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Facilities in School-Based, Agricultural Education (SBAE): A Historical Inquiry

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Abstract

Vocational education, including SBAE, reoriented as its role in U.S. public schools and society changed. However, the types of facilities in which to teach SBAE have remained somewhat consistent, even as the program's curriculum became less dominated by a production agriculture orientation. We examined the historical evolution of learning spaces and related resources for teaching SBAE. Findings revealed the need for specialized facilities in SBAE was emphasized by several early 20th century education philosophers and elected officials. The work of these early supporters of vocational training coupled with significant national and international events contributed to enactment of key federal legislation, which provided impetus to states and local schools to fund learning spaces for SBAE. The spaces included classrooms, agricultural mechanics laboratories, greenhouses, land laboratories, and food processing centers as locations for students to learn, apply, and develop knowledge, attitudes, and skills. Going forward, we suggest a diverse stakeholder group examine the facility and equipment needs of SBAE as related to enhancing its ability to prepare students for career pathways and/or pursue postsecondary education aligned with entry into STEM-related occupations. We also recommend systematic efforts to forecast trends likely to presage the facility and equipment needs of SBAE in the future.

Keywords: agricultural education facilities; federal legislation; vocational education

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Introduction

In his response to John Dewey during a published philosophical debate on education in 1915, David Snedden (1977) argued that "if we are to have vocational education for the rank and file of our youth . . . we shall be obliged to provide special vocational schools for this purpose" (p. 35). Snedden's argument for vocational education facilities was only one of many flashpoints in what was an ongoing debate over the purpose of vocational education during the early decades of the 20th century. As time progressed, "teachers of agriculture . . . found that teaching agricultural skills can be effective only to the extent facilities are available with which to teach the skills desired" (*"Providing Facilities,"* 1954, p. 9).

"The predominant model for organizing instruction in agricultural education involves the interrelationships between three major concepts: classroom and laboratory instruction, supervised

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agricultural experience, and agricultural youth organization participation," i.e., the three-circle model (Croom, 2008, p. 110). Croom (2008) concluded the model "seem[ed] to describe the philosophical thought surrounding agricultural education in the early twentieth century, and as such, became the guide for what agricultural education was to be or become" (p. 117). The model supports developing agricultural producers *and* agriculturally literate citizens (Croom, 2008; Roberts & Ball, 2009). Although early instruction in SBAE focused on preparing students for careers in farming and ranching, the program's philosophical grounding placed teachers of vocational agriculture in the position of having a foot in both *content*- and *context-centered* approaches to learning (Roberts & Ball, 2009). The blending of these approaches to support student learning had implications for the facility and equipment needs of SBAE.

Though progress has been made in interpreting and understanding SBAE's evolution and modes of delivery over time, the physical space in which learning occurred has received less attention in the literature. A historical account of the facilities and equipment used to teach SBAE deserves study to understand better the program's past while providing insight into factors likely to presage its future needs and resource priorities (McDowell, 2002).

The primary purpose of SBAE facilities has been to serve as spaces for instruction with students expected to develop cognitive, psychomotor, and affective skills (Franklin, 2008; Johnson, Wardlow, & Franklin, 1997) supporting their learning *in and about agriculture* (National Research Council, 1988). These facilities, however, carry increased costs for construction, maintenance, and use. Even before recognition of special funding needs for vocational agriculture education, as specified by the Smith-Hughes Act of 1917, officials realized that "to equip and maintain an agricultural department properly require[d] more money than is required for a pure science. Provisions must be made for both indoor and outdoor work" (Hummel & Hummel, 1913, pp. 89-90).

Sources of Foundational Funding for SBAE

The Nelson Amendment of 1907 was the first federal legislation to provide funds to agricultural colleges to prepare public school teachers of agriculture and mechanic arts (Hillison, 1987; Robinson & Jenks, 1913; Wheeler, 1948) but more significant funding came from the Smith-Hughes Act of 1917. The enactment of that legislation is recognized for providing funds to support the training of secondary vocational agriculture teachers by four-year institutions of higher education (Smith-Hughes Act of 1917 § Pub. L. No. 64-347 § 10).

Almost half a century later the Vocational Education Act of 1963 provided federal funding for off-farm occupational training (Barlow, 1967; Stevens, 1967). Thereafter, the Vocational Education Act of 1968 brought forth additional funding to support curriculum development for instruction in off-farm occupations among other priorities (Vocational Education Amendments of 1968, 1969). The Perkins Act of 1984 provided funding and federal direction to integrate the teaching of academic and vocational content (Gordon, 2014), which had implications for the facility and equipment needs of career and technical education (CTE).

