HOW SAFE ARE SELECTED TEXAS SCHOOL-BASED AGRICULTURAL MECHANICS LABORATORIES?: A REVIEW OF TEACHERS' SAFETY PERCEPTIONS

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Cassidy Leamon

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DEDICATION

I dedicate this thesis to all my friends and family you have been there for me during this journey.

To all my friends I have made in college, thank you for always being supportive of me even though you thought writing a thesis may have been crazy. Not only for supporting me in graduate school, but for always being there for me through all of college. Y'all made school so fun and worth it, I have been blessed to go through college with such amazing people, I wish all of you the best of luck in life.

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ABSTRACT

Leamon, Cassidy, *How safe are selected Texas school-based agricultural mechanics laboratories?: A review of teachers' safety perceptions.* Master of Science (Agriculture), May, 2021, Sam Houston State University, Huntsville, Texas.

The purpose of this study was to evaluate the safe working conditions in Texas agricultural mechanics laboratories. Researchers sought to identify the personal, professional, and program demographics of the teachers who instruct in the laboratories and the laboratories themselves. A survey was distributed in an online format to agricultural mechanics teachers across the state of Texas. A total of 133 (f = 55%) agricultural mechanics teachers responded to the survey. The instrument consisted of nine sections that included: demographics, general safety conditions, general appearance, personal protective equipment, condition of hand and power tools, electrical, fire safety, compressed gas cylinders safety, and storage in the agricultural mechanics laboratory. Frequency, percentages, mean, and standard deviation was used to analyze the data that was collected. It was found that the majority of agricultural mechanics teachers were self-perceived as safe in their agricultural mechanics laboratory, besides specific areas. It is recommended that agricultural mechanics teachers make sure they have all the proper safety equipment, attend workshops that are provided, and understand how to safely teach their students in an agricultural mechanics laboratory.

KEY WORDS: Agricultural mechanics, Safety, Agricultural mechanics laboratory, Sam Houston State University, Texas

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PREFACE

The basis for this research evolved because of my passion for agricultural mechanics and what learning opportunities it has for students. I have always been interested in the safety of an agricultural mechanics laboratory, so it was fitting that, that was my answer when I was asked what I wanted to write about. I designed this research with the intent to assist agricultural mechanics teachers become aware of the possible safety concerns in their agricultural mechanics laboratories.

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CHAPTER I

Introduction

This chapter begins with a discussion of the background and setting that provide the context of the problem statement for this research. The purpose and objectives of the research are presented along with the need for the study and the theoretical frameworks upon which the study is based. Finally, definitions of terms, limitations, and assumptions of the study are provided.

Background and Setting

School – Based Agricultural Education Programs

Agricultural education in public school pre-dates a long list of federal legislative acts that shaped and funded the United States public education in the 20th Century (Phipps, Osborne, Dyer, & Ball, 2008). Today there are over 800,000 students who participate in formal agricultural education programs that spreads throughout 50 states and three United States territories (National FFA, n. d. A). Three of the acts that predominantly influenced the agricultural education programs is the Smith-Hughes Act of 1917, the Vocational Education Act of 1963, and the Perkins Act (Phipps et al., 2008). The Smith-Hughes Act was designed to promote and further develop vocational education, as it provided funds for programs in agriculture, trades and industries, and homemaking (Phipps et al., 2008). Vocational education has been a part of public education since the Smith-Hughes Act was passed in 1917 (National FFA, n. d. B). The educational programs supported with the funds from the Smith-Hughes Act were restricted to prepare students for useful employment, less than college grade, and designed for students over 14 years old who were preparing to work on the home farm

(Phipps et al., 2008). Next, the Vocational Education Act of 1963, was designed to strengthen and improve the quality of vocational education and to expand vocational education opportunities (Phipps et al., 2008). Along with maintaining, extending, and improving existing programs, the Vocational Education Act funds were used to develop new vocational education programs and provide part-time employment for youth who needed earnings to continue their study in vocational education (Phipps et al., 2008). Finally, the Perkins Act of 1984, was focused on improving skill development for the labor force and job preparedness. (Phipps et al., 2008).

According to Phipps et al. (2008), "components of agricultural education programs include classroom instruction, supervised agricultural experience (SAE) programs, laboratory instruction, and student leadership development through participation in programs and activities of the National FFA Organization" (p. 4). Agricultural education prepares students for successful careers and a lifetime of informed choices in the global agriculture, food, fiber and natural resources systems (National FFA, n. d. A). Moreover, a comprehensive school-based agricultural education program includes Career and Technical Education (CTE) and agricultural literacy objectives (Phipps et al., 2008).

Agricultural Mechanics in School-Based Agricultural Education Programs

Agricultural mechanics coursework has historically been considered an important and vital construct of the agricultural education curriculum (Burris, Robinson, & Terry, 2005; Wells, Perry, Anderson, Shultz, & Paulsen, 2013). Agricultural mechanics courses utilize a broad spectrum of experiences and activities to engage students through emphasis on critical thinking skills, competence development, and hands-on learning

(Phipps et al., 2008; Baker, Robinson, & Kolb, 2012; Wells et al., 2013). "As agricultural mechanic laboratories remain an important component of agricultural education programs (Phipps et al., 2008; Shoulders & Myers, 2012), it is vital that quality learning experiences occur within those environments to provide students with high-quality agricultural education instruction" (Wells et al., 2013, p. 223). Agricultural education is designed to be industry-validated as it strives to equip students with the skills, education, and training important to be successful in industry and post-secondary education (Roberts & Ball, 2009; Leiby, Robinson, & Key, 2013).

Texas Agricultural Mechanics School-Based Curriculum

The Texas Essential Knowledge and Skills (TEKS) are a state mandated curriculum developed by the Texas State Board of Education for students in kindergarten through 12th grade. The TEKS objectives for the agriculture mechanics related courses are designed to prepare students for careers in agriculture power, structural, and technical systems (TEA, n.d.). According to TEA (2019), for students to prepare for success, they need opportunities to learn, reinforce, apply, and transfer knowledge and skills and technologies in a variety of settings. The Agricultural Mechanics and Metal Technologies course is recommended for students in grades 10-12. TEA states that this course is designed to develop an understanding of agricultural mechanics as it relates to safety and skills in tool operation, electrical wiring, plumbing, carpentry, fencing, concrete, and metal working techniques (TEA, n.d.). With these skills learned, students will be prepared for careers in agricultural power, structural, and technical systems and the industry (TEA, n.d.). Additionally, the Agriculture Facilities Design and Fabrication course is recommended for grades 11-12 and is for students to attain knowledge and skills related to agricultural facility design and fabrication by exploring different types of power systems and construct facilities. Another class offered is Agricultural Power Systems, where students in grades 10-12 can learn to be prepared for careers in agricultural power, structural, and technical systems. Students will attain academic skills and knowledge, acquire technical knowledge and skills related to power, structural, and technical agricultural systems. This course is designed to develop an understanding of power and control systems as related to energy sources, small and large power systems, and agricultural machinery. Finally, the last course is agricultural equipment design and fabrication, where students are prepared for careers and success in mechanized agriculture and technical systems, and attain knowledge and skills related to agricultural equipment and design fabrication.

Agricultural Mechanics Teacher Professional Development Needs

Educators are expected to provide a positive learning environment for students and prepare them for productive lives in a fast-paced world (Layfield & Dobbins, 2002). The constant evolution of agricultural education programs and the addition of core subject content skills have motivated many teachers to seek professional development opportunities to meet the demands of the changing emphasis of their programs (Washburn & Dyer, 2006). Goodlad (1983) stated that the teacher is the single most important variable in determining school effectiveness. Unfortunately, agricultural mechanics teacher preparation in the area of agricultural mechanics and safety instruction continues to be limited (Hubert, 1996). To keep teachers up-to-date of changing technology, policies and curriculum improvements, must be enacted for teachers to develop and improve their skills, pedagogically and technically, through high quality professional development programs (Anderson, Barrick, & Hughes, 1992). Some professional development needs are laboratory safety, laboratory and equipment maintenance, laboratory teaching, tool, equipment, and supply management, and program management (McKim & Saucier, 2011).

Importance of Teaching Safety in the Agricultural Mechanics Laboratory

Early exposure of a culture focused on safety will allow those students entering the classroom to have appropriate safety competencies, ultimately helping to lead to reduced accidents in the workplace (Chumbley, Hainline, & Wells, 2019). Ramsey and Edwards (2011) found that selected agricultural industry experts expect students to learn entry-level technical skills before entering the workforce. Furthermore, there is a strong demand for individuals with knowledge and skills in agricultural, food, and natural resources (AFNR) paired with proficiency in science, technology, engineering, and mathematics (STEM) concepts (Scherer, McKim, Wang, DiBendedetto, & Robinson, 2019).

If agricultural educators are to complete their moral and legal obligation to the students, it is essential for agricultural teachers to exhibit safe practices and behaviors, thus, creating a positive safety climate, not only while the student is in school, but also when they enter the workforce (Hubert, Ullrich, & Murphy, 2000). In order for students to acquire the knowledge and skills needed to be successful in the workforce, a well-prepared teacher and a safe working environment are required (Steffen & Spaulding, 2007). According to Hubert, Ullrich, Linder, and Murphy (2003), if teachers fail to promote and follow safety procedures, students may very well likely also follow suit. Without competent and knowledgeable agricultural teachers, the agricultural mechanics laboratory can quickly become an underutilized and unsafe environment (McKim & Saucier, 2011). As a training ground for the world- of -work, agricultural mechanics teachers must provide a safe teaching and learning environment while simultaneously preparing students to work safely and successfully in school as well as transfer those assets on-the-job (Threeton, Ewing, & Evanoski, 2015).

