experience and the longer I work, the more confident I’m becoming.” However, Ms. Hale reported: “I need a better understanding of it.” Other members of the student teaching cohort admitted they lacked knowledge of the subject. However, those with experiences related to Power, Structural, and Technical Systems expressed higher levels of competence than did student teachers with little or no related experience.

Objective 3 – Competence Enhancement

To address Objective 3, the National AFNR Career Pathways were ranked from highest to lowest MWDS for competence enhancement, as shown in Table 3. Power, Structural, and Technical Systems (MWDS = 1.63) and Biotechnology Systems (MWDS = 1.24) had the highest MWDS of the AFNR Career Pathways, and Natural Resources Systems (MWDS = 0.74) and Animal Systems (MWDS = 0.58) had the lowest MWDS of the eight pathways.

Table 3

Student Teachers' Perceptions of their Competence and Knowledge Enhancement Needs regarding the National AFNR Career Pathways based on Mean Weighted Discrepancy Scores [MWDS] (N = 16)

National AFNR Career Pathways	MWDS
Power, Structural, and Technical Systems	1.63
Biotechnology Systems	1.24
Agribusiness Systems	1.08
Food Products and Processing Systems	1.06
Environmental Service Systems	0.99
Plant Systems	0.84
Natural Resources Systems	0.74
Animal Systems	0.58

Conclusions

Objective 1 – Self-Perceived Importance

Student teachers varied in their perceptions regarding the level of importance they placed on teaching across the eight National AFNR Career Pathways, as shown in Table 1. However, student teachers responded that all pathways were important to teach. The student teachers placed high importance on teaching the Food Products and Processing Systems, Animal Systems, and Power, Structural, and Technical Systems Pathways and a moderate level of importance on teaching the Plant Systems, Natural Resources Systems, Environmental Service Systems, and Agribusiness Systems Pathways. Regarding Biotechnology Systems, student teachers perceived it to be the least important to teach of the eight National AFNR Career Pathways. Lower levels of their perceived strengths and interests related to the pathways, as expressed by student teachers during the interviews, resulted in lower levels of importance placed on those pathways. Based on personal interviews, the student teachers valued, and therefore chose to teach, courses related to their interests and perceived abilities. As such, it can be concluded that the interests and perceived strengths of the student teachers in this study were the most substantial factors affecting their perceptions of importance regarding teaching the pathways.

Objective 2 – Self-Perceived Competence

The self-perceived competence to teach across the eight National AFNR Career Pathways varied substantially among student teachers, as shown in Table 2. Student teachers reported a high level of competence for teaching the Animal Systems, Plant Systems, and Food Products and Processing Systems Pathways; a moderate level of competence to teach the Natural Resources Systems, Environmental Service Systems, and Agribusiness Systems Pathways; and a low level of competence regarding the Power, Structural, and Technical Systems and Biotechnology Systems Pathways. In personal interviews, student teachers reported their perceived competence was impacted by their personal, professional, and academic experiences, as related to the various pathways. It can be concluded that the student teachers perceived being competent to teach across the Animal Systems, Plant Systems, and Food Products and Processing Systems Pathways because, as the study's qualitative data indicated, they had related academic preparation and personal experiences.

The qualitative data also revealed that the student teachers were competent in pathways based on their interests in the content. Therefore, it was concluded based on the findings that student teachers' perceived competence results from their interests, personal experiences regarding agriculture, and professional work experiences. Bandura (1977) identified emotional arousal, such as interest and excitement about a topic, as an expectation for self-efficacy. And in this study, student teachers' interests aligned with their perceptions of competence (Cole, 1984; Edwards & Briers, 2001; Findlay, 1992; Findlay & Drake, 1989). Both support the conclusion that the student teachers' personal and professional experiences informed their views on competence to teach across the eight National AFNR Career Pathways.

Objective 3 – Competence Enhancement

Student teachers in this study reported a need for competence enhancement in the Power, Structural, and Technical Systems and the Biotechnology Systems Pathways, as shown in Table 3, which is congruent with findings by Leiby et al. (2013) who called for professional development in agricultural mechanics for SBAE teachers. A moderate need of enhancement was expressed for the Agribusiness Systems, which was also identified by Radhakrishna and Bruening (1994) as an area in need of enhancement, and for the Food Products and Processing Systems and the Environmental Service Systems Pathways (see Table 3). Natural Resources Systems, Plant Systems, and Animal Systems were found to be pathways in low need for knowledge and competence enhancement based on both the study's quantitative and qualitative findings.

According to Bandura (1977), competence and self-efficacy result from experience and success (see Figure 2). High levels of self-efficacy are associated with individuals having more experiences while low self-efficacy is related to the lack of such regarding the tasks or skills assessed (Bandura, 1977). The student teachers' self-perceived competence to teach within the National AFNR Career Pathways was impacted by their perceptions of teacher self-efficacy. Based on the study's findings, it can be concluded that additional knowledge and competence development was needed by students enrolled in agricultural education at Oklahoma State University especially regarding the Agribusiness Systems, Biotechnology Systems, Food Products and Processing Systems, and the Power, Structural, and Technical Systems Pathways.

Discussion and Implications

Based on personal interviews of the student teachers, it was indicated that their course preferences and importance ratings regarding the pathways were largely motivated by their interests and past experiences. In addition, student teachers rated teaching across the eight AFNR pathways higher in importance than their related competence. This is congruent with findings of employees perceiving employability skills to be more important than their ability to perform those skills (Radhakrishna & Bruening, 1994; Robinson & Garton, 2008).