These federal laws impacted the facilities and equipment needed to teach SBAE. A look at contemporary SBAE reveals that the use of specialized facilities holds significant value in regard to program delivery and meeting students' learning needs (Saucier & McKim, 2011). The types of facilities and equipment used to teach SBAE have seen some differentiation and increased specialization over time (Shoulders & Myers, 2012; Young & Edwards, 2005). This trend is likely to continue (Shinn, 1994; Stewart, Moore, & Flowers, 2004); therefore, examining the historical

evolution of SBAE facilities would be helpful in understanding what may be the emphases and orientations of learning spaces for teaching agricultural education in the future.

Purpose and Research Questions

The purpose of this study was to examine the historical evolution of learning spaces and related resources for teaching SBAE in the United States. Three research questions guided this study: (a) What were the early philosophical underpinnings of the need for specialized facilities and related equipment in SBAE? (b) What major federal legislation provided funding for specialized facilities and equipment to support teaching SBAE? (c) What have been the primary types of facilities used in SBAE throughout its history?

Methods

Historical research methods were used to obtain data to answer the study's research questions (McDowell, 2002). According to Ary, Jacobs, Razaveih, and Sorensen (2006), the intended result of historical research is an "increased understanding of the present and more rational basis for making choices" (p. 466) in the future. Although many historical research studies are classified as mixed, the data tends to be mostly qualitative in kind (Johnson & Christensen, 2014). This qualitative historical evidence helps us "develop a greater awareness and interest in the past, understand its complexity, and appreciate the forces which have brought about change in society" (McDowell, 2002, p. 5). McDowell's (2002) principles on historical evidence guided the sourcing, analysis, and interpretation of data for this study.

We examined primary and secondary sources and collected evidence from several databases (McDowell, 2002) through online search engines at Oklahoma State University. Key search terms included agricultural education equipment, agricultural education facilities, agricultural mechanics laboratories, food processing centers, land laboratories, school canneries, school farms, school greenhouses, vocational agriculture facilities, and vocational education. To avoid selection bias of the evidence analyzed, we triangulated the data by comparing multiple sources addressing the same aspect of the phenomenon (Tracy, 2010). This study used information derived from peer-refereed journal manuscripts, peer-reviewed articles, magazine articles, books, and reports, including official government publications (McDowell, 2002). The sources were exposed to internal and external criticism by the researchers to ensure the likelihood of validity with special attention given to authenticity and accuracy of the data (McDowell, 2002).

An outline was developed to establish the relevancy of source material and indicate how such could be used best to achieve the study's purpose (McDowell, 2002). After detailing important actors and events in the progression of SBAE facilities, sources of evidence were embedded in the outline. The study's outline was used to organize findings in a chronological sequence and establish a base of knowledge describing the historical context and progressive evolution of facilities and equipment employed in SBAE.

Findings

Research Question #1 – What were the early philosophical underpinnings of the need for specialized facilities and equipment in SBAE?

Many of the theories and practices for early vocational education were augmented by the views of philosophers beginning in the 18th century (Barlow, 1967). For example, Pestalozzi's elementary educational theory and practice served as the foundation for early industrial education

(Barlow, 1967). The acceptance of practical education as an important part of school curriculum gained popularity during the latter part of the 19th century. Calvin M. Woodward implemented the Della Vos' method as a manual training program (Bennett, 1926; Lannie, 1971). Woodward founded the first manual training school in the United States (Barlow, 1967). After assigning his students to construct wooden models to illustrate mechanical principles, Woodward became frustrated with their lack of basic hand tool competence and enlisted the university's carpenter to demonstrate the proper use of hand tools to his students (Barlow, 1967).

The idea of manual training precipitated the founding of the Manual Training School at Washington University in St. Louis, Missouri in 1870 (Woodward, 1887). By 1871, the school had a workshop equipped with basic woodworking tools. In the ensuing years, additional equipment was added, including forging and machining tools. Manual training schools were established soon thereafter in Baltimore, Chicago, New York, and Toledo (Woodward, 1887). Woodward's efforts in postsecondary education would soon penetrate some institutions of secondary education. In 1879, Woodward, along with a group of businessmen, industrialists, and educators, founded a school of general education using a manual training curriculum to teach boys starting at the age of 14 (Woodward, 1887).

As for SBAE, it is important to note the role Congressional district agricultural schools played as federally supported programs prior to passage of the Smith-Hughes Act in 1917 (Hillison, 1989); in particular, the early attention given by administrators regarding the need for specialized facilities and equipment to support instruction. In Alabama, Georgia, and Virginia, Congressional district schools "provided lessons on how to adapt vocational agriculture to the programs, curricula, and clientele of public schools" (Hillison, 1989, p. 7). Georgia's Congressional district schools' facilities included a main building with classrooms and dining facilities, two separate dormitories for boys and girls, several laboratories for practical work, and a farm to produce crops and livestock (Lane & Crosby, 1916).