Agricultural Mechanics Laboratory Management

Agricultural educators are expected to manage the learning environment as well as promote safe practices to control for potential hazards, furthermore, it is also their responsibility to keep themselves, their program, and students safe (Threeton et al., 2015). Shinn (1987) noted that the quality of an agricultural education teacher's laboratory instruction directly impacts the effectiveness of the total program. According to Phipps et al., (2008) agricultural science teachers should ensure that laboratory facilities and equipment comply with Occupational Safety and Health Administration (OSHA) standards and should keep Safety Data Sheets (SDS) files for reference as needed. Moreover, Saucier, McKim, Terry, and Schumacher (2014) suggested that pre-service and existing teachers must be properly educated in agricultural mechanics laboratory management to provide a safe and efficient laboratory learning environment for agricultural mechanics students.

Safety Concerns in the Agricultural Mechanics Laboratory

Agricultural mechanics laboratories are filled with dangerous tools, equipment, processes, materials, and supplies, within a wide range of environmental conditions, which are difficult to control (Threeton et al., 2015). Students in agricultural mechanics laboratories are exposed to metal working, wood working, machinery, chemicals, and other processes which could pose serious injury to the students and teachers (Chumbley, 2015). According to Miller (1988) vocational agricultural teachers should be concerned with student exposure to noise in the agricultural mechanics laboratory. Potentially damaging levels of constant noise were recorded during previous studies (Woodlord, Lawrence, & Bartrug, 1993). Woodlard et al. also stated that regardless of the specific mechanism utilized, agricultural mechanic teachers educating in areas involving high noise levels should have knowledge of the effects of noise on hearing. Also, when in a welding environment of a vocational agricultural mechanics laboratory, smoke will indicate that ventilation is inadequate, which may lead to health hazards of the students and teachers (Carr, Lindhardt, &Weston, 1982). Gliem and Miller (1993a) reported inexpensive safety materials and procedures such as color-coded tools, safety zones, and the safe storage of flammable liquids were not available in some schools.

Agricultural Mechanics in the Twenty-First Industry Workforce

Based on the results of a 2006 national survey of over 400 employers, high school graduates are “woefully ill-prepared” to enter today’s highly technical workplace (Casner-Lotto & Barrington, 2006, p. 9). Ramsey and Edwards (2011) found that selected agricultural industry experts expect students to learn entry-level technical skills before entering workforce. To more fully prepare our nation’s students to enter the globally competitive workforce, STEM integration allows students to make connections between the abstract concepts learned in core subject classrooms and real-world situations (Wooten, Rayfield, & Moore, 2013). In addition, with STEM concepts, the modern workplace requires workers to have various cognitive and affective skills, these skills are more referred to as 21st century skills (National Research Council, 2011). Scherer et al.

(2019) stated that the progress and prosperity within the United States cannot remain strong if young people are not STEM-literate and well prepared to enter the workforce of STEM professionals. Within this understanding, teaching STEM through AFNR contexts is a required component to preparing students to learn about, address challenges within, and be successfully employed by 21st century workplaces (Scherer et al., 2019).

Theoretical Framework

To guide this study, researchers utilized three theories: Bandura's Social Learning Theory, Operant Conditioning, and Protection Motivation Theory.

Bandura's Social Learning Theory

Bandura's Social Learning Theory is often described as the bridge between traditional learning and cognitive approach because it encompasses attention, memory, and motivation (McLeod, 2016). Social Learning Theory posits that people learn from one another via observation, imitation, and modeling (Nabavi, 2012). According to Nabavi, the people who are being observed are called models and the process of learning is called modeling. Bandura's stated that imitation and behavior modeling will occur if a person observes positive, desired outcomes (Nabavi, 2012).

There are four processes proposed by Bandura for the modeling process where the first is attention (McLeod, 2016). Attention is the extent to which people are exposed to behavior for it to be imitated (McLeod, 2016). Second is retention, meaning how well the behavior is remembered (McLeod, 2016). The behavior may not be noticed but it is not always remember which prevents imitation (McLeod, 2016). The third process is reproduction that is the ability to perform the behavior that the model had just demonstrated (McLeod, 2016). A model can be a live model which involves an actual individual demonstrating or acting out a behavior, verbal instructional which involves descriptions and explanations of a behavior, or a symbolic which involves real or fictional characters displaying behaviors (Nabavi, 2012). Finally, the fourth process is motivation when the behavior is performed, and there will be rewards or punishments that follow the behavior (McLeod, 2016). According to Muro and Jeffrey (2008) this kind of learning also emphasizes on internal thoughts and cognitions and it can help connect learning theories to cognitive development theories.

Operant Conditioning

B. F. Skinner's theory of operant conditioning is built on the ideas of Edward Thorndike (McLeod, 2018b). Edward Thorndike put forward a law of effect which states that any behavior that is followed by pleasant consequences is likely to be repeated, and any behavior followed by unpleasant consequences is likely to be stopped (McLeod, 2018a). Operant conditioning is a method of learning that occurs through rewards and punishments for a behavior (McLeod, 2018b). According to this principle, behavior is followed by pleasant consequences is likely to be repeated, and behavior followed by unpleasant consequences is less likely to be repeated (McLeod, 2018b). According to McLeod (2018b), a positive reinforcement strengthens a behavior by providing a consequence an individual finds rewarding. On the other hand a negative reinforcement is the removal of an unpleasant reinforcer because it removes the adverse stimulus which is rewarding (McLeod, 2018b). Skinner (1938), states that certain kinds of consequences reinforce behavior in the sense of strengthening it or making it more likely to occur again.

Protection Motivation Theory

The Protection Motivation Theory was originally developed for the health promotion prevention sector and describes how individuals are motivated to react in a protective way towards a perceived threat (Rogers, 1975). This theory can be applied to “any threat for which there is an effective recommended response that can be carried out by the individual” (Floyd, Prentice-Dunn, & Rogers, 2000, p. 409). This theory has four key elements, threat appraisal, coping appraisal, response efficacy, and self-efficacy (Westcott, Ronan, Bambrick, & Taylor, 2017). Response efficacy is the belief that certain processes will mitigate the threat and self-efficacy is an individual’s idea of their own ability to implement the required actions to mitigate the threat (Westcott et al., 2017). The objective of the Protection Motivation Theory is to recognize and asses the danger, and then counter the assessment with effective and efficacious mitigation options (Westcott et al., 2017). In general, Protection Motivation Theory states that being motivated to protect oneself requires not only adequate risk perception, but also the tools and skills to take preventative action (Inouye, 2003).

Statement of the Problem

Working in an agricultural mechanics laboratory can be very dangerous to students. Agricultural mechanics laboratories are filled with dangerous tools, equipment, processes, materials and supplies, within a wide range of environmental conditions, which are difficult to control (Threeton et al., 2015). Potentially damaging levels of constant noise were recorded during previous studies (Woodlord et al, 1993). Gliem & Miller (1993a) reported inexpensive safety materials and procedures such as color-coded tools, safety zones, and the safe storage of flammable liquids were not available in some schools.

To keep the students safe, the agricultural mechanics teacher needs to be knowledgeable in all aspects of the laboratory. Keeping the students safe in the high school agricultural mechanics laboratory will prepare them to work in industry. Estabrooke (1939) found that it is in the school shop that the great majority of students have their first opportunity to work with hand tools and machines and become acquainted with the materials and processes of the industrial world. The world demands individuals with knowledge and skills in agricultural, food, and natural resources (AFNR) paired with proficiency in science, technology, engineering, and mathematics (STEM) concepts (Scherer et al., 2019). In addition, with STEM concepts, the modern workplace requires workers to have various cognitive and affective skills (National Research Council, 2011). These skills are more referred to as 21st century skills. According to Casner-Lotto and Barrington (2006), the 21st century U.S. workforce is here, and it is "woefully ill-prepared" for the demands of today's workplace. In this study, employers responded to a survey that indicated that young people lack many basic skills and often, the ability to apply skills and knowledge once employed (Casner-Lotto & Barrington, 2006). Moreover, the teachers' responsibility is to prepare students for work by teaching them soft skills, technical skills, and the correct attitude toward work safely. Therefore, this study sought to answer the following general research objectives:

1. Determine the personal, professional, and program demographics of the selected Texas school-based agricultural mechanics programs and the instructors who teach within them.

2. Determine the self- assessed safety conditions in selected Texas school-based agricultural mechanics laboratories.

Purpose of the study

The purpose of this study is to evaluate the safe working conditions in Texas agricultural mechanics laboratories. Also, this study will determine the personal (age and gender), professional (highest degree earned, type of teaching certification, years of agricultural mechanics teaching experience, and what grade levels are taught), and program demographics (total number of students in high school, total number of students enrolled in agricultural program, total number of students enrolled in agricultural mechanics classes, agricultural mechanics classes offered, square footage of agricultural mechanics laboratory, age of agricultural mechanics laboratory, budget allotments for the agricultural mechanics laboratory, source of money for the budget, is there an FFA booster club, and number of students per agricultural mechanics laboratory class) of the Texas school-based agricultural mechanics programs and the instructors who teach within them. Furthermore, this study will evaluate the self- assessed safety conditions (general safety conditions, general appearance, personal protective equipment, condition of hand and power tools, electrical, fire safety, compressed gas cylinders safety, and storage) in the selected Texas school-based agricultural mechanics laboratories.

Research Objectives

This study will be guided by the following research objectives:

1. Determine the personal (age, gender, and ethnicity), professional (highest degree earned, type of teaching certification, years of agricultural mechanics teaching experience, and grade levels taught), and program demographics

(school's UIL ranking, total number of students enrolled in the agricultural program, total number of students enrolled in agricultural mechanics classes, agricultural mechanics classes offered, square footage of the agricultural mechanics laboratory, age of the agricultural mechanics laboratory, budget allotment for the agricultural mechanics laboratory, source of budget, the presence of an adult support group, the average number of students enrolled in each agricultural mechanics laboratory class, and the safety procedures if there is a student emergency) of selected Texas school-based agricultural mechanics programs and the instructors who teach within them.

