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Examining Agricultural Mechanics Projects and Their Use as Supervised Agricultural Experiences

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Abstract

The purpose of this descriptive study was to examine current agricultural mechanics project construction and its use as a supervised agricultural experience in Texas and was conducted using survey methods. The population was composed of agricultural education teachers who had students with an agricultural mechanics project at one or more of four selected agricultural mechanics project shows from the state. The sampling strategy was purposive in nature and all teachers were surveyed (N = 324). A response rate of 45.1% (n = 146) was achieved. Participants reported 2,626 agricultural mechanics projects were constructed for exhibition by students. Agricultural education teachers reported the majority of the projects used as a student's SAE were classified under the entrepreneurship category. Results indicate teachers believe in-class hours should count toward a student's SAE, agricultural mechanics projects should be used for SAEs, and record books were kept on about half of the projects. Recommendations include using more agricultural mechanics projects as SAEs and providing professional development for teachers in the area of SAE classification and using group projects for SAEs.

Keywords: supervised agricultural experience (SAE); agricultural mechanics

Introduction

At the establishment of early vocational agricultural education was curriculum focused on agricultural mechanics. When formal agricultural education began, agricultural mechanics courses were needed to enable students to cope with technical changes taking place in farming (Tenny, 1977). This led to the development of school shops to teach essential agricultural mechanics skills. In a more recent study, Shultz, Anderson, Shultz, and Paulsen (2014) highlighted the continued popularity of agricultural mechanics courses across the country and the extensive set of skills offered to students participating in the courses. In Texas, agricultural mechanics courses are taught in 90% of agricultural education programs (Hanagriff, Briers, Rayfield, Murphy, & Kingman, 2011). Students also have the opportunity to exhibit agricultural mechanics projects at numerous major, regional, county and local shows. These agricultural mechanics projects are built both in class and outside of class, by individuals and in groups with varying levels of complexity and

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funding sources. Given the number of students involved in agricultural mechanics courses and project exhibition shows, the potential exists for their use as a supervised agricultural experience (SAE).

According to Talbert, Vaughn, Croom, and Lee (2007), the supervised agricultural experience is the part of agricultural education that allows students to practice in the workplace what they have learned in the classroom or laboratory. Today SAEs are considered learning programs for agricultural education students designed to provide experiences in an agricultural career pathway (Croom, 2008). Students are expected to conduct SAEs outside of normal daily instruction and maintain records of their activities as a key component of the process (Croom, 2008; Davis & Williams, 1979). Others have similar definitions, in that SAEs should have educational value, be linked to classroom instruction, be conducted outside normal class hours, and be supervised by the agricultural instructor (Phipps, Osborne, Dyer, & Ball, 2008; Talbert et al., 2007). An area not clearly defined across the agricultural education field is whether SAEs should be conducted at school facilities or during class time. Talbert et al. (2007) say, under some circumstances, the SAE can be located on the school premises, but they should occur outside of normal instruction hours. Phipps et al. (2008) stated that the experience should be conducted outside of the normal class time. However, in an online publication from the Texas FFA Association (n.d.) concerning types of SAEs, it was stated: "laboratory SAEs may take place either during or outside of the regularly scheduled school day and tend to serve students who have no facilities to conduct specialized activities at home or away from school." This statement provides a contradiction to other literature on the subject and provides context to support Dyer and Osborne (1996) who stated SAE programs lack definition, direction, and focus.

There are more ways available for students to participate in SAEs than in the past. Four categories of SAEs are currently recognized by the National FFA Organization (2015): entrepreneurship, placement, agriscience research and experimentation, and exploratory where decision criteria for classification of the SAE are based on ownership, source of funding, and time invested. Requirements for the entrepreneurship SAE are that "you own the enterprise, equipment and supplies, making the management decisions and taking financial risk, with the ultimate goal of earning a profit" (National FFA Organization, 2015, p. 10). According to the manual, with placement SAEs students can work for someone else, it can be paid or unpaid, it could be a job or internship and take place at a business, school laboratory or community facility. Agriscience research and experimentation SAEs allow students to plan and conduct a major agricultural experiment using the scientific process. Exploratory SAEs allow the student to explore agriculture in a variety of ways (National FFA Organization, 2015, p. 10). Of the 49 proficiency areas awarded by the National FFA Organization (2013), four are directly related to agricultural mechanics. Agricultural mechanics is also recognized as one of the six categories included in the national Agriscience Fair under the Power, Structural, and Technical Systems category.