To the contrary, some "evidence [suggested] that in the past the agricultural instruction in these [Alabama] schools ha[d] been of the most *bookish kind* [emphasis added]" (*"An Educational Study,"* 1919, p. 225); even though the classrooms "may [have been] . . . used for laboratory work in soils, farm crops, and horticulture" (p. 225). However, Lane and Crosby (1916) indicated most of the schools' laboratories in Georgia were equipped with "hand tools, gasoline engine, planer, band saw, rip saw, cut-off saw, anvil, forge, and a few other tools" (p. 15). Congressional district agricultural schools also made use of school farms ranging from five to several hundred acres (Hillison, 1989).

Closely parallel to this time period was emergence of the Hampton Normal and Agricultural Institute, as designed by its founder, Samuel Chapman Armstrong, to serve the educational needs of freed slaves, including basic education coupled with vocational training and moral instruction (Croom & Alston, 2009). The Institute's approach involved manual training in "agriculture and mechanics" (Croom & Alston, 2009, p. 5), including learning in specialized laboratories, on school farms, and in nearby industries. Hampton's most famous graduate was Booker T. Washington who would provide the vision, leadership, and energy to make Tuskegee Normal and Industrial School (now Tuskegee University) a reality beginning with his appointment there in 1881 (Croom, 2007; Croom & Alston, 2009). Croom (2007) and Croom and Alston (2009) concluded that Washington applied, and over time adapted, the Hampton Institute approach, including extensive manual training in agriculture that occurred in specialized learning spaces; of note, many of Tuskegee's learning facilities were built by its students.

By the 20th century, the benefits of vocational training had become so evident the value it provided could no longer be ignored. In this regard, the National Society for the Promotion of Industrial Education (NSPIE) was founded on November 16, 1906 with several aims:

> [B]ring to public attention the importance of industrial education as a factor in the industrial development of the United States; to provide opportunities for the study and discussion of the various phases of the problem; to make available the results of experience in the field of industrial education both in this country and abroad, and to promote the establishment of institutions for industrial training. (NSPIE, 1907, p. 10)

NSPIE, under the leadership of its executive secretary, Charles Prosser, would serve as the driving public force behind passage of the Smith-Hughes Act in 1917 (Hawkins, Prosser, & Wright, 1951; Smith, 1999).

Several members of the NSPIE were appointed to serve as members of the Commission on National Aid to Vocational Education (Barlow, 1967). The group's final report addressed seven major issues. The commission discovered widespread stakeholder support regarding the need for vocational education in public schools and recommended the federal government provide national grants for the establishment of state-supervised, vocational education facilities (Barlow, 1967). The commission justified these grants on the philosophical basis of improving the general welfare of the nation and the federal government's obligation to regulate interstate commerce, which implied a well-trained labor force to ensure prosperity of the nation's industries and thereby its economy (Hawkins et al., 1951).

Prosser, and his mentor, David Snedden, Massachusetts' state commissioner of education beginning in 1909 (Hawkins, et al., 1951), recognized the need for specialized facilities in which to teach vocational education. Snedden (1920) conceptualized special facilities for agricultural education and other forms of vocational training and differentiated this need from traditional education facilities:

> No longer could the so-called vocational school consist only or chiefly of classrooms, desks, blackboards, ... Not only must the new vocational schools, as proposed, have workshops, or *farms* [emphasis added], but it was even suggested . . . the work done in these shops or on these farms ought to be somewhat like the real work done in the outside world. (p. 17)

The views of John Dewey on the design of school facilities, including those for the teaching of vocational subjects, differed little from Snedden. Dewey (1938) stated:

> The final justification of shops, kitchens, and so on in the school is not just that they afford opportunity for activity, but they provide opportunity for the *kind* of activity or for the acquisition of mechanical skills which leads students to attend to the relation of means and ends, and then to consideration of the way things interact with one another to produce definite effects. It is the same in principle as the ground for laboratories in scientific research. (p. 85)

Although early education philosophers made clear the need for specialized facilities in which to provide vocational education, including vocational agriculture, it was not until the second

decade of the 20th century that significant federal legislation encouraged state and local school officials to construct such learning spaces.

Research Question #2 - What major federal legislation provided funding for specialized facilities and equipment to support teaching SBAE?