2. Determine the self-assessed safety conditions (general safety conditions, general appearance, personal protective equipment, condition of hand and power tools, electrical, fire safety, compressed gas cylinders safety, and storage) in the selected Texas school-based agricultural mechanics laboratories.

Definition of Terms

For the purposes of this study, the following terms were defined:

Agricultural education- the agricultural education program is created by the three core components of classroom/ laboratory instruction, supervised agricultural experience programs, and FFA student organization activities and opportunities. Agricultural education prepares students for successful careers and a lifetime of informed choices in the global agriculture, food, fiber and natural resources systems (National FFA Organization, n.d. A).

Agricultural mechanics – secondary agricultural mechanics programs are designed to:

1). Develop understanding of basic principles of power and machinery, structures and electrification, agricultural construction, and soil and water conservation management.

2). Foster positive workmanship, work habits, time-on-tasks, and hands-on activities.

3). Develop attention to and consciousness is safety while using technology in agriculture (Hubert, 1996).

American National Standards Institute (ANSI) - ANSI's mission is to enhance both the global competitiveness of U.S. business and the U.S. quality of life by promoting and facilitating voluntary consensus standards and conformity assessment systems, and safeguarding their integrity (American National Standards Institute, n.d.).

Career and Technical Education – educational program that offers a sequence of courses that provides students with coherent and rigorous content. The CTE content is aligned with challenging academic standards, relevant technical knowledge, and skills needed to prepare for further education and current careers (Career and Technical Education, n.d.).

Ground Fault Circuit Interrupter (GFCI) – is a device that protects people from receiving electric shocks from faults in the electrical devices in homes or business (Ground Fault Circuit Interrupter, n.d.).

Laboratory and Equipment Maintenance- Maintenance activities that an agriculture teacher must perform to keep the laboratory and equipment in working order (McKim & Saucier, 2011).

Laboratory Safety- Activities that an agriculture teacher must perform to maintain a safe laboratory learning environment (McKim & Saucier, 2011).

Laboratory Teaching - Educational activities conducted in the laboratory by the agriculture teacher to ensure academic and vocational success (McKim & Saucier, 2011).

Occupational Safety and Health Administration (OSHA)- OSHA is responsible for protecting worker health and safety in the United States (Rouse, n.d. A).

Program management - Activities conducted by the agriculture teacher to plan, guide, assess, and evaluate the agricultural mechanics program (McKim & Saucier, 2011).

Safety Data Sheets (SDS) – includes information such as the properties of each chemical, physical, health, and environmental health hazards, protective measures, and safety precautions for handling, storing, and transporting the chemical (Safety Data Sheets, n.d.).

Supervised Agricultural Experience (SAE) - a required component of a total agricultural education program and intended for every student. Through their involvement in the SAE program, students are able to consider multiple careers and occupations, learn expected workplace behavior, develop specific skills within an industry, and are given opportunities to apply academic and occupational skills in the workplace or a simulated workplace environment (National FFA, n.d. A).

Science, Technology, Engineering, and Mathematics (STEM) - STEM is an educational program developed to prepare primary and secondary students for college and graduate studies in the fields of science, technology, engineering, and mathematics (Rouse, n.d. B).

The Texas Essential Knowledge and Skills (TEKS)- state required curriculum developed by the Texas State Board of Education for students in kindergarten through 12 grade (Texas Education Agency n.d.).

Tool, equipment, and supply management - Activities conducted by the agriculture teacher to ensure that all tools, equipment, and supplies are secured and in proper quality and quantity to facilitate the learning process (McKim & Saucier, 2011).

University Interscholastic League - The purpose of the UIL is to organize and properly supervise contests that assist in preparing students. It aims to provide healthy, character building, educational activities carried out under rules providing for good sportsmanship and fair play for all participants. The UIL exists to provide educational extracurricular academic, athletic, and music contests. (University Interscholastic League, n. d.).

Assumptions

The following assumptions were made in conducting this study:

1. The respondents were honest and truthful with their response and participation
2. The frame created for this study was representative of Texas school-based agricultural programs
3. The frame created for this study was representative of Texas school-based agricultural mechanics teachers
4. The researcher adequately controlled for collection errors

Limitations

The following limitations were associated with this study:

1. Not all agricultural mechanics teachers responded to the survey
2. Not all agricultural mechanics teachers have the same perception of safety concerns
3. Varying interpretations of safety knowledge
4. Agricultural mechanics teachers lack of safety knowledge

CHAPTER II

Literature Review

Chapter two consists of a review of literature related to a background in agricultural education history, agricultural mechanics curriculum, agricultural mechanics teacher requirements in Texas, agricultural mechanics laboratory safety and management, and twenty-first industry workforce. This review is structured into thirteen sections: History School-Based Agricultural Education Programs, School-Based Agricultural Education Programs, Agricultural Mechanics in School-Based Agricultural Education Programs, Texas Agricultural Mechanics School-Based Agricultural Education Programs, National Agricultural Education Competitions, Agricultural Education Competitions in Texas, Agricultural Mechanics Teacher Professional Development Needs, Importance of Teaching Safety in the Agricultural Mechanics Laboratory, Agricultural Mechanics Laboratory Management, Safety Concerns in the Agricultural Mechanics Laboratory, Agricultural Mechanics in the Twenty-First Industry Workforce, Theoretical Framework, and a Summary.

History School-Based Agricultural Education Programs

Agriculture, food, and natural resources are a part of a continuously changing environment (Miller, W. W., 2003). Agricultural educators are responsible for helping students become successful in ever-changing environments (Ewing, 2016). Students in agricultural education will develop skills and be offered opportunities that will give them the momentum to persevere in the face of adversity (DiBenedetto, 2015). Agricultural education prepares students for successful careers and a lifetime of educated choices in the global agriculture, food, fiber and natural resources (National FFA, n. d. A).

Moreover, CTE teachers have the responsibility to prepare students for the future workforce (Konkel & Henningfeld, 2013). Agricultural educators can never rest in the ongoing effort of putting agricultural education into context for the changing lives of their students (Camp, 1998). Moreover, a school-based agricultural education program includes career and technical education as well as agricultural literacy objectives (Phipps et al., 2008).

Agricultural education in public schools' pre-dates a long list of federal legislative acts that shaped and funded the United States public education system starting in the 20th century (Phipps et al., 2008). Three acts that predominantly influenced the agricultural education programs was the Smith-Hughes Act of 1917, the Vocational Education Act of 1963, and the Carl Perkins Act of 1984 (Phipps et al., 2008).

The federal government has supported vocational education programs since 1917 when the Smith-Hughes Act was passed to help schools train workers for the growing economy (Kister, 2020). The Smith-Hughes Act assisted the industry to supply skilled craftsmen for work in agriculture and industry (Dugger, 1965). This Act was designed to promote and further develop vocational education, as it provided funds for programs in agriculture, trades, industries, and homemaking (Phipps et al., 2008). The educational programs supported with the funds from the Smith-Hughes Act were restricted to prepare students for useful employment, less than college level, and designed for students over 14 years old who were preparing to work on the home farm (Phipps et al., 2008). The Smith-Hughes Act aided vocational education by an annual grant of approximately $7 million to be distributed to the states in the specific fields of vocational education in agriculture (Dugger, 1965). Passage of the Smith-Hughes Act in 1917 suddenly fostered a great interest in agricultural education as states began rapidly signing up for federal money to support their agricultural education programs (Hillison, 1998; Key, 2019).

The second act is the Vocational Education Act of 1963. By the 1960's, vocational education under the Smith-Hughes Act was in need of revision to meet the ever-changing needs of the economy (Talbert, Vaughn, Croom, & Lee, 2006; Key, 2019). Prior to enactment of the Vocational Education Act of 1963, leaders in industry and government noticed that increased automation and technology were also creating a need for different kinds of employment in which greater skills were required (Dugger, 1965). The Vocational Education Act of 1963 proclaimed its aim was the development of vocational education for all ages and communities (Wirth, 1972; Key, 2019). Millions of secondary school youth, out-of-school youth, and adults needed training and retraining to continue to hold jobs that would benefit by the massive effort which the Vocational Education Act made possible (Dugger, 1965). Furthermore, this Act was designed to strengthen and improve the quality of the vocational education and to expand vocational education opportunities (Phipps et al., 2008). Along with maintaining, extending, and improving existing programs, the Vocational Education Act funds were used to develop new vocational education programs and provide part-time employment for youth who needed earnings to continue their studies (Phipps et al., 2008). Fortunately, the Vocational Education Act assisted secondary school officials meet the needs of youth and adults who must go to work before obtaining professional college training (Dugger, 1965). Dugger stated that secondary schools must provide a balanced education for those youth who will enter the world of work without a bachelor's degree. In writing the Act, Congress indicated its purpose was to provide high quality vocational education opportunities for people in all type of communities (Dugger). Therefore, agricultural programs such as horticulture, natural resources, and agricultural mechanics were established through the passing of the Act (Phipps et al., 2008; Key, 2019). The Vocational Education Act of 1963 changed the supervised agricultural experience to not be restricted to only the production of agriculture (Talbert et al., 2006).