In the area of SAE participation, many researchers have noted a decline in participation as a portion of a complete agricultural education program (Croom, 2008; Lewis, Rayfield, & Moore, 2012b). While many believe student participation in SAEs is a positive and critical component of agricultural education, Dyer and Osborne (1995) found the percentage of students conducting SAE projects in programs is declining and further stated that participation in SAE programs by both teachers and students is lacking. Many researchers have reported the cause for the decrease in SAE participation is a lack of time the teacher has for supervising the projects (Lewis, Rayfield, & Moore, 2012a; Dyer & Osborne, 1996; Foster, 1986). Other causes contributing to decreased involvement in SAEs are a lack of student interest in the subject or an absence of school facilities to conduct projects (Robinson & Haynes, 2011; Lewis, Rayfield, & Moore, 2012a; Foster, 1986). Roberts and Harlin (2007) suggested a history of confusion regarding the classification of projects, also contributing toward declining participation. This confusion has continued with the more recent addition of exploratory SAEs. To address this confusion, a study by Zwilling, Rayfield, and Murphy (2016) was completed to help clarify what should be included in this category of SAE.

The National Council for Agricultural Education (2012) identified several factors contributing to poor SAE participation including the following: limited teacher time to supervise based on enrollment numbers, less students coming from an agricultural background, fewer available agriculture employment opportunities for youth, a lack of resources to help students generate SAE ideas and programs, perceived administrative barriers to the types of programs students could engage with at a local level, and a lack of understanding in how SAEs could contribute to evidence of student achievement beyond awards programs. The National Council for Agricultural Education (2015) approved a document outlining philosophies and guiding principles to address these barriers and provide a potential path to 100% SAE engagement. New SAE categories were presented that have yet to be adopted by the National FFA Organization or state FFA organizations.

Confusion surrounding classification of agricultural mechanics SAEs based on location of project construction, source of funding, and level of complexity could be a cause in the lack of agricultural mechanics projects used as SAEs. With high levels of participation in agricultural mechanics, great potential exists to use projects from this area to bolster SAE participation. Identifying reasons why agricultural mechanics projects are not considered SAE projects can help bridge the gap in participation levels and increase SAE involvement.

Theoretical Framework

The framework of this study is rooted in SAE literature and grounded in experiential learning theory. Experiential learning theory is the culmination of several works on learning through experience resulting in varying definitions of experiential learning. Beard and Wilson (2006) proposed that experiential learning is "the underpinning process to all forms of learning since it represents the transformation of most new and significant experiences and incorporates them within a broader conceptual framework" (p. 19). Most literature on the subject of experiential learning focuses on defining the experience and the learning process. Learning as defined by Kolb (1984) is "the process whereby knowledge is created through the transformation of experience" (p. 38). Considered by most to be the father of experiential learning, Dewey (1938) suggested all learning is experiential, however, all experiences are not educational. Dewey (1938) goes on to say, "attentive care must be devoted to the conditions which give each present experience a worthwhile meaning" (p. 49). According to Baker, Robinson, and Kolb (2012), experiential learning theory is the process of connecting new experiences and knowledge to pre-existing personal knowledge of the learner, closely following constructivist views of learning such as that of Dewey. In a philosophical examination of experiential learning theory, Roberts (2006) found most models of experiential learning are cyclical in nature, usually involving an input of information or experience, with reflection and application of new knowledge. Kolb's (1984) Model of the Experiential Learning Process is applied to agricultural education and has four defined learning modes throughout the cycle including active experimentation, reflective observation, concrete experience, and abstract conceptualization. These learning modes throughout the cycle are all employed in agricultural education, particularly in the area of SAEs.

Many have noted agricultural education is deeply tied to experiential learning (Knobloch, 2003; Roberts, 2006; Baker, Robinson, & Kolb, 2012). Knobloch (2003) posited that experiential learning is supported by four pillars: learning in real-life contexts, learning by doing, learning through projects, and learning by solving problems. The construction of agricultural mechanics projects makes use of all four of these pillars, highlighting their importance in the experiential learning process. It could be postulated that agricultural mechanics SAEs fit the mold for experiential learning, reinforcing their importance as a teaching tool, and pointing out the need to incorporate them more frequently into agricultural education programs. While experiential learning has the potential to be incorporated into each component of the agricultural education model, SAEs have traditionally been considered the experiential component of agricultural education (Baker, Robinson, & Kolb, 2012). Benefits of participating in experiential learning include encouraging higher student creativity and increased ability to practically apply new information (Baker & Robinson, 2016). Because of the alignment of experiential learning and SAEs, these benefits should be apparent in student projects.

