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Entry–level Technical Skills that Agricultural Industry Experts Expected Students to Learn through Their Supervised Agricultural Experiences: A Modified Delphi Study

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The National Research Council's (NRC) Report (1988), Understanding Agriculture: New Directions for Education, called on secondary agricultural education to shift its scope and purpose, including students' supervised agricultural experiences (SAEs). The NRC asserted that this shift should create opportunities for students to acquire supervised experience in land laboratories, agricultural mechanics laboratories, greenhouses, nurseries, and other facilities provided by schools. For example, the agricultural industry offers 52,000 job opportunities annually, including sales and marketing, specialty veterinary medicine, food safety/biosecurity, forest ecosystem management, precision agriculture, biomaterials engineering, landscape horticulture, plant and animal genetics, specialty crops production and nutrition services (Goecker, Gilmore, Smith, & Smith, 2005). Students' SAEs should reflect such aspects of the industry. Using a modified Delphi technique, this study identified the perceptions of agricultural industry experts on the role of SAE in facilitating students learning technical skills needed for entry–level employment. The experts expected that students would learn more entry–level technical skills associated with the career pathways of Animal Science and Agricultural Communications (44 of 60) than the other five pathways combined as a result of their participation in SAEs. This paper explores rationale regarding why it is important to address this "imbalance" and makes recommendations about that.

Keywords: career pathways, delphi method, entry–level technical skills, experiential learning, supervised agricultural experience

Introduction and Conceptual Framework

SAE is the part of agricultural education that allows students to practice in a work setting (placement) or an entrepreneurial (ownership) environment what they have learned in the classroom and laboratory (Talbert, Vaughn, Croom, & Lee, 2007). These work–based learning experiences are a component of agricultural education that sets it apart from many other programs or subjects in most secondary schools.

As depicted in Figure 1, Roberts and Ball (2009) reported that a review of early secondary agricultural education curricula (i.e., Stimson) revealed its focus was on the development of specific skills. This behaviorist framework for content–centered secondary agricultural education has been the foundation for much of its curriculum (Phipps, Osborne, Dyer, & Ball, 2008; Talbert et al., 2007), which has focused on preparing skilled workers for the industry of agriculture.

SAE is one of the critical components of secondary agricultural education's "three–circle" model of program delivery. Agricultural education's proponents have touted the benefits of this critical component of the program because it includes acceptance of responsibility, development of self–confidence, opportunity to learn independently, development of independence, and learning to work with others as student learning experiences (Pals, 1988). In so far as students developing favorable work attitudes, Dyer and Williams (1997) spoke to the knowledge and skills students acquire in that regard through SAE placement opportunities particularly.

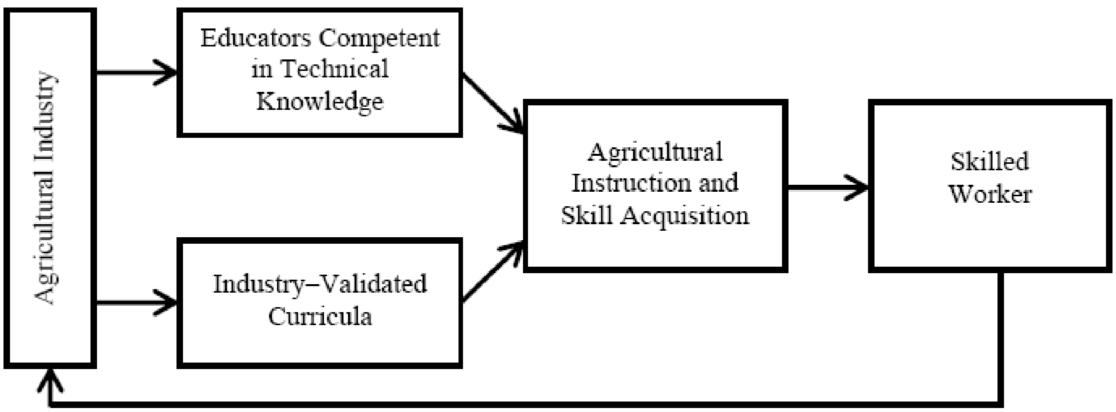

Figure 1. A content–based model for teaching agriculture (Used with permission from Roberts & Ball, 2009)

The abovementioned content–based model of teaching agriculture would resonate with the early proponents of vocational education. Stimson's project method of teaching and Prosser's focus on industry specific training can be found in both the "industry–validated curricula" and the emphasis placed on "agricultural instruction and skill acquisition" (Roberts & Ball, 2009, p. 84). Regarding a model of secondary agricultural education that focuses on the "melding" or integrating of classroom and laboratory instruction, youth development, and experiential learning, an observer can identify easily the opportunity for students acquiring skills through their supervised agricultural experiences.