Finally, the Carl D. Perkins Act of 1984, was focused on improving labor force skill development and job preparedness (Phipps et al., 2008). The purpose of the act was to develop the academic, vocational, and technical skills of secondary and postsecondary students who enrolled in vocational and technical education programs (Kister, 2020). The Carl Perkins Act continued to focus on access for special populations, such as women, minorities, and special needs, it also added a focus on program improvement (Kister, 2020). Since 1984, the Perkins Act has been edited multiple times with the latest being in 2018 (Perkins Collaborative Resource Network, n.d.). With each time the act had edits, it still has the same purpose, to develop more fully the academic knowledge, technical, and employability skills of secondary education students (Perkins Collaborative Resource Network, n.d.). The most recent edition to the Act is the Strengthening Career and Technical Education for the 21st Century Act (Perkins V) which was signed into law by President Trump on July 31, 2018 (Perkins Collaborative Resource Network, n.d.). This reauthorized the Carl D. Perkins Career and Technical Education Improvement Act of 2006 (Perkins IV) and continued Congress' commitment to providing nearly $1.3 billion annually for CTE programs for our nation's youth and adults (Perkins Collaborative Resource Network, n.d.).

School-Based Agricultural Education Programs

Agricultural education in public schools was predominantly viewed as a vocational education program from its beginnings in the early 1900s to the 1980s (Phipps et al., 2008). Vocational education in agriculture was defined as systematic instruction in agriculture at the secondary, postsecondary, or adult level for the purpose of preparing people into agricultural careers (Phipps et al., 2008). Agricultural education was designed to be industry-validated as it strived to equip students with the skills, education, and training to be successful in industry and post-secondary education (Roberts & Ball, 2009; Leiby, et al., 2013). Agricultural education is delivered through three major components: classroom/laboratory, Supervised Agricultural Experience (SAE) programs, and student leadership organizations (FFA), this is also known as the three-circle model (National FFA, n.d. A). According to Phipps et al. (2008), a complete school-based agricultural education program consists of the three essential components part of the three-circle model.

The roots of the FFA originated from a time when boys were losing interest and leaving the farm, Walter S. Newman sought a solution to the problem with many other staff members of the Virginia Polytechnic Institute Agricultural Education Department (National FFA, n.d. B; Key, 2019). According to National FFA, (n.d. B), the organization proposed establishing an organization that allowed these farm boys opportunities for leadership development and a sense of pride in being a farm boy (Key, 2019). “The idea was presented during an annual vocational rally in the state in April 1926, where it was met positively, there the Future Farmers of Virginia was born” (National FFA, n.d. B; Key, 2019). Today there are over 800,000 students participating in formal agricultural education programs in grades seven to adult throughout 50 states and three U.S. territories (National FFA, n.d. A).

Agricultural science teachers are challenged to teach in a multitude of environments through classroom/laboratory, FFA, and SAE programs (Ewing, 2016). SAE's provide students with additional learning experiences in a career pathway of their choice (Croom, 2008; Key, 2019). According to Talbert et al. (2006), SAE is an independent learning program for students enrolled in agricultural education courses (Key, 2019). There are multiple types of SAE's that students can be involved in, these include: placement/internship, ownership/entrepreneurship, research, school-based enterprise, and service learning (Texas FFA, A). These programs have many purposes and objectives that benefit students by challenging them to gain new skills and experiences (Bryant, 2003). Moreover, there is a desire to connect classroom experiences to SAE and FFA so students are able to gain hands-on career skills and understand the significance of classroom content (Rada, 2015). "Supervised Agricultural Experience programs have been the cornerstone of agricultural education programs since the program's inception in the late 19th century" (Boone, 2010, p. 2). These programs provide excellent opportunities for experiential learning to take place (Ewing, 2010). According to Talbert et al. (2006), the SAE is the part of agricultural education that allows students to practice in the workplace what they have learned in the classroom and laboratory (Doss, Rayfield, Murphy, & Frost, 2019). Newcomb, McCraken, and Warmbrod (1986) state that SAE experiences is one of the true trademarks of every agricultural education program, it is considered to be important because it improves learning, student personal, and occupational development. "With SAEs as an integral part of the curriculum, agricultural education programs have provided a quality experiential learning experience for thousands of youth" (Boone, 2010, p. 2). Furthermore, a successful agriculture education program should encompass a mixture of all three of these components (Talbert et al. 2006; Phipps et al., 2008; Key, 2019).

Agricultural Mechanics in School-Based Agricultural Education Programs

Agricultural mechanics coursework has historically been considered an important and dynamic construct of the agricultural education curriculum (Burris et al., 2005; Wells et al., 2013). Since the establishment of early vocational agricultural education, the curriculum was focused on agricultural mechanics (Tenny, 1977; Doss et al., 2019). When formal agricultural education began, agricultural mechanics courses were needed to enable students to cope with technical changes taking place (Tenny, 1977; Doss, et al., 2019). "Agricultural education has always adapted to the ever-changing nature of the agricultural industry" (Hubert, 1996, p. 1). Competent persons in agriculture and mechanical arts are needed to meet rapidly expanding agricultural and industrial development throughout the nation (Dugger, 1965). Vocational education programs are offered in comprehensive high schools, vocational schools, career centers, as well as community and technical colleges (Kister, 2020). Moreover, the curriculum should develop a variety of mechanical skills that the student can use throughout life in both vocational and non-vocational settings (Shinn, 1997). "Agricultural mechanics courses expose students to critical thinking skills, the use of common sense, reading for content, practical mathematics applications, and cooperative interactive skills" (Soresen, 1997, p. 26). A study conducted by Burris, Robinson, and Terry (2005) identified nine agricultural mechanics content areas taught in secondary programs (Key, 2019). "90% of agricultural mechanic teachers respondents indicated that the areas they teach include metal fabrication, operating hand and power tools, project planning, and designing, electricity, and building/construction" (Key, 2019, p. 7). Additionally, 80% of the respondents noted that plumbing, concrete, and machinery where included in their state's secondary curriculum (Burris et al., 2005; Key, 2019). "Furthermore, agricultural mechanics curriculum allows for hands-on application of heat, thermodynamics, measurements, chemical reactions, and electricity concepts" (Miller, G. M., 1991; Key, 2019, p. 34) Shinn (1997), stated instruction should also emphasize safe use of equipment and develop critical reasoning skills regarding safety and work quality. According to Burris et al. agricultural mechanics has historically been a cornerstone in secondary agricultural programs and still remains a strong interest for students (Key, 2019).

"Agriculture mechanics has been described as the utilization of materials and processes to increase efficiency in all areas of production agriculture" (Casey & Swan, 2010, p. 12). Agricultural mechanics content provides students with opportunities to engage in hands-on learning experiences that accentuate cognitive development, mechanical skill achievement, and academic concept application through a technology-rich context (Hubert & Leising, 2000; Parr, Edwards, & Leising, 2009; Wells et al., 2013). "Training in a technologically rich field, such as agricultural mechanics, can help to prepare secondary students for the rigors, needs, and challenges of the real world" (Doerfert, 2011; Wells et al, 2013, pg. 225). "Contextual teaching and learning means focusing teaching around real-world application so that the student has a framework in which to apply learning" (Camp, 1998, p. 5). According to Kister (2020), there is strong evidence that the generic technical skills and occupationally specific skills provided in vocational education increase worker productivity, skill transfer, job access, and job stability when vocational graduates find training-related jobs. Moreover, welding and metal fabrication skills readily transfer into a variety of construction and fabrication industries allowing students to have several options when choosing a career pathway (Casey & Swan, 2010). “The content within agriculture mechanics is closely connected with many industries outside of agriculture, essentially preparing agricultural mechanics students for career entry into a broad spectrum of industries” (Casey & Swan, 2010, p. 12). Agriculture mechanics courses that emphasize welding within their curriculum have an opportunity to prepare their graduates for the welding industry (Casey & Swan, 2010).

Texas Agricultural Mechanics in School-Based Agricultural Education Programs

The Texas Essential Knowledge and Skills (TEKS) are a state mandated curriculum developed by the Texas State Board of Education for students in kindergarten through 12th grade (Texas Education Agency, n.d.). The TEKS objectives for the agriculture mechanics related courses are designed to prepare students for careers in agriculture power, structural, and technical systems (TEA, n.d.). In 2011, Texas agricultural mechanics courses were taught in 90% of agricultural education programs (Hanagriff, Briers, Rayfield, Murphy, & Kingman, 2011; Doss et al., 2019). Agricultural mechanics courses continue to be one of the most popular and frequently offered school–based, agricultural education courses in Texas (TEA, n.d.). According to TEA, for students to prepare for success, they need opportunities to learn, reinforce, apply, and transfer knowledge, skills, and technologies in a variety of settings.

According to TEA, the Agricultural Mechanics and Metal Technologies course is recommended for students in grades 10-12; however, 9th graders may take the course if they meet the prerequisite of Principles of Agriculture, Food, and Natural Resources. TEA states that this course is designed to develop an understanding of agricultural mechanics as it relates to safety and skills in tool operation, electrical wiring, plumbing, carpentry, fencing, concrete, and metal working techniques (TEA, n.d.). With these skills learned, students will be prepared for careers in agricultural power, structural, and technical systems and the industry (TEA, n.d.). Additionally, the Agriculture Structures Design and Fabrication course is recommended for grades 11-12 and is for students to attain knowledge and skills related to agricultural facility design and fabrication by exploring different types of power systems and construct facilities (TEA, n.d.). With this class, students will learn how to construct agricultural structures and demonstrate metal construction techniques (TEA, n.d.). Another class offered is Agricultural Power Systems where students in grades 10-12 learn to be prepared for careers in agricultural power, structural, and technical systems. Students will attain academic skills and knowledge, acquire technical knowledge and skills related to power, structural, and technical agricultural systems (TEA, n.d.). This course is designed to develop an understanding of power and control systems as related to energy sources, small and large power systems, and agricultural machinery (TEA, n.d.). Finally, the last course is Agricultural Equipment Design and Fabrication where students are prepared for careers and success in mechanized agriculture and technical systems, and attain knowledge and skills related to agricultural equipment and design fabrication (TEA, n.d.). Students will plan, construct, and maintain the design and fabrication in agricultural machinery and equipment (TEA, n.d.). According to TEA, in all the courses stated above, each course is required to have a SAE.