To understand better the forces that surrounded development of and influenced funding for facilities and equipment to teach SBAE, we must consider historical events on the national and even international stages (Gordon, 2014; Wheeler, 1948). Vocational education funding was shaped by a movement for federal aid to support and augment the workforce training needs of industry, including the agriculture sector, during the first two decades of the 20th century (Smith, 1999). Even though state legislation provided limited funding for vocational agriculture education in some cases, the work of the NSPIE, organized in 1906 (Barlow, 1967; Hawkins et al., 1951; Roberts, 1971; Wheeler, 1948), led to the first significant and recurring federal funding for vocational education. The society's publications received national attention (Wheeler, 1948). One year after its establishment, President Theodore Roosevelt commented on their work:

> We of the United States must develop a system under which each individual citizen shall be trained so as to be effective individually as an economic unit and fit to be organized with his fellows so that he and they can work in efficient fashion together. This question is vital to our future progress and public attention should be focused upon it. . . . Surely this means that there must be some systematic method provided for training young men in the trades, and that this must be coordinated with our public school system. (NSPIE, 1907, pp. 6-7)

Due to the Nelson Amendment of 1907 modifying the recurring Agricultural Appropriations Bill (Robinson & Jenks, 1913), federal funds could be used by agricultural colleges to provide courses to train instructors to teach agriculture and mechanic arts in secondary schools. Beginning in 1908, each state was given $25,000 annually for this purpose (Wheeler, 1948).

President Woodrow Wilson built upon Roosevelt's remarks when he formed the Commission on National Aid to Vocational Education in 1914 (Barlow, 1967). Senator Hoke Smith from Georgia was selected to chair the commission, after having established the Cooperative Extension service by successfully guiding the Smith-Lever Act of 1914 through the legislative process (Barlow, 1967; Smith 1999). The commission initially received mixed reactions on the need for vocational training. However, through hearings lasting more than a year, the commission gradually found overwhelmingly favorable support for vocational education. With World War I unfolding and the possibility of the United States' participation on the horizon, the commission found it prudent to compare vocational education in the United States with Germany's system (Barlow, 1967). House Report No. 181 of 1916 stated:

> In this whole country there are fewer trade schools than are to be found in the little German kingdom of Bavaria, with a population not much greater than that of New York City. There are more workers being trained at public expense in the city of Munich alone than in all of the larger [U.S.] cities . . . . It is substantially true that every German citizen who would profit by it may receive vocational training for his life work in the schools and classes supported out of the public treasury. (as cited in Barlow, 1967, p. 62)

It is likely the comparison to Germany swayed several major stakeholders regarding the final report's composition. The report proposed legislation that would emerge as the National Vocational Education Act of 1917 (Barlow, 1967). Senator Smith and a fellow Georgian, Representative Dudley Hughes, introduced the bill in both chambers of Congress (Barlow, 1967); thus, the Smith-Hughes Act was born. Their bill was introduced to

> [p]rovide for the promotion of vocational education; to provide for cooperation with the States in the promotion of such education in agriculture and the trades and industries; to provide for cooperation with the States in the preparation of teachers of vocational subjects; and to appropriate money and regulate its expenditure. (as cited in Barlow, 1967, pp. 61-62)

Passage of this act mandated the use of federal money for the training of vocational agriculture teachers (Gordon, 2014). Of note, however, school facilities were typically the local education unit's responsibility (Lewis, 1988). To that end, local school officials could refer to Section 10 of the Smith-Hughes Act of 1917 when interpreting eligible expenditure of these funds, including their responsibility regarding facilities: "that the State or local community, or both, shall provide the *necessary plant and equipment* [emphasis added]" (Smith-Hughes Act of 1917 § Pub. L. No. 64-347 § 10). Although this law allowed the use of matching federal funds to hire agriculture teachers, it left the obligation for funding the *space or physical plant* in which to house vocational agriculture programs to states and local schools. It was not until World War II that federal funds were used to rent space and purchase equipment for such purposes (Stevens, 1967). For example, The National Defense War Training Acts during World War II provided more than $14,000,000 for public schools to purchase equipment supporting agricultural mechanics and food processing instruction without the need of matching state or local funds (Stevens, 1967). It is likely the educational provisions of these training acts were precipitated by the spiking need of adult education in agriculture for returning war veterans.

Sputnik, a satellite launched by the Soviet Union in 1957, fomented recognition of "the overpowering need for highly educated personnel, increased by the cold war fear, ha[d]put much pressure on the educational system to improve its effectiveness in the production of such persons" in the United States (Brookover & Nosow, 1963, p. 41). The Soviets had achieved a significant milestone in the Cold War's *Space Race*. Part of the U.S. response was the Vocational Education Act of 1963, the most significant federal legislation since the Smith-Hughes Act of 1917 in regard to vocational training and workforce preparation (Tanner & Tanner, 1980). As a result of the Vocational Education Act of 1963, for the first time, SBAE was directed by statute to focus instruction on off-farm occupations. To this point, Brookover and Nosow (1963) wrote: "One of the responses to this increasing emphasis upon the school's allocation process is the specialization of vocational curricula at various educational levels" (p. 41). Rather than the priorities of industry being the primal concern, this act expanded and redirected vocational education by providing funds intended to meet the needs of individuals (Mason, Furtado, & Husted, 1989). President Kennedy delivered a special message to Congress hailing the need for this legislation:

> I am requesting the Secretary of Health, Education, and Welfare to convene an advisory body drawn from the educational profession, labor, industry, and agriculture . . . to be charged with the responsibility of reviewing and evaluating the current National Vocational Education Acts, and making recommendations for improving and *redirecting the program* [emphasis added]. (*"Education for a,"* 1964, p. v)

Most SBAE programs at the time were organized for instruction in production agriculture, namely, farming and ranching. However, this increase in federal allocation stimulated improvements in the type and quality of instruction and provided funding to purchase the equipment necessary to prepare students for off-farm occupations (Stevens, 1967). It was soon evident, however, that the expanding need for training in "off-farm agriculture occupations . . . placed increasing demands on existing facilities for agricultural programs" (*"Facilities for Agricultural,"* 1968, p. i). To address this, the Vocational Education Act of 1963 was amended by the Vocational Education Amendments of 1968 (Gordon, 2014). This act required that 33.3% of each state's allotment of funding for the fiscal year of 1968 and 25% of each following year be spent on full-time students who had completed or left high school and/or for the construction of area vocational education school facilities (Vocational Education Amendments of 1968, 1969). These amendments also provided additional funding to construct special facilities needed to teach students with disabilities and to meet the needs of instruction in off-farm occupations.

In 1981, the U.S. Secretary of Education, T. H. Bell, chartered the National Commission on Excellence in Education (NCEE) to review the quality of education in U.S. public schools (Gardner, 1983). The report of the NCEE would redefine U.S. education going into the 21st century, including what eventually would be called *career and technical education*. The NCEE's report, *A Nation at Risk,* recommended increasing the requirements for high school graduation, including more core academic courses in the curriculum, raising the accountability expectations for academic performance, lengthening the time students spent in school, and strengthening the rigor associated with teacher candidates obtaining licensure (Gardner, 1983).

In response to the increased demands placed on vocational education, federal legislators passed the Carl D. Perkins Vocational Education Act of 1984 (Threeton, 2007). Subsequent versions of this act would address concerns with the notion of public schools in the United States falling behind the rest of the world (Finch, 1999). Multiple renewals followed, including the Carl D. Perkins CTE Improvement Act of 2006, which "placed greater accountability on integration of academic standards" in CTE (Threeton, 2007, p. 69). To that end, the 2006 Perkins Act more clearly defined accountability standards regarding the integration of academic content and CTE. The act was a driving force for the STEM integration movement in CTE (Threeton, 2007), including the provision of funding for facilities and equipment to achieve that aim.

Research Question #3 - What have been the primary types of facilities and equipment used in SBAE throughout its history?

SBAE facilities, historically, were learning spaces in which students applied agricultural concepts (Agnew & Vestal, 1986) and developed knowledge, attitudes, and skills (Franklin, 2008; Johnson et al., 1997) with implications for employment or entrepreneurship in the agriculture sector and its allied industries or to pursue postsecondary education in agriculture. The facilities were also designed and equipped with the vocational training needs of local communities and specific regions in mind (*"Facilities for Agricultural,"* 1968; Hummel & Hummel, 1913; Stevens, 1967; Wheeler, 1948).

As early as 1913, Hummel and Hummel asserted that "[i]n discussing the agricultural equipment of the high school we may perhaps most profitably consider it under four heads: (1) the laboratory; (2) the school farm; (3) the agricultural library; and (4) illustrative exhibits" (p. 93). In Georgia, *The Planning Guide for the Construction of Vocational Facilities* (1988) recognized the location, environment, availability of utilities, and the type of construction as the four essential elements in planning for the building of SBAE facilities. The Texas Education Agency (1974) stipulated that facilities should be designed around one or a combination of three foci, production

agriculture, cooperative part-time training, and pre-employment laboratory training. Other than classrooms and associated storage areas, two additional types of learning spaces are most often found in SBAE: an agricultural mechanics laboratory and a greenhouse or greenhouse-type structure or learning area (Shoulders & Myers, 2012). These learning spaces received the researchers' primary attention, but discussion of other facilities was also warranted, including land laboratories, or *school farms,* and food processing laboratories, or *food canneries.*

Classroom Space and Storage

Classroom space has served as the cornerstone of most SBAE facilities (National FFA Organization, 1945). Students "receive[d] their instruction in well-planned, modernly equipped classrooms. Instruction develops abilities that lead to successful farming" (National FFA Organization, 1945, p. 11). A caption from a photo in the *National Future Farmer Magazine* (National FFA Organization, 1945) stated: "A class in vocational agriculture studies scientific methods of farming. Visual aids, including posters, charts, slides, film strips and motion pictures are used extensively for instructional purposes in these classes" (p. 15).