However, the decline in delivery of this facet of the model (Baggett–Harlin & Weeks, 2000; Dyer & Osborne, 1995; Rayfield & Wilson, 2009; Steele, 1997) has implications regarding agricultural education's role in the preparation of students for entry–level positions in the agricultural industry. For example, the skills being learned may not be congruent with today's agricultural industry standards. This discrepancy may be contributing to a decline in students participating in SAEs. However, little is known about reasons for that decline, especially from an empirical perspective.

Today's workplace reflects the many changes that occurred during the last century, from emergence of the information age to the shift to a global economy; accordingly, the workplace requires a different set of skills (Ruffing, 2006). The career cluster Agriculture, Food and Natural Resources (AFNR) consists of seven career pathways that can be used to facilitate students acquiring the skills needed for entry–level employment in the 21st century (Oklahoma Department of Career and Technology Education [ODCTE], 2009; Ruffing, 2006). Federal lawmakers, through authorization of Perkins IV legislation, called for the development of "programs of study" at both secondary and post–secondary levels that would be aligned with industry–recognized standards (Carl D. Perkins Career and Technical Education Improvement Act of 2006, p. 683). These "career pathways are programs of academic and technical study that integrate classroom and real–world learning organized around industry" (Hoachlander, 2008, p. 23). This study focused on the SAE component of secondary agricultural education and its potential for facilitating students learning entry–level technical skills associated with the career pathways of the AFNR career cluster. However, if a primary purpose of secondary agricultural education is to prepare students for entry–level employment in the agricultural industry (Phipps et al., 2008), what is known about the views of individuals who may employ the programs' graduates, especially regarding the role of students' SAEs and their job preparedness?

Purpose and Objectives

The purpose of this study was to describe the perceptions of a select group of agricultural professionals regarding the entry–level technical skills they expected students to learn through their participation in the SAE component of secondary agricultural education in Oklahoma. A modified Delphi technique was used to achieve this purpose. The following objectives guided the study: (a) describe selected personal and professional characteristics of agricultural industry experts who comprised the study's Delphi panel; (b) describe the perceptions of panelists regarding the SAE component of the secondary agricultural education model as related to the technical skill acquisition of students preparing for entry–level positions in the agricultural industry in Oklahoma, using the seven career pathways as an exploratory framework; and (c) suggest career pathways in which students should learn entry–level skills through participation in SAEs such that their job preparedness on entering the agricultural industry in Oklahoma is enhanced. Accordingly, Roberts and Ball's (2009) content–based model for teaching agriculture would be explored regarding its relevance to students' SAEs.

Methods and Procedures

This was a descriptive study that employed a survey research design using the Delphi technique (Sackman, 1975). The Delphi technique is a widely accepted method for achieving convergence of opinion concerning real–world knowledge solicited from experts on certain topic areas (Hsu & Sandford, 2007). Linstone and Turoff (1975) characterized the Delphi technique as a communication process structured to produce a detailed examination of a topic/problem and discussion from the participating group (i.e., expert panel), but not one that forces a quick compromise. The purpose of the Delphi technique is to gather responses from an expert panel or panels and combine the responses into one useful statement or position (Stitt–Gohdes & Crews, 2004).

A review of the *Journal of Agricultural Education* from 2000 to 2006 revealed eight studies that relied on the Delphi technique to evaluate a variety of topics of importance to agricultural education researchers. To that end, the Delphi technique has been accorded a reasonable degree of acceptance; e.g., the technique has been used in the area of curriculum planning and the identification of personal qualities of student leaders (Martin & Frick, 1998). Regarding SAE, Camp, Clarke and Fallon (2000) used the Delphi technique to examine the efficacy and structure of SAE for the 21st century.