Supervised agricultural experiences are deeply rooted in the project method of teaching proposed by Rufus Stimson (Moore, 1988). In a historical examination of the educational intent of SAEs and project-based learning in agricultural education, Smith and Rayfield (2016) found Rufus Stimson, David Snedden, and Charles Prosser had a similar belief that the project method, or what we now call SAE projects, was intended to reinforce skills learned in agricultural classes. In an opposing view, John Dewey and William Kirkpatrick saw the project method as a means for students to learn and discover new concepts with experimentation (Smith & Rayfield, 2016). According to Smith and Rayfield (2016), Dewey and Kirkpatrick's view on the project method began to take hold in the 1960s, moving the intent of this teaching method away from an application of concepts already learned in class, to a method by which new information could be acquired. This reflects the current intent of SAEs today as published by the National Council for Agricultural Education (2015).

There are many benefits for students participating in SAEs. In a Delphi study, Ramsey and Edwards (2011) surveyed agriculture industry experts who reached consensus on 60 entry-level skills students should learn by participating in a SAE. In a second Delphi study conducted by Ramsey and Edwards (2012), consensus was reached on 161 skills that should be learned by students participating in SAEs. Within these, the greatest number of skills came from agricultural communication, agricultural power, structures, and technology, animal science, and plant and soil science career pathways. These studies quantified the number of skills students can learn from participation in SAEs, highlighting a conclusion of Robinson and Haynes (2011) that SAEs provide instructional value for agricultural science teachers in developing critical thinking skills in their students. They also found teachers in Oklahoma recognized the experiential nature of SAEs and their ability to develop important career preparation skills. Dyer and Williams (1997) concluded research findings support the belief that SAEs are valuable in helping prepare students for jobs in agriculture and help develop good work habits and attitudes.

Dyer and Osborne (1995) recommended the identification of factors that aid or limit student participation in SAE programs. Hanagriff, Briers, Rayfield, Murphy, and Kingman (2011) found programs not involved in agricultural mechanics shows had higher SAE involvement than those that participated in agricultural mechanics shows, indicating those programs participating in agricultural mechanics shows were not reporting those projects as SAEs. Under Research Priority 4: Meaningful, Engaged Learning in All Environments, lies the question "how do we make project-based learning more relevant and contemporary in youth programs in agriculture and natural resources" (Roberts, Harder, & Brashears, 2016, p. 39)? This study examined agricultural mechanics projects, an area lacking in SAE participation with the potential of making project-based learning more relevant in agricultural education. A snapshot of what is currently taking place with project construction, teacher opinions of SAE, and how teachers are using agricultural mechanics projects as SAEs may be helpful in identifying areas to address that will increase participation in SAEs.

Purpose and Objectives

The purpose of this study was to assess current agricultural mechanics project construction in Texas and examine how these projects were being utilized as supervised agricultural experiences. The research objectives for this study were the following:

1. Describe the demographics of the agricultural mechanics instructors and agricultural mechanics programs.
2. Identify the type of agricultural mechanics projects constructed by students in high schools with agricultural mechanics programs in Texas.
3. Determine the number of agricultural mechanics projects in high school agricultural mechanics programs that are considered SAEs by the agricultural education teacher.
4. Determine which FFA recognized SAE category teachers use to classify an agricultural mechanics project.
5. Examine agricultural education teacher practices and opinions of agricultural mechanics project construction, record keeping, and use as a SAE.
6. Identify sources of funding used in student agricultural mechanics project construction to determine SAE categorization possibilities.

Methods

To accomplish the objectives of this study, a descriptive survey design was utilized. The survey instrument included questions in the form of yes/no, multiple choice (both single- and multiple-response items), and open-ended short-answer and essay items. Descriptive statistics were used to analyze the data. Fraenkel, Wallen, & Hyun (2012) noted descriptive statistics allowed researchers to describe information contained in scores with a few indices, such as mean, standard deviation, and frequencies.

The population of this study was Texas high school agricultural education instructors who teach agricultural mechanics courses. A purposive sampling method was used for this study based on lists of schools that participated in the following agricultural mechanics shows San Antonio, Houston Livestock Show and Rodeo, San Angelo, and Blinn College. From these shows, there were 324 unique participants identified. All unique participants were surveyed with 146 agricultural science teachers completing the survey, resulting in a response rate of 45.1% (N = 324, n = 146). Teachers surveyed in this study were considered experts in the area of agricultural mechanics because of their involvement in the construction of agricultural mechanics projects in addition to having successfully completed all of the requirements necessary for state teaching licensure.