The existence of community and student demands result in the regular inclusion of the Animal Systems Pathway in SBAE programs in Oklahoma State University. With a local emphasis on content related to Animal Systems, student teachers require strong competencies in this pathway prior to entering the profession. This implies the high competence of the student teachers in Animal Systems is due to Oklahoma's emphasis on animal agriculture and animal science, which is a popular course in SBAE programs. Student teachers know Animal Systems is an expected pathway to be taught and many have sought out opportunities to be competent in it prior to student teaching. Perhaps, if a similar culture was created in Oklahoma regarding the other National AFNR Career Pathways, student teachers would place higher levels of importance on acquiring experiences related to those pathways. However,

changing the culture to include additional areas of emphasis is a significant undertaking. Moreover, Dewey (1938) stated experiences, at times, might be misinforming. It was implied that the student teachers in this study had a high knowledge in Animal Systems because of their experiences related to livestock production and exhibition. But, do we truly understand the breath, depth, and scope of the student teachers' Animal Systems competence and knowledge? Perhaps their perceived competence related only to a small portion of the content in the Animal Systems Pathway and their experience with livestock exhibition had an outside influence on perceptions of ability.

Recommendations for Practice

It is recommended that the Oklahoma State University teacher preparation program consider revising its core course requirements for agricultural education majors to include opportunities for preservice teachers to experience all eight National AFNR Career Pathways. In particular, the Oklahoma teacher preparation program in agricultural education is urged to enhance its curriculum in the Power, Structural, and Technical Systems and the Biotechnology Systems Pathways to expand the knowledge and competence of preservice teachers related to these pathways. Based on the student teachers' perceptions, it is also recommended that more learning experiences related to the Agribusiness Systems Pathway be introduced into the Oklahoma teacher preparation program. And it is recommended to expand the agricultural mechanics course offerings in Oklahoma State University's agricultural education program to provide preservice teachers with more exposure to the Power, Structural, and Technical Systems content either prior to or during student teaching. This may occur through additional undergraduate course options, short course or weekend trainings, and/or strategic student teaching site placements. Likewise, it is recommended that other university teacher preparation programs in agricultural education assess the competence of their preservice teachers to teach across the National AFNR Career Pathways and enhance the related curriculum and learning experiences, as may be warranted.

Further, Oklahoma State University's teacher preparation program in agricultural education should continue to emphasize the importance of preservice teachers acquiring agriculturally related work experience prior to student teaching. Bandura (1977) stated vicarious experience and performance accomplishments relate positively to increasing a person's self-efficacy (see Figure 2). Therefore, an increase in appropriate experiences may improve the self-perceived competence among SBAE student teachers regarding aspects of the AFNR industry and its allied sectors. This may occur through the creation of a list of viable and helpful work experiences, internship opportunities, short course or weekend training programs, on-campus involvements, and research topics to be distributed to preservice teachers during their preparation program. One way of addressing this need may be by increasing the quantity and quality of early field-based experiences, in the classroom and laboratory or otherwise, required of preservice teachers prior to their student teaching internships.

Beginning SBAE teachers may require additional professional development experiences to enhance their knowledge and competence to teach across the eight National AFNR Career Pathways. It is recommended that the Oklahoma agricultural education faculty members collaborate with staff members of the Oklahoma State Department of Career and Technology Education to encourage student teachers to teach the pathways that are emphasized in their local communities. If discrepancies exist between student teachers' abilities and their communities' expectations, then systematic and intensive professional development experiences should be created. This professional development should align directly with the National AFNR Content Standards to enhance teachers' efficacy for teaching content supporting the career pathways.

Recommendations for Additional Research

Due to participant size and state specificity, the findings of this study should not be generalized beyond the Oklahoma State University teacher preparation program in agricultural education. To address this limitation, a similar study should be replicated in Oklahoma with a larger group of participants and across the United States in other teacher preparation programs for agricultural education. This could occur by assessing all beginning agricultural education teachers within a particular state rather than only student teachers or through conducting regional studies assessing agricultural education student teachers at various institutions. In particular, individual teacher preparation programs in agricultural education could use the instrument and interview protocol developed for this study to determine the knowledge and competence enhancement of their own student teachers related to the National AFNR Career Pathways. Such information may help identify trends or gaps and deficiencies as well as strengths across multiple programs in the United States. In addition, this study should be replicated over time to evaluate other cohorts in the Oklahoma State University teacher preparation program for agricultural education to detect trends in students' perceived competence, knowledge, and importance regarding them teaching content supporting the National AFNR Career Pathways.

It is recommended a longitudinal study be conducted with the cohort of student teachers assessed to measure their competence to teach across the National AFNR Career Pathways as they progress in their teaching careers. These student teachers could be followed throughout their careers to determine how their perceptions of importance and competence change in regard to teaching across the pathways. A longitudinal study assessing these variables over time could identify changes in teacher competence and the factors affecting such. Future studies should also assess the impact these teachers have on their SBAE students' learning content knowledge in the AFNR pathways and its contribution to their agricultural literacy, career preparation, and career paths.

Investigations should also occur to identify what specific competencies exist within each of the eight National AFNR Career Pathways. For example, although teachers reported high perceived competence in Animal Systems, generally, are they equally competent to meet each expected competency across the entire pathway? Research is needed to define the specific competencies associated with each pathway and to assess teacher competence related to such.

It is also recommended that university teacher preparation programs in agricultural education assess the needs of their state's agricultural industry as related to the National AFNR Career Pathways. By understanding the knowledge and skills needed by entrants to the AFNR industry, the learning needs of students enrolled in SBAE courses could be understood better. This is congruent with recommendations by Ramsey and Edwards (2011) who stated SBAE teachers are expected to provide experiences to their students that reflect the agriculture sector and its allied industries. By understanding their future students' learning needs, the performance expectations and professional development needs of SBAE teachers become more apparent, including while learning as preservice students and during student teaching.

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