Purposeful sampling was used to select members for the study's expert panel. Creswell (2005) defined purposeful sampling as "a qualitative sampling procedure in which researchers intentionally select individuals and sites to learn or understand the central phenomenon" (p. 359). The Delphi method allows for development of consensus on a number of issues without face–to–face confrontation (Helmer, 1966). For this study, a panel of experts, representing the agricultural industry in Oklahoma, was used.

The panel was comprised of experts (i.e., panelists) representing agricultural cooperatives, livestock production, livestock marketing, small grain production, small grain marketing, as well as other ancillary agribusiness entities in Oklahoma. All panelists were familiar with the entry–level technical skills expected for their sector of the agricultural industry. They either were or had been responsible for hiring entry–level employees. In addition, selected panelists were business and industry sponsors of the Oklahoma FFA Proficiency Award program. So, the panel included representatives of commodity groups as well as other agricultural sector leaders who represented the seven career pathways for agricultural education in Oklahoma (Table 1).

The career pathways for AFNR (referred to as Agricultural Education in Oklahoma) include (a) Food Products and Processing (FPP), (b) Plant and Soil Science (PSS), (c) Animal Science (ANSI), (d) Agricultural Power, Structures and Technology (APST), (e) Agribusiness and Management (AGBMGT), (f) Agricultural Communications (AGCM), and (g)

Natural Resources and Environmental Science (NRES) (ODCTE, 2009). In addition to the industry panelists being appropriately representative of the AFNR Career Cluster in Oklahoma, the researchers were interested in describing their personal characteristics and experiences related to SAE (or similar activities); to that end, objective one sought to provide a descriptive "profile" of the expert panel.

Table 1
Composition of the Study's Delphi Panel: Agricultural Industry Representation by Career Pathways

Industry Sectors	Career Pathways
Dairy Production	Food Products and Processing
Creamery (Dairy Processing)	Food Products and Processing
Retail Greenhouse	Plant and Soil Science
Small Grain Commodity Group	Plant and Soil Science
Livestock Marketing	Animal Science
Corporate Swine Farm	Animal Science
Livestock Association	Animal Science
Implement Dealership	Agricultural Power, Structures and Technology
Agricultural Lending Association	Agribusiness and Management
Electric Cooperatives	Agricultural Communications
Farm Cooperatives	Agricultural Communications
Soil and Water Conservation Service	Natural Resources and Environmental Science

Agricultural education faculty members at Oklahoma State University established both content and face validity for the initial instrument used in this study. One of the original researchers who developed the Delphi technique, i.e., Dalkey (1969), stated that a reliability of .7 or greater could be achieved when the expert panel consisted of 11 or more members. After further use of the Delphi technique, Dalkey, Rourke, Lewis, and Snyder (1972) indicated that a group size of 13 was needed for reliability with a correlation coefficient of .9. Therefore, Dalkey et al. recommended a group size of 12 to 15 panelists. The initial inclusion of 17 industry experts as panelists contributed to the reliability of the multiple round, modified Delphi procedure used in this study.

Selected personal and professional characteristics unique to the panel of experts were collected: gender, age, years of professional experience, and highest educational degree earned. Regarding SAEs (or similar 4–H projects), including particularly their types, intensity of involvement, and panelists' perceptions of benefits to themselves, was also of interest to the researchers. In all, eight items were asked regarding panelists' characteristics. Using the seven career pathways for agricultural education in Oklahoma as a context, panelists were asked to identify entry–level technical skills that should be learned through student participation in the SAE component of secondary agricultural education. In addition, the following explanatory paragraph was included on the round one instrument.

> The Oklahoma Department of Career and Technology Education defines SAE programs as teacher–supervised, individualized, hands–on, student developed projects that give students real–world experience in agriculture and/or agriculture related areas (ODCTE, 2009). The seven career pathways for Oklahoma Agricultural Education include 1) Food Products and Processing, 2) Plant and Soil Science, 3) Animal Science, 4) Agricultural Power, Structures and Technology, 5) Agribusiness and Management, 6) Agricultural Communications, and 7) Natural Resources and Environmental Science. Please, focus only on the career pathways that best fit your area of industry expertise and, please, list as many skills as you can. (Ramsey, 2009, p. 57)

Electronic reminder messages were sent to panelists approximately one week prior to the assigned due date encouraging the return of round one responses. From round one, 140 statements (n = 12; 70.5% response rate) were provided by the Delphi panelists. The researcher analyzed each statement. Similar or duplicate statements (i.e., skills) were combined or eliminated and compound statements were separated (Linstone & Turoff, 2002; Shinn, Wingenbach, Briers, Lindner, & Baker, 2009). From 140 original statements, 105 were retained for presentation to panelists in round two.