National Agricultural Education Competitions

"Agricultural mechanization has been a strong component of the local high school agricultural education program since its early beginnings" (Schumacher, 1997, p. 10). Agriculture teachers soon sought ways to reward students for their skills in agricultural mechanization in a way of agricultural mechanics contests (Schumacher, 1997). Approximately 33 years before the National FFA Organization founded the National FFA Agricultural Mechanics contest, Hagen stated that agricultural mechanization contests provided a reward to students as early as 1938 (Hagen, 1978, Schumacher, 1997). "In 1972, the first National FFA Agricultural Mechanics Contest was conducted at the Fort Osage Area Vocational - Technical School near Independence, Missouri" (Hoerner & Johnson, 1997, p. 20). "Teams representing 35 states participated in the contest which consisted of skill and problem-solving activities, and a written exam covering power and processing, and agricultural skills" (Hoerner & Johnson, 1997, p. 20). The first meaningful discussion leading to the present National FFA Agricultural Technology and Mechanical Systems CDE occurred at the 1967 Northeastern States Agricultural Education Seminar (Hoerner & Johnson, 1997). According to Hoerner and Johnson, the National FFA Agricultural Technical and Mechanical Systems CDE has made significant contributions to the personal and career development of agriculture students, to the improvement of instruction in agricultural mechanics, and to the betterment of agricultural education as a whole.

The national FFA hosts the National Agricultural Technology and Mechanical Systems (ATMS) CDE for students to practice and improve their skills related to agricultural mechanics curriculum (National FFA, n.d. C). The national ATMS CDE assesses student's abilities in 5 different areas as individuals and as a team (Key, 2019). The 5 areas include: machinery and equipment, electricity, compact equipment, structures, and environmental and natural resources (National FFA, n.d. D). Certain competencies are selected each year from these 5 areas (Key, 2019). The individual portion of the contest consists of each student being evaluated in each of the 5 areas (Key, 2019). The team portion involves each student working with their team to solve multi-system agricultural problem that is designated from the skills and problem solving portion of the 5 system areas (National FFA, n.d. D).

Agricultural Education Competitions in Texas

The Texas FFA Association hosts hands-on contests that test the knowledge and skills taught in agricultural mechanics related courses (Key, 2019). The contests include: ATMS CDE, Tractor Tech, welding contests, trailer build offs, and project shows. Texas participates in the ATMS CDE where students are able to advance to the national level as stated above. The Tractor Technician CDE consists of a three part competition, team members appraise components and parts of tractors and make recommendations for services needed, complete a written exam, and will compete as a team in locating, correcting, and safely repairing five placed malfunctions on the tractor (Texas FFA, n.d. B). The student's goal is to complete all the five malfunctions in the tractor and drive the tractor through a driving course all within a 25-minute time limit (Texas FFA, n.d. B).

Additionally, various organizations offer welding contests that consist of a team of four Texas FFA members, grades 9-12 (Judging Card, n.d. A). Each team will be required to bring equipment to the competition including proper PPE for various welding techniques (Judging Card, n.d. A). An example of what students may work with is material that includes up to 12” ID, plate, c-channel, I-beam, and/or rod (Judging Card, n.d. A). This contest may consist of two sections which is a welding exam and metal fabrication skills depending on the location (Judging Card, n.d. A). The students are allowed to take the exam for a certain allocated time, the exam covers welding theory, facts, welding symbols, electrode identification and possibly much more (Judging Card, n.d. A).

Texas has recently started a new competition that involves building a trailer in a single day. The purpose of this contest is to simulate real-world working conditions found on many construction job sites where metal fabrication and safe working skills are required (Judging card, n.d. B). This contest consists of four FFA students who are under the supervision of their agricultural science teacher (Judging card, n.d. B). Teams are required to bring their own tools and welders as they are provided the plans for the trailer and the metal to fabricate the trailer (Judging card, n.d. B). The agricultural science teacher has fifteen minutes to discuss the fabrication of the trailer and answer any questions the students have, they then can only have oral communication across a marked line (Judging card, n.d. B). The trailer becomes the property of the team, once the competition is completed (Judging card, n.d. B).

Texas students also have the opportunity to exhibit agricultural mechanics projects at numerous local, county, and major shows (Doss et al., 2019). Often these agricultural projects are completed in groups or individual students in a classroom/laboratory setting (Doss et al., 2019). According to San Antonio Junior Agricultural Mechanics project show (n.d.), the project show focuses on Texas 4-H and FFA student’s expertise to design and construct projects. Project shows are to recognize individual and group accomplishments and promote the development of skills in agricultural mechanics through competition (Houston Livestock Show and Rodeo, n.d.). These shows reinforce the students' use of basic skills and often require student initiative and team decision making skills (Bartholomew, 1997). The use of agricultural project shows improve employability and life skills by participating in the activity (Bryant, 2003). "Job performance skills such as problem solving, following through to the completion of a task, sales, and pride in workmanship can be attained by the students in agricultural classes" (Bartholomew, 1997, p. 5).

Agricultural Mechanics Teacher Professional Development Needs

"Professional development generally refers to the ongoing learning opportunities available to teachers and other educational personnel and is usually provided by local schools and school districts" (Saucier, 2010, p. 25). Teacher preparation programs should focus on providing a high level of technical skill training in agricultural mechanics and strive to increase students' confidence to teach it effectively because producing and retaining highly qualified teachers is imperative to the success of the United States as a country (Wallis, 2008; Leiby et al., 2013). The constant evolution of agricultural education programs and the addition of core subject content skills have motivated many teachers to seek professional development opportunities to meet the demands of the changing emphasis of their programs (Washburn & Dyer, 2006). "Therefore, it is important to identify the needs of beginning agricultural educators, especially the relevant skills that link classroom and laboratory instruction to real–world application (Hubert et al., 2003; Parr et al., 2008) — these skills are included in agricultural mechanics curriculum" (Saucier, McKim, & Tummons, 2012, p. 137). "Rodriguez and Knuth (2000) stated that professional development opportunities can come in a variety of forms such as mentoring, modeling, ongoing workshops, special courses, structured observations, and summer institutes" (Saucier, 2010, p. 29).

Unfortunately, according to research done by Hubert (1996) agricultural mechanics teacher preparation in the area of agricultural mechanics and safety instruction continues to be limited. "Knowledge and skills associated with agricultural mechanics education are essential for agricultural educators who intend to provide a safe and efficient laboratory learning environment for agricultural mechanics students" (Saucier et al., 2009; Saucier et al., 2012, p. 137). It is imperative that agricultural education teachers become skilled in agricultural mechanics coursework to better prepare the future teachers currently enrolled in secondary programs (Burris, Robinson, & Terry, 2005; Wells et al., 2013). Saucier and McKim (2011) stated that all school–based agriculture educators who instruct agricultural mechanics must be technically competent and be able to safely manage the school laboratory for effective student instruction. According to McKim and Saucier (2011) some professional development needs are laboratory safety, laboratory and equipment maintenance, laboratory teaching, tool, equipment, and program management. Also, according to a study done by Shultz, Anderson, Shultz, and Paulson (2014) the areas of highest perceived importance were welding, construction, and shop safety. "Agricultural education and agricultural mechanization programs have a long tradition of cooperation and integration" (Hubert, 1996, p. 3). Cooperation and integration of new agricultural skills and knowledge must continue in order to supply competent teachers of agriculture (Hubert, 1996). "Following a review of the literature, it can be posited that agriculture teachers, at all career levels, have professional development education needs in the area of agricultural mechanics" (Saucier et al., 2012, p. 138).

Importance of Teaching Safety in the Agricultural Mechanics Laboratory

Agriculture is one of the most dangerous occupations in the United States, and unlike other industries, children and adolescents make up a substantial portion of the agricultural workforce (Rivara, 1997; Perry, 2010). Due to the nature of the agricultural mechanics laboratory, the inexperience of students who participate and the proximity to dangerous equipment and chemicals, the potential for injury exists (Dyer & Andreasen, 1999; Perry, 2010). Furthermore, early exposure of a culture focused on safety will allow those students entering the classroom to have appropriate safety competencies, ultimately helping to lead to reduced accidents in the workplace (Chumbley et al, 2019). According to McKim and Saucier (2013) the most important responsibility of the instructor is to ensure the safety of the students. "Gliem and Miller (1993a) conducted a study that examined the administrators' perspective on laboratory safety in vocational agriculture" (Perry, 2010, p. 6). They found that administrators in all the schools examined indicated that teachers instructed students on how to properly use and demonstrate the proper use of equipment in the agricultural mechanics laboratory (Perry, 2010). Additionally, vocational teachers in 97.7% of the schools gave an equipment test to students to verify their knowledge of safe use before using the equipment (Perry, 2010).

Ramsey and Edwards (2011) also found that selected agricultural industry experts expect students to learn entry-level technical skills before entering the workforce. It is important for students to learn the best safety practices and management during their time in the agricultural program, so they can carry those precautions into the workforce (Rave

Mobile Safety, n.d.). Slusher, Robinson, & Edwards (2011) stated that safety precautions should always be considered, regardless of the sector of the agricultural industry in which an individual works (Leiby et al., 2013).