In the 1970s, a handbook on facility standards from the Texas Education Agency (1974) recommended 1,000 square feet of floor space for a classroom that also would be large enough in which to hold FFA meetings. Their emphasis on the need to build a space large enough to conduct FFA chapter meetings exemplified a programmatic, i.e., three-circle model (Croom, 2008), view on the facility needs for a SBAE department. The Texas facility standards for SBAE also recommended 100 square feet of dedicated classroom storage for each agriculture teacher in the department. For the state of Georgia, *The Planning Guide for the Construction of Vocational Facilities* (1988) advised 900 square feet of classroom space. The need for appropriate classroom space and accompanying storage has long been considered essential for teaching SBAE, e.g., see Bear and Hoerner, 1978; *"Facilities for Agricultural,"* 1968; *"Providing Facilities,"* 1954; Texas Education Agency, 1974; and *"The Planning Guide,"* 1988. This recognition continued with major program reorientations beginning in the 1960s and remains a fundamental aspect of most SBAE departments' space requirements.

Agricultural Mechanics Laboratories or *Farm Shops*

Other than classrooms, agricultural mechanics laboratories are the most common feature of SBAE facilities (Shoulders & Myers, 2012; Young & Edwards, 2005), and were consistently mentioned in the historical literature. Stevens (1967) described the agricultural mechanics *shop* as "unquestionably the most distinctive feature of most agriculture departments" (p. 89) and stated its purpose was "primarily for instruction of farmers in the selection, safe operation, maintenance and repair of agricultural production machinery and equipment" (p. 89). Of note, Stevens (1967) omitted the word *future* in regard to farmers in his description of the uses of agricultural mechanics laboratories. In the early years of SBAE, in-school students were not the only individuals to use a school's *farm shop.* For example, recent high school graduates and older farmers used the facilities through adult classes taught or organized by vocational agriculture teachers (Phipps, 1972; *"Providing Facilities,"* 1954; Stevens, 1967; Wheeler, 1948). Issues of the *National Future Farmer Magazine* featuring stories on SBAE facilities focused primarily on the popularity of *farm mechanics* activities (National FFA Organization, 1945, 1947; see Figure 1).

Figure 1. "Students of vocational agriculture learn how to line up a cutter bar on a mower under the direction of a competent instructor. Farm boys learn to adjust, operate and maintain their farm machines while studying scientific farming." From "School Facilities," by the National FFA Organization, 1947, *FFA in Action,* Issue 2, p. 18. Copyright 1947 by the National FFA Organization.

Agricultural mechanics laboratories often served the primary purpose of instruction in operation, maintenance, and repair of agricultural production machinery and equipment (see Figure 1). However, their purpose would be called on to change as SBAE reoriented. "As additional specialized programs for off-farm agricultural occupations are organized, adjustments in the teaching of mechanics principles and practices appropriate to supplies merchandising, products marketing, ornamental horticulture services, and resources management [should] be made" (Stevens, 1967, pp. 89-90).

In the 1960s and 1970s, many states began to publish recommendations for building and equipping agricultural mechanics laboratories. For example, South Carolina recommended 3,000 square feet of agricultural mechanics laboratory space in addition to 500 square feet of storage for tools and consumables (*"Facilities for Agricultural,"* 1968). Bear and Hoerner (1978) recommended no less than 150 square feet per student in the agricultural mechanics laboratory as well as additional specifications for floor, electrical wiring, lighting, entrance doors, heating, ventilation, benches, equipment, and tool and supply storage.

Greenhouses

Although some greenhouse facilities in SBAE departments existed before the Vocational Education Act of 1963, their use in facilitating instruction in the off-farm occupation of greenhouse production and management led to the construction of many beginning in the late 1960s and through the 1970s (Bear & Hoerner, 1978; *"Facilities for Agricultural,"* 1968; Texas Education Agency, 1974). In regard to their importance, Ross (1980) stated greenhouses are "essential for effective vocational horticulture programs" (p. 15). Greenhouses would be used predominantly with pre-employment laboratory training courses in Texas (Texas Education Agency, 1974). Texas' standards recommended 1,600 to 2,000 square feet of space for instruction in ornamental horticulture (Texas Education Agency, 1974). Georgia's planning guide specified 2,000 square feet for greenhouses (*"The Planning Guide,"* 1988). The greenhouse would serve to "provide a suitable environment for plant growth, particularly during the fall-to-spring period when crops are not grown outside" (Ross, 1980, p. 13) and allowed for hands-on instruction year-round.