Round Two

The round two instrument asked panelists to rate their level of agreement on the entry–level technical skills retained from round one. All panelists were asked to respond to the 105 statements presented in round two. Panelists were asked to use a six–point response scale to rate the skills: "1" = "Strongly Disagree," "2" = "Disagree," "3" = "Slightly Disagree," "4" = "Slightly Agree," "5" = "Agree," and "6" = "Strongly Agree." Electronic "reminder" messages were sent to panelists approximately one week prior to the assigned due date encouraging the return of round two responses. Twenty–four skills, for which less than 51% of the respondents scored the item a "5" or "6," were removed from further investigation as a result of round two (Hsu & Sandford, 2007; Jenkins, 2009).

Round Three

The panelists were asked to rate their level of agreement for those skills that at least 51% but less than 75% of panelists had selected "Agree" or "Strongly Agree" in round two. The round three instrument included the percentage of panelists who indicated "5" ("Agree") or "6" ("Strongly Agree") for that skill in round two. Electronic "reminder" messages were sent to panelists approximately one week prior to the assigned due date encouraging the return of round three responses. Compared to the previous round, only a slight increase in "consensus of agreement" among the panelists was expected (Anglin, 1991; Dalkey et al., 1972; Jacobs, 1996; Weaver, 1971).

Categorical data, i.e., personal and professional characteristics of the Delphi panelists, were analyzed using frequencies and percentages. For each skill item in rounds two and three, the frequency distribution valid percentage was used to determine if the item reached consensus (i.e., ≥ 75% of the panelists indicated "Agree" or "Strongly Agree") (Buriak & Shinn, 1989).

Findings

Of the 12 panelists who completed the round one instrument, 83.4% were male and 16.6% female. Eight of 12 (66.7%) panelists reported their age to be between 20 and 49 years. Four of the 12 (33.4%) panelists reported being 50 years or older. Regarding ethnicity or race, 83.4% of the panelists reported they were Caucasian, and 16.6% were Native American. Two–thirds of the panelists reported a bachelor's degree as the highest degree earned, 25.0% of panelists held a master's degree, and 8.4% reported high school as their highest level of education. All of the panelists indicated "Full–time employment" in agriculture.

Panelists reported a range of participation in agricultural youth organizations. Seventy–five percent indicated involvement in FFA. Other youth organizations in which panelists reported involvement included 4–H (16.7%) and "Other" (e.g., Oklahoma Junior Cattleman's Association), 8.3%. Five or more years of participation was reported by 75.1% of panelists. The remaining panelists reported four, three and two years of participation in an agricultural youth organization. More than 80% of the panelists indicated they were "very involved" in an agricultural youth organization, 8.3% reported "somewhat involved," and 8.3% reported "no involvement."

In addition, more than 80% of panelists indicated participation in an SAE/4–H project; the remainder reported no participation. The SAE/4–H projects in which panelists participated included "exhibited livestock" (83.4%), "worked in an agriculturally related job" (58.3%), "raised livestock" (83.4%), and "raised crops" (50.0%). When asked if their participation in SAE/4–H projects led to entry–level technical skill acquisition, eight of 12 (66.7%) panelists reported "yes" and four (33.3%) indicated "no."

Round One Findings: Entry–level Technical Skills

The 140 skills provided by agricultural industry experts in round one ranged from "Hygiene" to "Bread Making." The number of skills identified by pathway were Animal Science (ANSI), 37; Agricultural Communications (AGCM), 19; Plant and Soil Science (PSS), 16; Food Products and Processing (FPP), 13; Agricultural Power, Structures and Technology (APST), 12; Agribusiness and Management (AGBMGT), 6; and Natural Resources and Environmental Science (NRES), 2. After removing duplicate items and compound statements (Linstone & Turoff, 2002; Shinn et al., 2009), 105 items were retained for presentation to the panelists in round two.