The instrument used in this study was developed by the principal researcher with questions designed to provide a snapshot of agricultural mechanics SAE participation and opinions. Demographics, project construction information, and data on teacher practices and opinions concerning agricultural mechanics SAEs was collected with the 20-question instrument. The instrument was reviewed by a panel of experts in agricultural education with agricultural mechanics and SAE expertise at Texas A&M University for content and face validity. After revisions, the instrument was pilot tested to determine reliability by 25 agricultural education teachers who were not included in the study but teach agricultural mechanics. Cronbach's alpha was used to determine internal consistency of all non-demographic, scale items in the instrument with a resulting $\alpha = .90$. In a review of standards proposed by measurement specialists for reporting and interpreting reliability coefficients, Warmbrod (2014) found that .90 is a desirable reliability coefficient. Since the reliability coefficient met this standard, no changes were necessary for the instrument between pilot testing and main distribution. According to Gay, Mills, and Airasian (2012), researchers should report reliability information about instruments from pilot tests as well as reliability for the group being tested in the main study. A Cronbach's alpha was calculated post hoc on the final instrument ($\alpha = .99$), confirming reliability from the pilot test.

Before survey distribution teacher email contact information was obtained from the show superintendents of the four agricultural mechanics project shows listed. Contact information from the four shows were combined and duplicate contacts were removed. Email addresses were verified through an online agriculture education teacher directory for the state. The instrument was then distributed through emails containing a link for the online Qualtrics™ questionnaire. The Dillman, Smyth, and Christian (2014) tailored design method was used to establish a clear data collection procedure. Individualized invitation emails were sent initially with a link to the questionnaire to encourage teachers to participate. Four additional reminder emails were sent to those who did not respond, each one week later, to encourage participation. A thank you email was sent following completion.

With a response rate of 45.1%, additional measures were necessary to control for nonresponse error since a response rate of 85% was not achieved (Lindner, Murphy, & Briers, 2001). A comparison of early to late respondents was used to address nonresponse error as recommended by Lindner, Murphy, and Briers (2001) with early respondents operationally defined as participants in the first three rounds of the survey and late respondents as participants in the last two rounds of the survey. It was necessary to use the last two rounds of the survey to obtain 30 late respondents for comparison. No statistically significant differences were found for each instrument item from early respondents to late respondents. Each response was then checked for missing data and all complete responses were exported into a Microsoft Excel spreadsheet, and coded for electronic calculations. Basic descriptive statistics calculations were performed within the spreadsheet including frequencies, percentages, means, and standard deviations.

Findings

Demographic data were collected from respondents of the online agricultural mechanics survey. Frequencies and percentages were calculated for gender, years of teaching experience, high school size, and agricultural science department size. This information is summarized in Table 1. A large majority of the teachers surveyed were male (91.1%, n = 133), while only a few female teachers responded (8.9%, n = 13). Years of teaching experience was distributed well among respondents with (22.6%, n = 33) reporting they had been teaching for one to five years, (19.9%, n = 29) had been teaching for six to ten years, (17.1%, n = 25) had been teaching for 11 to 15 years, (13.7%, n = 20) had been teaching for 16 to 20 years, and (26.7%, n = 39) had been teaching for 21 years or more. This data is summarized in Table 1.

Table 1

Teacher Demographics Among Respondents (N = 146)

Demographic	*f*	%
Gender		
Male	133	91.1
Female	13	8.9
Years of Teaching Experience		
1-5	33	22.6

Table 1

Teacher Demographics Among Respondents (N = 146) Continued…

6-10	29	19.9
11-15	25	17.1
16-20	20	13.7
21+	39	26.7

To develop an idea of the program size, the researcher asked agricultural science teachers how many teachers were employed in the agricultural education department. This information is summarized in Table 2.

Table 2

Agricultural Education Program Size by Number of Teachers (N = 146)

Agricultural Education Department Size	*f*	%
1 Teacher	54	37.0
2 Teachers	54	37.0
3 Teachers	30	20.5
4 Teachers	5	3.4
5+ Teachers	3	2.1

Teachers were also asked to specify student enrollment numbers for the school year to determine program size. Specifically, teachers were asked how many students were in the whole agricultural science program, including non-agricultural mechanics courses, and how many students were in enrolled in their agricultural mechanics courses alone. Means and standard deviations for this data are shown in Table 3.

Table 3

Mean Departmental and Subject Enrollment (N = 146)

Student Enrollment	*M*	*SD*
Agricultural Education Department	166.0	121.8
Agricultural Mechanics Courses	58.9	38.5

Teachers were asked to indicate which of the four Texas Education Agency recognized agricultural mechanics courses they taught. An option was provided to indicate if they taught another local course related to agricultural mechanics. Table 4 indicates the frequencies and percentages of the teachers surveyed that taught the listed courses.