Greenhouses, as part of SBAE, have been used for instruction in plant science principles such as plant nutrition, plant structure, and fundamentals in production and harvesting of plants (Franklin, 2008). Allen (1994) asserted greenhouses served several purposes in SBAE programs such as "SAEP enhancement, hands-on skill development in new agriscience areas of instruction, and applied problem solving dealing with plants and fish" (p. 10). Integrating aquaponic equipment in a traditional greenhouse became popular in some programs, which supported skills development in water testing, hydroponic solution calibration, identification of fish parasites and diseases, and using fish waste as fertilizer (Allen, 1994).

Land Laboratories or *School Farms*

The use of land laboratories, or *school farms*, as a venue for learning has been an important component of SBAE since its earliest days (Tucker, 1994). Even before significant federal funding was provided for SBAE, schools teaching agriculture recognized the need of land for "practical outdoor work and experimental and demonstrational purposes" (Hummel & Hummel, 1913, p. 312). Hummel and Hummel (1913) recognized the school farm was not only a place to instruct students and give boys a chance to learn by doing, "but [also] through repetition in the doing should give him good habits of work" (p. 312). Early literature, e.g., *"An Educational Study,"* 1919; Hummel and Hummel, 1913; Lane and Crosby, 1916; and Robinson and Jenks, 1913, supports this *dual concept* regarding the purpose of most SBAE facilities. However, as time progressed, attention shifted away from using school farms as places of labor for production, and more toward use as spaces for students having applied learning experiences. According to Agnew and Vestal (1986), animal science laboratories provided students the opportunity to "apply basic and advanced principles learned in the classroom" (p. 16).

Not only did school farms provide students enrolled in SBAE courses a space to apply principles learned through classroom instruction, in the case of some students, school farms also offered a physical location for their SAE projects. According to an article in the *National Future Farmer Magazine* (National FFA Organization, 1947), "many F.F.A. chapters own and operate chapter farms where members may keep livestock and crop projects to get their practical training in agriculture. The farms are particularly useful where several students live within the town" (p. 49). Further, Agnew and Vestal (1986) described another example of school farm use by students conducting SAEs: "One very popular program for 'non-farm students' is [the] purchasing of feeder pigs, feeding them out at the school, and then showing and selling them at the County Fair's Junior Market Hog Show" (p. 17). McCarthy (1981) also elaborated on the critical role school farms could play in the development of students' SAE projects. He concluded the greatest benefit of school farms was to "generate circumstances for students to market agricultural products" (McCarthy, 1981, p. 113). According to McCarthy (1981), the second most popular benefit to students was that school farms provided space for the application of principles and concepts learned in the agriculture classroom. McCarthy (1981), however, asserted the popularity of school farms vacillated through the years.

Food Processing Facilities or *Food Canneries*

Nowhere in the United States was it more evident that SBAE facilities not only served the dual purpose of instructing students in and about agriculture but also assisted in improving the general wellbeing and livelihoods of local communities than in the South, especially during the Great Depression. This included needs associated with enhancing food security and food hygiene (Wheeler, 1948). In Georgia, for example, vocational education buildings typically housed both agriculture and home economics programs (Wheeler, 1948). A number of food-canning facilities were built in Georgia during the 1930s to combat "economic erosion" (Wheeler, 1948, p. 46).

Between 1926 and 1942, 383 canning plants produced tens of millions of cans of meat and vegetables to help preserve food and feed farm families in Georgia (Wheeler, 1948). Food produced through students' home projects was brought to school, canned, and returned home to help "fortify the family's food supply – no part of it was sold" (Wheeler, 1948, p. 48). A Georgia facility planning handbook stated "really effective and lasting instruction in food preservation can be provided in an adequately equipped food processing center but without such facilities the instruction probably would be academic and largely meaningless" (*"Providing Facilities,"* 1954, p. 8).

Conclusions and Implications

Historical sources supported an early recognition of the need for specialized facilities and equipment to educate students in SBAE, e.g., *"An Educational Study,"* 1919; Hummel and Hummel, 1913; Lane and Crosby, 1916; and Snedden, 1920. Even though the aims and purposes of SBAE evolved and reoriented over time, the type of facilities in which programs were housed remained somewhat consistent (Lannie, 1971; Phipps, 1972; Shoulders & Myers, 2012; Young & Edwards, 2005). Most facilities still include a classroom, an agricultural mechanics laboratory, and a greenhouse (Shoulders & Myers, 2012). Other facilities, such as land laboratories and food processing centers or food canneries, also may be found. Although early learning spaces were used most often for instruction in production agriculture, many present-day facilities have become spaces to integrate agricultural concepts with related academic content in which agriculture is the *context for learning* (Roberts & Ball, 2009).