Round Two Findings: Entry–level Technical Skills

In round two, the panelists were asked to rate their level of agreement on 105 entry–level technical skills. The number of items reaching "consensus of agreement" (i.e., ≥ 75 % indicated "Agree" or "Strongly Agree"), by pathway, were FPP, 2; PSS, 5; ANSI, 29; APST, 2; AGBMGT, 3; and AGCM, 13. No skill items from the NRES pathway reached "consensus of agreement" in round two. In total, 54 of the 105 items reached the level of agreement described as "consensus" *a priori*.

Round Three Findings: Entry–level Technical Skills

Buriak and Shinn (1989) described the third round of a Delphi study as developing consensus. The panelists were asked to rate their level of agreement on 27 proposed skills that had not reached the established "level of agreement" (i.e., ≥ 51% but < 75%) for consensus in round two. Six additional items reached "consensus of agreement" in round three (i.e., ≥ 75% of panelists indicated "Agree" or "Strongly Agree"). By pathway, they were FPP, 1; PSS, 1; ANSI, 2; APST, 2. The remaining skill items failed to reach the established level of agreement for consensus, as established *a priori*. The total number of entry–level technical skills that reached "consensus of agreement" was 60. The distribution of entry–level technical skills by career pathway was AGBMGT, 3; AGCM, 13; ANSI, 31; APST, 4; FPP, 3; PSS, 6 (Table 2).

Table 2
Entry–level Technical Skills Students Should Learn through Their Participation in SAEs that reached "Consensus of Agreement" after Three Rounds of the Modified Delphi Study (N = 60)

Entry–level Technical Skills*	Career Pathway	% Agreement
Balance sheets	AGBMGT	92.30
Assets and liabilities	AGBMGT	84.60
Simple interest	AGBMGT	84.60
Total Number of Skills for the Pathway	3	
Dependability	AGCM	100.00
Reliability	AGCM	100.00
Trust	AGCM	100.00
Speaking (oral communication)	AGCM	100.00
Self–motivation	AGCM	100.00
Loyalty	AGCM	100.00
Consistency	AGCM	100.00
Determination	AGCM	100.00
Confidence	AGCM	100.00
Organization	AGCM	100.00
Commitment	AGCM	100.00
Team player	AGCM	84.60
Writing letters to elected, appointed, and career officials	AGCM	76.90
Total Number of Skills for the Pathway	13	
People skills	ANSI	100.00
Know proper terminology regarding gender (livestock)	ANSI	100.00
Animal health	ANSI	100.00
Basic math	ANSI	100.00

Entry–level Technical Skills*	Career Pathway	% Agreement
Different classes of livestock	ANSI	100.00
Balancing a checkbook	ANSI	92.30
Basic first aid	ANSI	92.30
Proper vaccination sites	ANSI	92.30
Safety awareness	ANSI	92.30
Basic animal nutrition	ANSI	92.30
Basic livestock anatomy	ANSI	92.30
Marketplace sale trends	ANSI	92.30
Birthing assistance	ANSI	92.30
State regulations (regarding agriculture)	ANSI	84.60
Handling (livestock)	ANSI	84.60
Budgets	ANSI	84.60
Species of livestock	ANSI	84.60
Vaccination of animals	ANSI	84.60
Inventory	ANSI	84.60
Live animal evaluation	ANSI	84.60
Air quality (animal confinement)	ANSI	83.30
Disease treatment (animals)	ANSI	76.90
Consumer expectations	ANSI	76.90
Animal reproduction	ANSI	76.90
Business math	ANSI	76.90
Animal breeding	ANSI	76.90
Processing of newborns	ANSI	76.90
Bio–security	ANSI	76.90
Identify bloat	ANSI	76.90
Differences between major breeds of livestock	ANSI	76.90
Processing (livestock)	ANSI	75.00
Total Number of Skills for the Pathway	31	
Basic computer skills	APST	76.90
Change a tire	APST	76.90
Tool identification	APST	75.00
Change oil	APST	75.00
Total Number of Skills for the Pathway	4	
Hygiene (as related to handling food)	FPP	100.00
Food borne pathogens	FPP	84.60
Harvesting (livestock)	FPP	83.30
Total Number of Skills for the Pathway	3	
Plant identification	PSS	84.60
Plant types	PSS	84.60
Marketing (agriculture products)	PSS	76.90
Weed identification	PSS	76.90
No–till (soil preparation)	PSS	76.90
Seed identification	PSS	75.00
Total Number of Skills for the Pathway	6	
Total Number of Skills, all Pathways	60	

**Note.* Wording represents the panelists' verbatim responses with the exception of editing for spelling in a few cases, and the addition of parenthetical information for improved clarity.