Table 4

Agricultural Mechanics Courses Taught by Respondents (*N* = 146)

Course	*f*	%
Agricultural Mechanics & Metal Technologies	131	89.7
Agricultural Facilities Design & Fabrication	94	64.4
Agricultural Power Systems	54	37.0
Practicum in AFNR	39	26.7
Other	28	19.2

Note: Respondents were asked to mark all that apply.

Identifying the types of agricultural mechanics projects constructed by high school students with agricultural mechanics programs in Texas was an objective used to guide this study. To accomplish this objective, teachers were asked to list the types and quantities of projects that were constructed in their program during the school year. The top 25 responses are summarized in Table 5.

Table 5

25 Most Frequently Constructed Agricultural Mechanics Projects Among Responding Programs

Project Type	*f*	%
BBQ Pit	302	11.50
Firewood Rack	207	7.88
Trailer	202	7.69
Grill	160	6.09
Art/Decorative Projects	159	6.05
Hay Rings	133	5.06
Quail Cage	100	3.81
Toolbox	94	3.58
Picnic Table	93	3.54
Deer Stand	76	2.89
Signs	74	2.82
Feeders	73	2.78
Gates	65	2.48
Fire Pit	63	2.40
Flag Holder	60	2.28
Livestock Panels	59	2.25
Lamp	56	2.13
Livestock Pen	45	1.71
Benches	42	1.60
Hog Trap	40	1.52
Shop Table/Work Bench	31	1.18
Coffee Table	27	1.03
Cooker/Fryer	26	0.99
Tractor Implements	23	0.88
Cooking Stands	20	0.76
Other	396	15.08

Table 5

25 Most Frequently Constructed Agricultural Mechanics Projects Among Responding Programs Continued…

Totals	2626	100.00

The third objective of the study was to determine the number of agricultural mechanics projects that are considered SAEs by agricultural education teachers in high school agricultural mechanics programs. Participants were asked to provide the number of agricultural mechanics projects constructed by both a single student and projects constructed as a group. Teachers were also asked to specify how many projects were considered to be a SAE on projects constructed by both a single student and as a group. The results of these questions can be found in Table 6.

Table 6

Quantity of Agricultural Mechanics Projects Considered Single Student Projects, Group Projects, and SAE Projects (N = 146)

Category	*f*	%
Single Student Projects Constructed	2044	57.3
Group Projects Constructed	1523	42.7
Totals	3567	100.0
Single Student Projects Considered a SAE	798	47.2
Group Projects Considered a SAE	893	52.8
Totals	1691	100.0

The fourth objective of this study was to determine which FFA recognized SAE category teachers used to classify an agricultural mechanics project. Teachers were prompted to provide specific numbers of agricultural mechanics projects considered to be SAEs. Categories for classification of SAEs were: Entrepreneurship, Placement, Research, Exploratory, and Improvement. The frequency and percentages of reported SAEs in each category are reported in Table 7. A total of 1,519 SAEs were classified by agricultural science teachers.

Table 7

Categories of SAE Used to Classify Agricultural Mechanics Projects by Respondents (N = 146)

SAE Category	*F*	%
Entrepreneurship	1,041	68.5
Exploratory	212	14.0
Placement	126	8.3
Improvement	104	6.8
Research	36	2.4
Totals	1519	100.0

The fifth objective of this study was to examine agricultural science teacher practices and opinions of agricultural mechanics project instruction. A series of yes/no questions were asked regarding time and location of project construction, record book practices, and opinions of in-class and outside of class hours and their consideration for a SAE. Frequencies and percentages can be found for the answers provided to these questions in Table 8.

Table 8

Teacher Practices and Opinions of Agricultural Mechanics Project Instruction

		Yes		No	
Question	*n*	*f*	%	*f*	%
Did your students use school facilities to work on ag mechanics projects outside of their class period?	143	117	81.8	26	18.2
Did your students use instructional/class time to work on ag mechanics projects during their class period?	143	142	99.3	1	0.7
Do all of your students who construct ag mechanics projects maintain a record book?	142	73	51.4	69	48.6
Do you think in-class hours used to build ag mechanics projects should count toward a student's SAE?	143	127	88.8	16	11.2
Do you think outside of class hours used to build ag mechanics projects should count toward a student's SAE?	144	142	98.6	2	1.4
Do you think all ag mechanics projects should be considered SAEs?	141	113	80.1	28	19.9

The final objective for this study was to identify sources of funding agricultural mechanics instructors used for agricultural mechanics project construction. The objective was addressed by asking participants to indicate sources of funding utilized for agricultural mechanics projects in the following areas: student, parent, teacher, ag program/school, community member, built to sell, or other. Respondents had the option to check all areas that apply. Frequencies and percentages of participants that indicated each area of funding are provided in Table 9.