Furthermore, agricultural mechanics teachers must make sure that they are keeping the environment as safe as possible; just as important, they need to make sure students are properly taught how to work safely in such an environment (Ewing, 2016). If agricultural educators are to complete their moral obligation to the students, it is essential for agricultural teachers to display safe practices and behaviors, thus, creating a positive safety climate, not only while the students are in school, but also preparing them for when they enter the workforce (Hubert et al., 2000). In order for students to acquire the knowledge and skills needed to be successful in the workforce, a well-prepared teacher and a safe working environment is required (Steffen & Spaulding, 2007). Moreover, teachers must instill an attitude of safety in their students, so the students understand safe work habits, and have an attitude of working safely; those are the type of students that employers want to hire (Ewing, 2016). According to Hubert et al, (2003), if teachers fail to promote and follow safety procedures, students may very well likely also follow suit. Without competent and knowledgeable agricultural teachers, the agricultural mechanics laboratory can quickly become an underutilized and unsafe environment (McKim & Saucier, 2011). “When assessing working conditions, the teacher should be identifying the safety guards and preventative measures in place to protect the student from an injury” (Lawver & Pate, 2016, p. 19). As a training ground for the world- of -work, agricultural mechanics teachers must provide a safe teaching and learning environment while simultaneously preparing students to work safely and successfully in school as well as transfer those assets on-the-job (Threeton et al., 2015). Shinn (1997) recommends safety lessons that simultaneously involved theory and practical exercises to encourage active learning and teamwork. "Therefore, safety is the single most important consideration when teaching in a laboratory environment (Dyer & Andreasen, 1999) and is the primary responsibility of the teacher" (Gliem & Miller, 1993b; Saucier et al., 2012, p. 137).

Agricultural Mechanics Laboratory Management

"As agricultural mechanic laboratories remain an important component of agricultural education programs (Phipps et al., 2008; Shoulders & Myers, 2012), it is vital that quality learning experiences occur within those environments to provide students with high-quality agricultural education instruction" (Wells et al., 2013, p. 223). Educational laboratories are part of the three-circle model which consists of classroom and laboratory instruction, Supervised Agricultural Experience (SAE), and leadership development and personal growth through FFA (Phipps et al., 2008). Agricultural laboratories are vital educational tools for agriculture mechanic courses and provide students with the opportunity to develop skills and knowledge pertaining to agriculture mechanics (Phipps et al., 2008). "One of the most important issues an instructor in an agricultural education setting faces is safety in the agricultural mechanics laboratory" (Chumbley et al., 2019, p. 1). Agricultural educators are expected to manage the learning environment as well as promote safe practices to control for potential hazards, furthermore, it is also their responsibility to keep themselves, their program, and students safe (Threeton et al., 2015). Agricultural education laboratories allow students to actively engage in scientific analysis and application (Osborne & Dyer, 2000; Saucier et al., 2012). "Paulter (1971) stated that teachers of laboratory subjects require more organizational and management abilities than do classroom teachers" (Johnson & Schumacher, 1989, p. 23). Additinally, Talbert et al. (2006) suggested that by utilizing laboratories, agricultural educators can make a positive difference in students' learning by changing the quality, breadth, and depth of instruction to which they are exposed. "In order for laboratory instruction to occur in a safe environment, the agricultural mechanics teacher must be knowledgeable and competent in managing the laboratory" (Saucier, Terry, & Schumacher, 2009; Saucier, Vincent, & Anderson, 2011; Key, 2019, p. 8). Shinn (1987) noted that the quality of an agricultural education teacher's laboratory instruction directly impacts the effectiveness of the total program. Instructors must be prepared to ensure that students are working in safe conditions which helps to instill good work-related habits in others (Phipps et al., 2008). "Agricultural mechanics curricula and laboratories can serve as excellent vehicles for a multitude of teaching and learning purposes, including facilitating thinking and reasoning skills" (Pate & Miller, 2011; Blackburn & Robinson, 2017; Chumbley et al., 2019, p. 64). According to Phipps et al., agricultural science teachers should ensure that laboratory facilities and equipment comply with OSHA standards and should keep SDS files for reference as needed. Documentation of safety instruction is the most important competency that a secondary agriculture teacher must possess in order to effectively manage an agricultural mechanics laboratory (Phipps et al., 2008). Additionally, for laboratories to be beneficial, they need to duplicate real-life situations as close as possible, supply enough materials, and provide enough space to perform educational tasks (Blackburn & Kelsey, 2012; Byrd, Anderson, & Paulsen, 2015; Key, 2019). Moreover, Saucier et al. (2014) suggested that pre-service and existing teachers must be properly educated in agricultural mechanics laboratory management to provide a safe and efficient laboratory learning environment for agricultural mechanics students.

Instructors in agricultural education settings have a unique opportunity to cultivate a climate of safety amongst their students, which should be a belief when considering the high expectations of the students for safe working practices and conditions (Phipps et al., 2008). According to Chumbley et al. (2019) identifying and cultivating a culture of safety in students will allow those students entering the classroom to have appropriate safety competencies, ultimately, helping to lead to reduced accidents in the workplace. “Developing a deeper understanding of the safety climate in an educational laboratory environment, along with the safety-related attitudes and perceptions of the students, is paramount to addressing safety needs” (Chumbley et al., 2019, p. 64). According to a study conducted by Chumbley et al., they concluded that students value safe working environments and help maintain a culture of safety within laboratory settings. Johnson and Schumacher (1989) conducted a study that examined agricultural mechanics specialists’ identification and evaluation of agricultural mechanics laboratory management competencies. The specialists involved in this study were all postsecondary, college, and university agricultural mechanics experts serving on the National FFA Agricultural Mechanics Contest Committee during the 1986-87 school years (Perry, 2010). From this research, the specialists compiled a list of competencies that were representative of their perceptions in regard to the skills needed by high school agricultural teachers in order to effectively manage an agricultural mechanics laboratory (Perry, 2010). The experts determined that the top five management competencies of a secondary agriculture teacher were to provide and document safety instruction, store hazardous materials safely, update course offerings, safely arrange shop equipment, and conduct safety inspections. The overall consensus was that safety was the most important factor in laboratory management (Perry, 2010). Eleven of the top 18 competencies identified by the respondents were safety related (Johnson & Schumacher, 1989). Therefore, efficient management of the agricultural mechanics laboratory is essential if optimal student learning is to occur (Bear & Hoerner, 1986; Johnson & Schumacher, 1989).

Safety Concerns in the Agricultural Mechanics Laboratory

For agricultural mechanic laboratories to be effective they need to authentically duplicate real-life situations as closely as possible, contain adequate supplies, and have sufficient space for experiential learning activities (Sutphin, 1984; Shinn, 1987). Agricultural mechanical laboratories are filled with potentially dangerous tools, equipment, processes, materials, and supplies, within a wide range of environmental conditions, which are difficult to control (Threeton et al., 2015). Since students in agricultural mechanics laboratories are exposed to metal working, wood working, power machinery, chemicals, and other processes that could pose serious injury to the students and teachers (Chumbley, 2015). Saucier et al. (2014), suggested that without adequately sized and safe working conditions, agricultural mechanics laboratories may lead to more accidents and reduced learning opportunities for the students using them. Overcrowding in the classes, can also lead to a potential increase in safety hazards (Saucier et al., 2014).

One important factor in the agricultural mechanics laboratory is having proper guards on all power machinery (United States Department of Labor, n.d.). One or more methods of machinery guarding should be provided to protect the operator from hazards such as rotating parts, flying chips, and sparks (United States Department of Labor, n.d.). Hazardous chemicals are another hazard in the agricultural laboratory which can include irritants, corrosives, and agents that may damage lungs, skins, and eyes (OSHA, n.d.). According to OSHA, all containers must be clearly labeled and stored properly according to their SDS. Also, within agricultural laboratories, compressed gases can most likely be found and can be toxic, flammable, oxidizing, and corrosive (OSHA, n.d.). Leakage of any of these compressed gases can be dangerous as well (OSHA, n. d.).

Another important factor in the agricultural mechanics laboratory is, personal protective equipment (PPE) which helps keep the welding operator free from injury, such as burns and exposure to arc rays (Lincoln Electric, n.d.). The correct PPE allows for freedom of movement while still providing adequate protection from welding hazards (Lincoln Electric, n.d.). Also, according to G. M. Miller (1988) vocational agricultural teachers should be concerned with student exposure to noise in the agricultural mechanics laboratory. Potentially damaging levels of constant noise were recorded during previous studies (Woodlord et al., 1993). Not to mention, there are two types of hearing protection available for students, earmuffs and ear plugs; ear muffs are more effective, but the level of protection varies due to differences in size, shape, seal material, shell mass, and type of suspension (National Ag Safety Database, n.d.). Woodlard, Lawrence, and Bartug also stated that regardless of the specific mechanism utilized, agricultural mechanic teachers educating in areas involving high noise levels should have knowledge of the effects of noise on hearing.