Conclusions

Concerning objective one, a majority of the agricultural industry panelists were Caucasian males who ranged in age from 20 to 49. A majority of panelists identified FFA as the agricultural youth association in which they were most involved as youth. A majority of panelists reported five or more years of participation in agricultural youth associations; the panelists' predominant level of participation was very involved. Eighty–three percent of panelists reported participation in SAEs or 4–H projects as youth. A majority of the SAEs or 4–H projects reported were entrepreneurial. A majority of panelists identified that their SAEs or 4–H projects had led to the acquisition of entry–level technical skills.

Regarding objective two, the expert panelists reached consensus of agreement on 60 entry–level technical skills that should be learned by students participating in supervised agricultural experiences (Table 2). So, it was concluded that students' acquisition of these technical skills could facilitate their preparation for entry–level positions in the agricultural industry. The panelists reached consensus of agreement on the highest number of entry–level technical skills from two career pathways: Animal Science (31) and Agricultural Communications (13) (Table 2). Accordingly, it was concluded that, based on the panelists' perceptions, SAEs held more potential for students acquiring entry–level technical skills related to these career pathways.

As for objective three, this study identified the career pathways selected industry experts perceived as having the largest number of entry–level technical skills that should be learned by students who participate in the SAE component of secondary agricultural education in Oklahoma. These findings support Roberts and Ball's (2009) content–based model of teaching agricultural education and expanded its relevance to SAE. Specifically, the identification of entry–level technical skills per the seven career pathways for the AFNR career cluster informs the *Agricultural Instruction and Skill Acquisition* component of the model proffered by Roberts and Ball (Figure 1).

Recommendations

Recommendations for Future Practice

Teacher educators of agricultural education should make the Agriculture, Food, and Natural Resources Career Cluster and the representative career pathways more transparent to pre–service students during their teacher preparation program. The integration of SAE opportunities throughout the seven career pathways and the link that exists between agricultural industry representatives' expectations (i.e., potential employers) and the entry–level technical skill acquisition of secondary agricultural education students should be emphasized.

State staff members who are responsible for secondary agricultural education in Oklahoma should consider facilitating externship opportunities that allow teachers to experience industry environments and expectations for entry–level workers. According to Luft (1999), externships help teachers make their instruction more relevant when preparing students for the world of work. Work–based learning experiences are important for teachers as well as the students who are enrolled in agricultural education. Teachers could use contextual examples from their externship experiences when planning, facilitating, and assessing students' SAEs.

Teacher attitudes and expectations influence student participation in SAEs (Dyer & Osborne, 1995). Camp et al. (2000) reported that SAE, as structured then, was a vital component of a comprehensive program of secondary agricultural education. Rayfield and Wilson (2009) identified that principals viewed SAEs as an important part of secondary agricultural education in North Carolina schools. This study found that selected agricultural industry experts perceived students should learn entry–level technical skills, related to their employability in the agricultural industry, through SAEs. The career pathways Animal Science and Agricultural Communications were recognized more than the other five. So, teachers, teacher educators, and state program leaders should continue to facilitate and promote the SAE component of secondary agricultural education. In particular, teachers should consider increasing their collaboration with industry partners to provide worksite placement opportunities in which students conduct their SAEs (National Council for Agricultural Education, 1992).

Recommendations for Future Research

Pals (1988) reported that employers recognized the benefits of SAE to students. Results of this study supports Pals' conclusion. However, inquiries should be conducted to determine the appropriate role of industry participation in the SAE component of secondary agricultural education in Oklahoma. Further investigation of experts' perceptions regarding the SAE component of the secondary agricultural education model is needed. For example, what are industry experts' views on how best they could collaborate with agriculture teachers on planning and facilitating students' SAEs such that opportunities for learning entry–level technical skills are optimized (i.e., through worksite placements)? Moreover, how are agricultural industry experts being used by teachers currently (e.g., as advisory group members or otherwise) to inform the relevance of their programs, including students' SAEs? Concomitantly, what is the role of the agricultural industry in Oklahoma regarding state–level decision making on the direction and future of secondary agricultural education, including significant programmatic aspects such as students' SAEs? These questions warrant additional inquiry.