Leaders of the early vocational education movement, such as David Snedden and Charles Prosser, recognized the need for specialized facilities and equipment in vocational education, including instruction in production agriculture (Hawkins et al., 1951; Snedden, 1920). Before passage of the Smith-Hughes Act, manual training schools, Congressional district agricultural schools, and Tuskegee Normal and Industrial School used laboratories and teaching methods that stressed applied learning and skills development (Croom, 2007; Croom & Alston, 2009; Hillison, 1989; Lane & Crosby, 1916; Woodward, 1887). Their facilities included classrooms, workshops, and, in some cases, farms (*"An Educational Study,"* 1919; Croom, 2009; Hillison, 1989; Hummel & Hummel, 1913; Lane & Crosby, 1916). Facilities such as land laboratories, greenhouses, and food canneries tended to appear as a response to local and regional needs (Agnew & Vestal, 1986; Bear & Hoerner, 1978; *"Facilities for Agricultural,"* 1968; Phipps, 1980; Texas Education Agency, 1974; Wheeler, 1948). For example, the Great Depression propelled the emergence of food processing centers or food canneries, especially in economically troubled communities of the rural South (Wheeler, 1948).

National and international events fomented federal legislative mandates leading to new priorities for SBAE, including off-farm occupational training as a result of the Vocational Education Act of 1963 and related laws thereafter (Barlow, 1967; Brookover & Nosow, 1963; Gordon, 2014; Smith, 1999; Vocational Education Amendments of 1968, 1969). Typically, federal funding for SBAE was *reactive* to national and international events. For example, the onset of World War I contributed to passage of the Smith-Hughes Act of 1917 (Barlow, 1967) which provided significant funding to train vocational agriculture teachers (Gordon, 2014). Further, the Cold War's so-called *Space Race* played a role in precipitating the Vocational Education Act of 1963. The Soviet Union's launching of the satellite *Sputnik* caused Americans to fear the nation's science and technology education had fallen behind. The Vocational Education Act of 1963 supported student preparation in SBAE leading to employment in off-farm occupations which had implications for specialized facilities and equipment to achieve the program's transition toward that aim (Gordon, 2014; Stevens, 1967). The report *A Nation at Risk,* published in 1983, again raised

public concerns about slipping education standards in the United States (Gardner, 1983). The Perkins Act of 1984 resulted from such concern, as did aspects of updated Perkins Acts that followed. Moreover, the 2006 Act provided funding for facilities and equipment related to STEM integration in CTE (Gordon, 2014), including SBAE.

Recommendations and Discussion

As new SBAE facilities are planned and constructed, teachers, school administrators, boards of education, community members and other stakeholders should consider the skills to be learned and applied and the requisite equipment necessary for such to occur. A related challenge will be to construct facilities with an eye cast on future learning needs in regard to career preparation for the agriculture, food, fiber, and natural resources (AFFNR) sectors, including many STEM-related occupations and career pathways.

Similar to individual states publishing facility guidelines and standards for SBAE programs over the decades, stakeholders comprising the National Council for Agricultural Education (NCAE), including the American Association for Agricultural Education (AAAE), the National Association of Agricultural Educators (NAAE), the National Association of Supervisors of Agricultural Education (NASAE), and representatives of industry, should create a task force with the goal of sourcing and publishing facility and equipment guidelines for SBAE. In particular, attention should be paid to the program's unique role in meeting the STEM-related workforce education needs of the United States. A Delphi study similar to Stewart et al. (2004) could augment this effort. Similar forms of systematic forecasting (Shinn, 1994; Stewart et al., 2004) stand to position SBAE to be more *proactive* as it navigates an uncertain future. Examples of emerging trends and learning needs are likely to include the demand for more *Climate Smart* agricultural practices and a plethora of topics related to climate variability with special relevance to the AFFNR sector. Implications for facility and equipment needs to deliver SBAE in the future may be substantial but nonetheless *very real.*

In addition, it would be beneficial for all stakeholders responsible for funding, building, and maintaining SBAE facilities to consider their historical uses. For instance, as SBAE continues to become more popular in peri-urban and urban schools, and teachers struggle with assisting students in conducting appropriate SAEs, land laboratories could serve as important learning venues as well as provide space for students' SAEs. Similar to how food canneries helped to mitigate the effects of economic depression during the 1930s, a 21st century food processing center, if coupled with a school or community garden, might help combat the *food deserts* now commonplace in parts of our nation. Students could also learn about proper nutrition and eating practices. Learning spaces such as gardens and other land laboratories may also serve as venues to enhance the application of various STEM concepts taught in SBAE as well as provide ways to process and market the outcomes of students' SAEs. Finally, workforce preparation for the AFFNR sectors intersects with our nation's overarching security needs. Can any nation be secure without an abundant, wholesome, and safe supply of food and fiber, as well as sustainable stewardship of its natural resources? Early proponents of SBAE thought not. This persistent national priority augurs a bright future for a *modern and proactive form of SBAE,* which implies the need for learning spaces commensurate with its purpose, history, and evolving place in U.S. society.

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