Table 9

Funding Sources for Agricultural Mechanics Projects Among Respondents (N = 146)

Funding Source	*f*	%[a]
Ag Program/School	104	71.2
Student	100	68.5
Parent	96	65.7
Built to Sell	84	57.5
Community Member	78	53.4
Teacher	59	40.4
Other	8	5.5

[a] Multiple source of funding were reported by respondents. Percentages are reported as percent of sample indicating each source of funding.

Conclusions

With this study, a cross-sectional view of current agricultural mechanics project construction in Texas, as well as teacher practices concerning their inclusion as SAEs, has been provided. It should be noted the results of this study cannot be generalized nationally as the data for this study was obtained from a Texas-only sample, representing only those agricultural mechanics instructors.

Teachers surveyed were those who taught agricultural mechanics as indicated by their participation in agricultural mechanics project shows. Nearly half of the agricultural science teachers in Texas are female yet over 90% of the teachers surveyed were male. The gender makeup of teachers in agricultural mechanics programs does not reflect the gender demographics of the agricultural education profession. Years of teaching experience was spread out evenly across participants in the study. It should be noted the largest area of teaching experience was 21 years or greater, with 26.7% of the agricultural mechanics' teachers falling into this category.

Agriscience program total student enrollment averaged approximately 166 students. The average number of students enrolled in agricultural mechanics courses in Texas is approximately 59. When compared to the average total number of students in agricultural science programs, these students make up nearly one- third of the total students. According to the Texas Education Agency (2010), there are four courses out of 24 agricultural science courses that have agricultural mechanics standards to be taught. Enrollment numbers in agricultural mechanics courses indicate a high level of student interest in courses designated as the agricultural mechanics pathway in Texas.

From attending the agricultural mechanics project shows in Texas, one might expect trailers would be high on the list for projects constructed. Trailers ranked third in number with 202 constructed in the programs surveyed. Building trailers has many different processes involved including metal cutting, measurement, welding, electrical systems, painting, and mechanical work at differing levels of complexity. Most trailers require extensive time to construct and can be used as a student's or multiple students' SAE. The project reported with the highest frequency was BBQ pits accounting for over 10% of the total projects constructed. Based on the current descriptions provided by the National FFA Organization (2015), it is possible to consider the project as a student's SAE in any of the four SAE categories depending on the individual's role in the project, ownership, or time contribution.

Other notable projects reported were grills, art/decorative projects, hay rings, quail cages, toolboxes, picnic tables, deer stands, signs, feeders, gates, fire pits, flag holders, livestock panels, and lamps. Most of these projects are smaller in size than the top three reported above but are still popular with all of them having been reported in numbers of 50 or greater. While the projects may be small in size, it is still possible to report them as a student's SAE. Some of the projects reported have a low level of complexity, requiring only a small amount of time to complete. These projects may not need to be classified in a standalone SAE category but rather be included as a supplemental project to a larger SAE project in other areas such as agricultural mechanics repair and maintenance, agricultural sales, swine production, and many others.

Dyer and Osborne (1995) identified a lack of participation in SAE programs by teachers and students. Information gathered in this study supports Dyer and Osborne's position. When comparing the number of projects constructed during the school year and the number of projects considered to be SAEs, there was a considerable difference. Teachers responding to the survey for this study reported a total of 3,567 projects constructed with only 1,691 of the projects used as SAEs. Less than half of the projects constructed were used as a student's SAE, confirming not all agricultural mechanics projects are considered SAEs. This fails to take full advantage of project-based learning and the benefits of experiential learning as outlined by Baker and Robinson (2016).

Teachers were asked to specify how many of the projects were group or single student projects, and if the project was utilized as an SAE. Of the 3,567 projects constructed, 2,044 (57.3%) were single student projects and the remaining 1,523 (42.7%) were group projects. Since the number of projects built by a single student was greater, one might expect the number of SAEs for single student projects to be greater as well. In this case, the opposite was found. 1,691 (47.4%) of the total projects were utilized as a SAE and 893 (52.8%) of those were considered group projects.