The career pathways of ANSI and AGCM were identified as having the most potential for entry–level skill acquisition through students' participation in SAEs. Conversely, experts identified fewer skills in the pathways of FPP, AGBMGT, APST, and PSS as having the potential to be learned through students' SAEs. Additional study is needed to understand more clearly the potential for skill acquisition in these pathways through student participation in SAE. The absence of any entry–level technical skills representing the NRES career pathway reaching "consensus of agreement" may reflect the panel's composition (Table 1); i.e., only one expert represented that career pathway. Two skills from this pathway were identified during round one of the study but failed to reach sufficient consensus in round two to be carried forward. Further investigation should be conducted regarding this career pathway and its relationship to students' SAEs, especially due to the escalating imperatives of environmental sustainability and "green collar" jobs in Oklahoma and the United States generally.

Discussion and Implications

Phipps et al. (2008) described the purpose of agricultural education as preparing people for entry or advancement in agricultural occupations and professions, job creation, and agricultural literacy. The National FFA Organization reported that more than 300 career opportunities in the agricultural science, food, fiber, and natural resources industry exist (2008–2009 Official FFA Manual). A comprehensive program model consisting of classroom and laboratory instruction, FFA, and supervised agricultural experience is used to deliver experiential learning opportunities to students enrolled in secondary agricultural education (Dyer & Osborne, 1995; Roberts & Ball, 2009, Talbert et al., 2007). Findings of this study support using the SAE component of secondary agricultural education to assist students in learning entry–level technical skills.

Notably, not all career pathways were viewed by the study's Delphi panelists as holding or promoting a substantial number of entry–level technical skills, e.g., Food Products and Processing. However, the Oklahoma Governor's Council for Workforce and Economic Development (GCWED) report, *Understanding the Knowledge and Skill Gaps Impacting the State's Key Industry Sectors* (Oklahoma Department of Commerce, 2005), identified the agriculture and food–processing sector as one of six targeted industries that were at risk. This sector includes the production of agricultural products, animal food manufacturing, dairy product manufacturing, animal processing, beverage manufacturing, industrial machine manufacturing, and numerous other enterprises. Per the report, "at risk" meant those critically important industry sectors that would experience gaps in availability of workers with the necessary technical skills needed to sustain the industry in Oklahoma.

Manufacturing is one of the top five industries in Oklahoma that account for two–thirds of the state's jobs. Oklahoma's manufacturing industry is driven by processed meat, tire manufacturing, oil and gas field machinery and equipment, air conditioning and heating equipment, as well as poultry processing

(Oklahoma Department of Commerce, 2005). Of the top 10 agricultural knowledge requirements, "Mechanical" and "Food Production" were identified as the first and second knowledge items needed in the agriculture and food processing industry in Oklahoma (Oklahoma Department of Commerce, 2005). However, the findings of this study are incongruent or "imbalanced" with the needs identified by the GCWED report. Industry experts reached "consensus of agreement" on only three entry–level technical skills for the Food Products and Processing pathway and four skills in the career pathway Agricultural Power, Structures and Technology. These are career pathways that could prepare students for entry–level positions in the Mechanical and Food Production sectors of Oklahoma's agriculture and food processing industry.

In addition, an *Occupational Outlook Quarterly* report, prepared by the U.S. Department of Labor (2006), identified occupations and their viability from 2004 through 2014. The pathways of Food Products and Processing as well as Agribusiness and Management (three skills each that reached consensus, respectively in this study) will show "average growth" in the time frame represented by the report. Therefore, jobs are available and could provide future opportunities for students seeking entry–level employment in those areas either during high school (e.g., worksite placement SAEs) or after graduation. So, change may be needed to ensure more students participate in SAEs that present them with opportunities to learn job skills in those occupational areas.

This study identified entry–level technical skills that industry experts perceived should be learned through the SAE component of the secondary agricultural education model. Accordingly, Roberts and Ball (2009) proffered a content–based model for teaching agriculture (Figure 1) relying on industry–relevant instruction that results in observable skill acquisition by students. But how should teachers, including aspirants, acquire industry–relevant content knowledge and skills, so they are prepared to facilitate SAEs such that their students learn and practice entry–level technical skills sufficiently? Is Luft's (1999) view on "externships" an appropriate answer? What may be other methods or approaches? These questions require further study and dialogue by agricultural education professionals and interested stakeholders.

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