In any welding situation, welding operators should pay close attention to safety information on the products being used such as the SDS provided (Lincoln Electric, n.d.). Acute exposure to welding fume and gases can result in eye, nose and throat irritation, dizziness, and nausea (OSHA Fact Sheet, n.d.). Moreover, prolonged exposure to welding fume may cause lung damage and various types of cancer, including lung, larynx, and urinary tract (OSHA Fact Sheet, n. d.). When in a welding environment of a vocational agricultural mechanics laboratory, smoke will indicate that ventilation is inadequate, which may lead to health hazards of the students and teachers (Carr, Lindhardt, & Weston, 1982). Furthermore, the use of adequate ventilation to effectively remove the fumes and gases produced and to supply sufficient clean air to the welder is of utmost importance (Lincoln Electric, n.d.). Welding fumes contain potentially harmful complex metal oxide compounds from consumables and base metal coatings, so it's important to keep the welder's head out of the fumes and use enough ventilation to control exposure to substances (Lincoln Electric, n.d.). Carr, Lindhardt, and Weston determined that iron oxide, carbon monoxide, and ozone were contaminants which might be present in a vocational agriculture mechanics laboratory during arc welding. The welding arc creates extreme temperatures and can pose a significant fire or explosion hazard if safe practices are not followed (Lincoln Electric, n.d.). Lincoln Electric suggests to prevent fires, students must inspect the work area before beginning to weld for any flammable materials and remove them. Flammable materials are comprised of three categories: liquid, solid, and gas (Lincoln Electric, n.d.). Electric shock is also one of the most serious and immediate risks facing a welder (Lincoln Electric, n.d.). Electric shock can lead to severe injury or death, either from the shock itself or from the fall caused by the reaction to the shock (Lincoln Electric, n.d.). Electric shock occurs when a welder touches two metal objects that have a voltage between them, therefore inserting themselves into the electrical circuit (Lincoln Electric, n.d.).

Agricultural Mechanics in the Twenty-First Industry Workforce

Based on the results of a 2006 national survey of over 400 employers, high school graduates are "woefully ill-prepared" to enter today's highly technical workplace (Casner-Lotto & Barrington, 2006, p. 9). Not to mention, the agricultural industry has indicated a desire for entry-level employees to possess basic mechanical skills (Ramsey & Edwards, 2011). Ramsey and Edwards found that selected agricultural industry experts expect students to learn entry-level technical skills before entering workforce. Skilled workers that are ready for successful employment in the agricultural industry is what the ideal result is (Roberts & Ball, 2009).

Moreover, there is a strong demand for individuals with knowledge and skills in agricultural, food, and natural resources (AFNR) paired with proficiency in science, technology, engineering, and mathematics (STEM) concepts (Scherer et al., 2019). "Agricultural education teachers have been teaching science, technology, engineering, and mathematics since the late 19th century" (Boone, 2013, p. 2). According to DiBenedetto (2015) STEM has become a critical component to discussions in education and industry. Emphasizing STEM in agricultural education isn't about changing what is taught or drastically how it's taught, but about increasing communication with other realms of education and using a common language to describe what happens in agriculture programs (Blythe, 2015). Furthermore, anyone who has ever taken a welding class, small engines, construction, agricultural power, or structures class knows how big a part engineering plays in these classes (McDonald, 2013). To more fully prepare students in the United States to enter the globally competitive workforce, STEM integration allows students to make connections between the abstract concepts learned in core subject classrooms and real-world situations (Wooten et al., 2013). This is built on the notion that the fields of STEM provide numerous opportunities for the integration of ideas which provide meaningful, robust, and context-rich settings for learning and help prepare students for college and careers (Campbell, 2015). Wingenbach, White, Degenhart, Pannkuk, and Kujawski (2007) stated that, CTE teachers are essential in helping the United States develop a 21st-century workforce that will be competitive in the world marketplace (Leiby et al., 2013).

In addition, with STEM concepts, the modern workplace requires workers to have various cognitive and affective skills, these skills are more referred to as 21st century skills (National Research Council, 2011). Agriculture teachers teaching in the twenty first century must have exposure to and have knowledge of the technology which await those individuals entering an ever-changing agricultural industry (Hubert, 1996). Educating students in STEM subjects has become fundamental to providing them with a foundation for successful employment in the 21st century (DiBenedetto, 2015). According to DiBenedetto, students develop teamwork, critical thinking, problem solving, and communication skills that are necessary for successful entry into college and careers. Agriculture students are successful because they learn STEM concepts in the context of real-life agriculture practices (Boone, 2013).

Scherer et al. (2019) stated that the progress and prosperity within the United States cannot remain strong if young people are not STEM-literate and well prepared to enter the workforce of STEM professionals. By encouraging students to integrate STEM learning into all areas of agricultural education, agricultural educators can create a well-rounded, career-ready learner (Rada, 2015). Interdisciplinary collaboration through AFNR and STEM can assist in preparing students to be college and career ready (DiBenedetto, 2015). Within this understanding, teaching STEM through AFNR contexts is a required component to prepare students to learn about, address challenges within, and be successfully employed by 21st century workplaces (Scherer et al., 2019). Many aspects of STEM are naturally highlighted and integrated into the curriculum through the three-circle model of the school-based agricultural education program (DiBenedetto, 2015). Stakeholders within agricultural mechanics generally agree that the industry is continuously changing, and that agricultural mechanics curriculum needs to evolve with the fast paced industry (Shultz et al, 2014).

Theoretical Framework

To guide this study, researchers utilized three theories: Bandura’s Social Learning Theory, Operant Conditioning, and Protection Motivation Theory.

Bandura’s Social Learning Theory

Bandura’s Social Learning Theory can be described as the bridge between traditional learning and cognitive approach because it encompasses attention, memory, and motivation (McLeod, 2016). Social Learning Theory suggests that people learn from one another via observation, imitation, and modeling (Nabavi, 2012). Identification is different to imitation as it may involve several behaviors being adopted, whereas, imitation usually involves replicating a single behavior (McLeod, 2016). Identification occurs when a person observes behaviors, values, beliefs and attitudes of the person with whom they are identifying (McLeod, 2016). According to Nabavi, the people who are being observed are called models and the process of learning is called modeling. If a person imitates the model's behavior and the consequences are rewarding, the person is likely to continue performing the behavior (McLeod, 2016). Bandura stated that imitation and behavior modeling will occur if a person observes positive, desired outcomes (Nabavi, 2012). According to McLeod, this is because it focuses on how mental factors are involved in learning. McLeod (2016) also stated that Bandura believes that humans are active information processors and think about the relationship between their behavior and its consequences. The social learning approach takes thought processes into account and recognizes the role that they play in deciding if a behavior should be imitated or not (McLeod, 2016).

There are four processes proposed by Bandura for the modeling process where the first is attention (McLeod, 2016). Attention is the extent to which people are exposed to behavior for it to be imitated (McLeod, 2016). Second is retention, meaning how well the behavior is remembered (McLeod, 2016). As stated by McLeod, the behavior may not be noticed but it is not always remembered which prevents imitation. The third process is reproduction which is the ability to perform the behavior that the model just demonstrated (McLeod, 2016). A model can be a live model which involves an actual individual demonstrating or acting out a behavior, verbal instructional which involves descriptions and explanations of a behavior, or a symbolic which involves real or fictional characters displaying behaviors (Nabavi, 2012). Finally, the fourth process is motivation when the behavior is performed, and there will be rewards or punishments that follow the behavior (McLeod, 2016). According to Muro and Jeffrey (2008) this kind of learning also emphasizes on internal thoughts and cognitions and it can help connect learning theories to cognitive development theories.

When students are in agricultural education programs, they are looking up to the agricultural science teacher, which in this case can be called the model. If the model is not working or behaving unprofessionally, the students will act the same way. Especially in the agricultural mechanics laboratory, if the instructor is not practicing safety procedures, then the students will most likely follow suit. It is the instructor's responsibility to practice safe procedures and set a good example for their students.

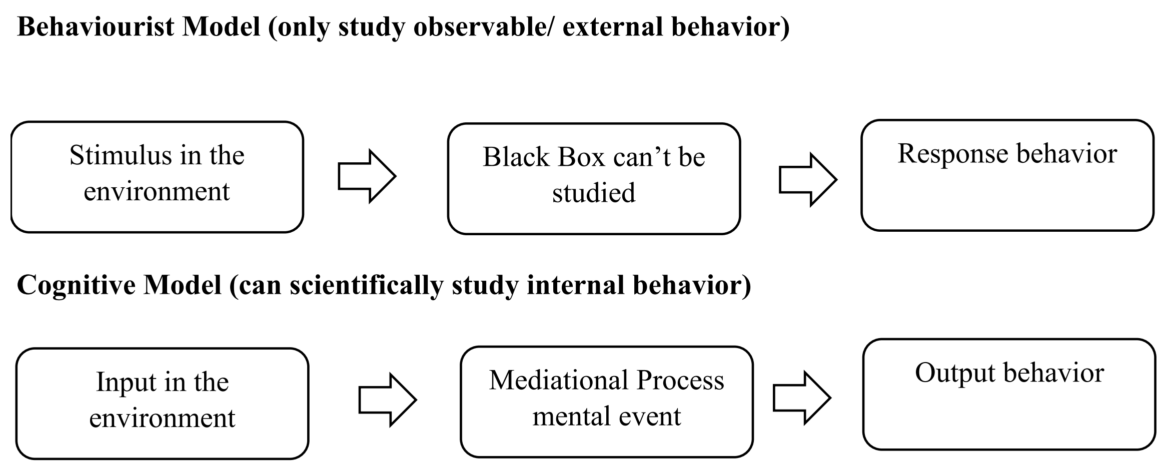

Figure 1

Bandura's Social Learning Theory Model

Operant Conditioning

The work of B. F. Skinner was rooted in a view that classical conditioning was far too simplistic to be a complete explanation of complex human behavior (Skinner, 1948). He believed that the best way to understand behavior is to look at the causes of an action and its consequences (Skinner, 1948). He called this approach operant conditioning (Skinner, 1948). Skinner's theory of operant conditioning is built on the ideas of Edward Thorndike (McLeod, 2018a). Edward Thorndike put forward a law of effect which states that any behavior that is followed by pleasant consequences is likely to be repeated, and any behavior followed by unpleasant consequences is likely to be stopped (McLeod, 2018a). According to McLeod (2018b), operant conditioning is a method of learning that occurs through rewards and punishments for a behavior. Skinner introduced a new term into the Law of Effect – Reinforcement. McLeod (2018b) also states, a positive reinforcement strengthens a behavior by providing a consequence an individual finds rewarding. On the other hand, a negative reinforcement is the removal of an unpleasant reinforcer because it removes the adverse stimulus which is rewarding (McLeod, 2018b). Skinner (1938), states that certain kinds of consequences reinforce behavior in the sense of strengthening it or making it more likely to occur again.