Participants were asked to list the number of agricultural mechanics projects considered as SAEs in each of five categories. Out of the 1,519 projects that participants classified in the survey, 1,041 of them were classified in the entrepreneurship category. The second- highest category used by teachers was exploratory, accounting for a distant 14.0% (*n* = 212) of the total reported. SAEs classified as placement and improvement both had numbers slightly over 100. By far the least used was research with only 2.4% (*n* = 36) reported. The results of this part of the study indicate using agricultural mechanics projects as an entrepreneurship SAE is more feasible than in other categories. It also suggests teachers are unsure how to enter agricultural mechanics projects in a record book as a placement, research, exploratory, or improvement SAE. Teacher confusion in this area may have its roots in the complicated past of classifying projects, supporting previous research of Roberts and Harlin (2007).

When teachers were asked a series of yes/no questions to gain a clearer understanding of their practices and opinions regarding agricultural mechanics project construction and their implementation as SAEs, 81.8% indicated their agricultural mechanics laboratory was available for student use outside of normal class hours. According to the definition of SAE by many, this would allow the students to consider this time usage on projects as SAEs hours (Croom, 2008; Phipps, Osborne, Dyer, & Ball, 2008; Talbert et al., 2007). Over 99% of the teachers reported projects were worked on during class hours. If a project is constructed only during class time, then it probably should not be considered a SAE (Croom, 2008; Phipps, Osborne, Dyer, & Ball, 2008; Talbert et al., 2007).

When teachers were asked if all students who construct agricultural mechanics projects maintained a record book, 51.4 respondents indicated records were kept. Maintaining a SAE in any area of agricultural education, including agricultural mechanics, should include maintaining a record book to simulate real- world business applications and further reinforce the purpose of having a SAE as was recommended by Davis and Williams (1979) and Talbert et al. (2007).

Concerning teacher opinions on hours spent constructing agricultural mechanics projects, 98.6% of teachers thought outside of class hours should count toward a student's SAE. This indicates most of the teachers surveyed were familiar with requirements for SAEs and agreed with these requirements. A majority of the teachers surveyed (88.8%) thought in-class hours should be counted toward student SAEs. This is interesting since most publications do not list in-class hours as part of a SAE. One source for this line of thought may come from the online publication from the Texas FFA Association (n.d.) that stated: "laboratory SAEs may take place either during or outside of the regularly scheduled school and tend to serve student who have no facilities to conduct specialized activities at home or away from school." Further, possible confusion on this subject comes from publications of the National FFA Organization (2016) that indicate some placement and school-based enterprise SAEs can be completed utilizing school facilities and further state that laboratory and agricultural mechanics activities can fall under the "Exploratory" SAE category.

Implications and Recommendations

Zwilling, Rayfield, and Murphy (2016) found experts in SAE agreed SAEs should take place outside the classroom. This belief by experts and the differing teacher opinions concerning inside and outside of class hours for SAEs as found in this study outlines areas for needed clarification regarding time and facilities usage with agricultural mechanics SAEs. Since these projects are commonly constructed at school facilities and even during class time, teachers may be inclined to allow students to use these projects as their SAE, even though most literature on the subject clearly states SAEs should be conducted outside of class (Phipps, Osborne, Dyer, & Ball, 2008; Talbert et al., 2007).

When agricultural science teachers were asked if they thought all agricultural mechanics projects should be SAEs, 80.1% of them said yes. This indicates the intention or potential to use the projects as SAEs, but other factors prevent their full implementation. As an indicator of how agricultural mechanics projects could be categorized as a SAE, participants were asked to identify which sources of funding their program used to finance agricultural mechanics projects. The source most teachers acknowledged using for agricultural mechanics project construction was from the agriculture program or school. According to the National FFA Organization (2016) SAE category definitions, this type of funding for a project limit which type of SAE a student could use to the categories of exploratory, research, and placement. The second highest indicated source of funding was from the student which could easily be categorized under the entrepreneurship category. Parents were the third most used source of funding followed by built to sell which could be classified under entrepreneurship if the funding is viewed as a gift, grant, or loan. Financial support by the family could also be considered placement if the project was funded as part of a family-based venture.

Approximately 53% of teachers reported community members fund projects. This funding source eliminates the possibility of using the project as an entrepreneurship SAE. According to the Official FFA Manual (National FFA Organization, 2015), a project with outside funding could be included in a placement SAE. The source of funding with the lowest number reporting was funding by the teacher. Interestingly, the category of SAE used the most was entrepreneurship. Personal investment by the student is only one of the sources of project funding teachers indicated using. The other five sources of funding do not technically allow the students to use a project constructed from those sources as an entrepreneurship SAE because they would not be investing their own money. This may indicate teachers are unsure how to enter records to use the project as a SAE when it is funded by someone other than the student. The funding of the project is directly related to the desired end result of the project. Students can keep the project for themselves, sell it for a profit, it may remain at the school, or be delivered to the person who ordered it. Knowing the destination of the project would also be helpful in determining the correct SAE category to classify the project.

Agricultural mechanics projects provide an opportunity for hands-on experience for students. Often these projects are completed in groups by students in a classroom/laboratory setting. Professional development for agricultural science teachers should be provided to clarify how group projects can be used for SAEs not only in the area of agricultural mechanics, but others as well. Davis and Williams (1979) stressed record- keeping for supervised agricultural experiences should not be overemphasized but is a critical component in agricultural education because it provides skills in simple business analysis. Based on the findings of this study, teachers in Texas sometimes do not know how to enter some projects into a record book when documenting SAEs. Teacher educators or record book providers should clarify how to enter group projects in record books.

There is some misunderstanding as to what defines a SAE among teachers. Unless the agricultural education community agrees on one definition of SAE, there will likely continue to be confusion on the subject. Further studies are needed to clarify the criteria, definitions, and limitations of SAEs for all stakeholders involved. The definition and categorization of SAEs should remain consistent for an extended period of time, within all facets of agricultural education, to promote understanding among agriculture educators and students. At the time of this study, efforts by the National Council for Agricultural Education (2015) are being made to address these issues. After implementation of the council's SAE recommendations, further research should be conducted to assess the effectiveness of the changes.

One of the limitations of this study was the use of a purposive sample of agricultural science teachers in Texas. A broader investigation should be conducted concerning the use of agricultural mechanics projects as SAEs. A recommendation for further research beyond the scope of this study is to ask teachers to specify how each project constructed as a SAE was categorically classified. This would give a more direct answer to how SAEs are classified. Determining if the project is part of a larger SAE would be helpful in categorizing the project as well. Some agricultural mechanics projects may be supplemental to a student's main SAE such as building livestock panels for a beef production SAE for example.

Agricultural mechanics SAEs have the potential to instill many entry-level technical skills on students (Ramsey & Edwards, 2012). These SAEs should continue to be developed and further implemented to guarantee a future in this pathway. This study shows a lack of SAE utilization and inclusion among those constructing agricultural mechanics projects. Further research is needed to determine what barriers exist to using agricultural mechanics projects as SAEs and in how to make this form of project-based learning more relevant in youth programs in agriculture. Further research in other states may reveal agricultural mechanics projects are being used more effectively as SAEs and could provide insight into how to implement their use more effectively in Texas. Before professional development concerning SAEs is presented to teachers in Texas, an assessment of teacher knowledge in SAEs is necessary in order to more effectively address problems in the area.

Another area in need of closer examination is the teacher's intent of the agricultural mechanics project. Dewey (1938) said, "attentive care must be devoted to the conditions which give each present experience a worthwhile meaning" (p. 38). While agricultural mechanics project construction is a form of project-based learning, the intent of the project must be clearly defined in order to be able to meet the constraints of effective experiential learning. The intent of agricultural mechanics project construction should be to learn new skills to take advantage of the benefits of project-based learning. If this is the intent of the project from the beginning and SAE requirements are met in the areas of project construction location, financial or time input from the student, and whether or not the project construction takes place inside or outside of normal class hours, agricultural mechanics project construction can be a more relevant form of project-based learning.

The identification of record- keeping practices in agricultural mechanics SAEs could be helpful in determining if record- keeping processes and knowledge are serving as barriers for SAE inclusion. Identifying specific reasons for lack of both student and teacher interest in the record-keeping process would be vital information to attempt to correct the problem. To address a concern identified in this study, further research should be conducted concerning the use of group projects as SAEs.

Identification of specific record- keeping practices and practices used in applying for FFA awards when using a group project would be useful for teachers so these projects may be used as SAEs. A possible way to encourage the use of group projects may be to explain how to classify the project in each student's record book. The classification of the project would depend on the student's role in the financing of the project. A group project may have one student classify it as entrepreneurship if he/she financed its construction. Other students in the group could categorize their role as unpaid placement or exploratory, depending on how much time was spent working on the project by each individual student. Further research concerning SAE categorization will need to be completed after the agricultural education community implements recommendations from the National Council for Agricultural Education. Students should be encouraged to keep records on the project as part of their course grade. If each student is required to have a SAE, a group project would be a way to get several students keeping records on an active SAE, with little difference required in explanation of record book entry for each individual.

Supervised agricultural experiences are an essential part of the integrated three-component model of agricultural education (Croom, 2008). Research in the area of SAE should continue so that its interaction with FFA and classroom activity will continue to enhance the complete agricultural science program.

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