According to McLeod (2018b), there are neutral operant which are responses from the environment that neither increase nor decrease the probability of a behavior being repeated. Reinforcement strengthens a behavior by providing a consequence an individual finds rewarding (McLeod, 2018b). The removal of an unpleasant reinforcer can also strengthen behavior (McLeod, 2018b). This is known as negative reinforcement because it is the removal of an adverse stimulus which is ‘rewarding’ to the person (McLeod, 2018b). Negative reinforcement also strengthens behavior because it stops or removes an unpleasant experience (McLeod, 2018b). Reinforcement and punishment take place almost every day in natural settings as well as in more structured settings such as the classroom (Cherry, 2019). Skinner believed that it was not really necessary to look at internal thoughts and motivations in order to explain behavior (Cherry, 2019). Instead, he suggested, we should look only at the external, observable causes of human behavior (Cherry, 2019).

When students are in the agricultural mechanics laboratory and they are working unsafely, they must be punished for it. If students continue to work in the laboratory unsafely and do not get punished for it, they will continue to make that mistake and form unsafe habits. It is the agricultural mechanics teachers' responsibility to punish and reward the students properly.

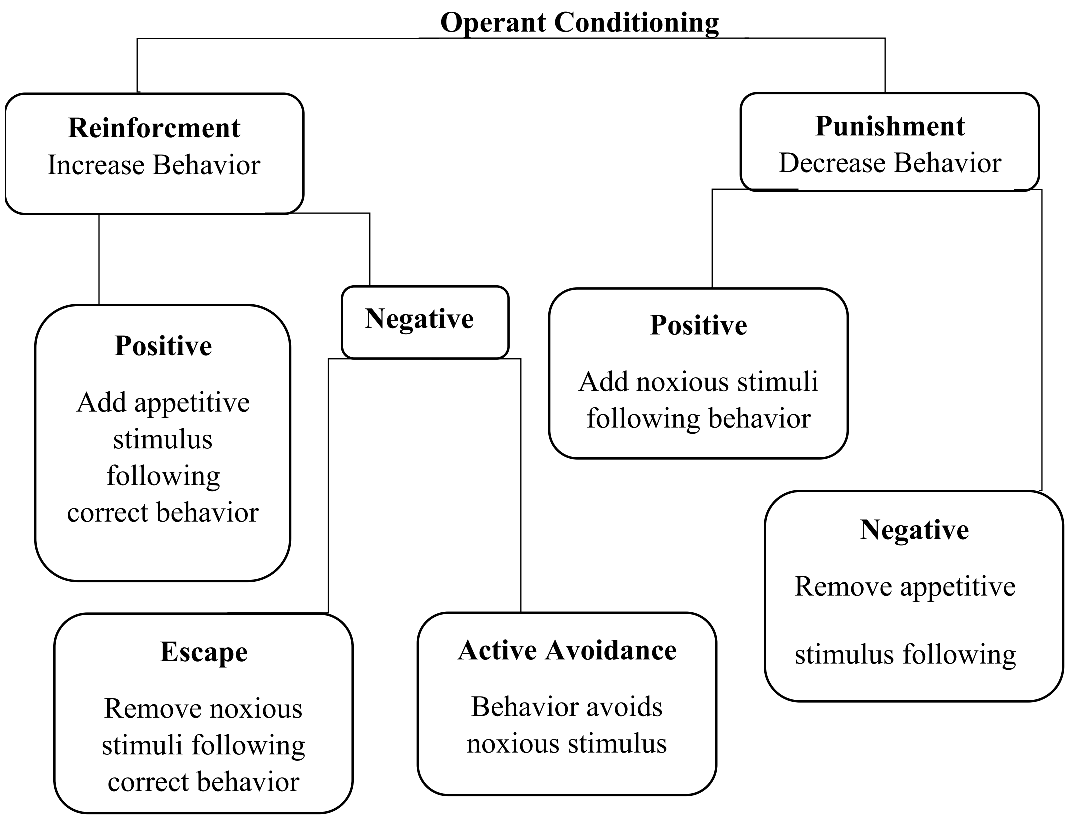

Figure 2

Operant Conditioning Model

Protection Motivation Theory

The Protection Motivation Theory was originally developed for the health promotion prevention sector and describes how individuals are motivated to react in a protective way towards a perceived threat (Rogers, 1975). This theory can be applied to "any threat for which there is an effective recommended response that can be carried out by the individual" (Floyd et al., 2000, p. 409). This theory has four key elements, threat appraisal, coping appraisal, response efficacy, and self-efficacy (Westcott et al., 2017). Response efficacy is the belief that certain processes will mitigate the threat and self-efficacy is an individual's idea of their own ability to implement the required actions to mitigate the threat (Westcott et al., 2017). The objective of the Protection Motivation Theory is to recognize and assess the danger, and then counter the assessment with effective and efficient options (Westcott et al., 2017). In general, Protection Motivation Theory states that being motivated to protect oneself requires not only adequate risk perception, but also the tools and skills to take preventative action (Inouye, 2003). Thus, the protection motivation concept involves any threat for which there is an effective recommended response that can be carried out by the individual (Floyd et al., 2000).

With so many dangerous elements in the agricultural mechanics laboratory, students and teachers but be conscious of what they are doing. They must protect themselves from the different elements of the laboratory and think clearly about what they are doing and if it is safe or not. Students must be able to recognize and assess the danger and then realize their options for the safest outcome.

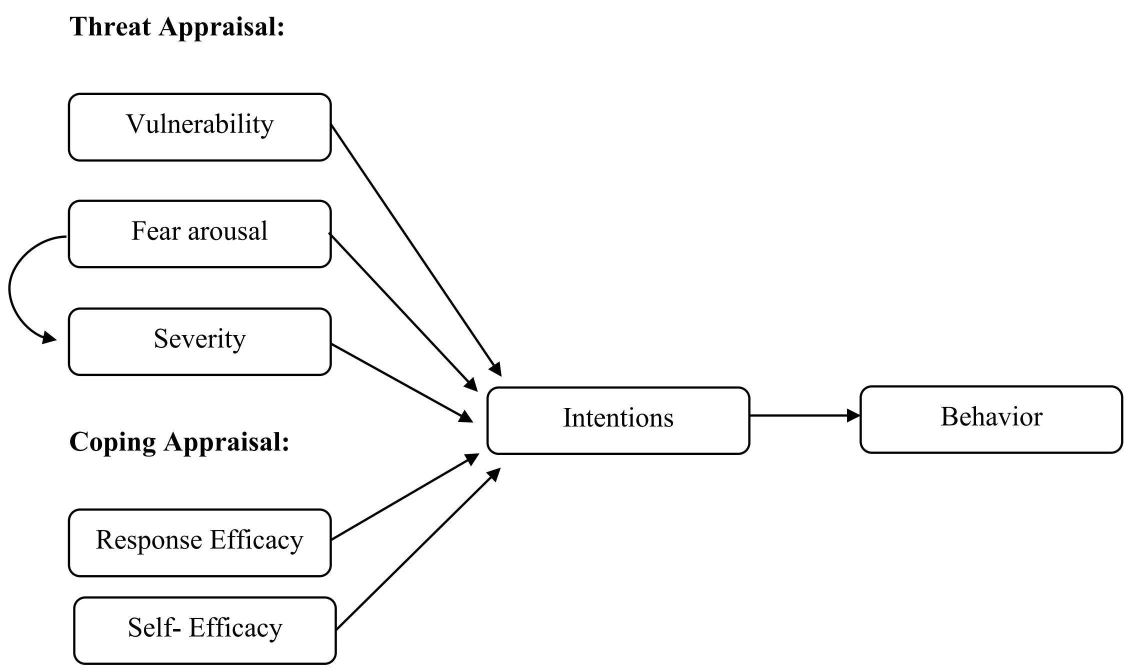

Figure 3

Protection Motivation Theory Model

Summary

Agricultural education in public schools was predominantly viewed as a vocational education program since its early beginnings (Phipps et al., 2008). Agricultural education prepares students for successful careers and a lifetime of educated choices in the global agriculture, food, fiber and natural resources (National FFA, n.d. A). Three acts that predominantly influenced the agricultural education programs was the Smith-Hughes Act of 1917, the Vocational Education Act of 1963, and the Carl Perkins Act of 1984 (Phipps et al., 2008). Agricultural education is delivered through three major components: classroom/laboratory, Supervised Agricultural Experience (SAE) programs, and student leadership organizations (FFA), this is also known as the three-circle model (National FFA, n.d. A). One vital part of the three-circle model is agricultural mechanics. Agricultural mechanics content provides students with opportunities to engage in hands-on learning experiences that accentuate cognitive development, mechanical skill achievement, and academic concept application through a technology-rich context (Hubert & Leising, 2000; Parr et al. 2009; Wells et al., 2013). Students have the opportunity to participate in many competitions nationally and in Texas. The national FFA hosts the National Agricultural Technology and Mechanical Systems (ATMS) CDE for students to practice and improve their skills related to agricultural mechanics curriculum (National FFA, n.d. C). Additionally, the Texas FFA Association hosts hands-on contests that test the knowledge and skills taught in these agricultural mechanics related courses (Key, 2019). These contests include: ATMS CDE, Tractor Tech, welding contests, trailer build offs, and project shows. Furthermore, teacher preparation programs should focus on providing a high level of technical skill training in agricultural mechanics and strive to increase students' confidence to teach it effectively because producing and retaining highly qualified teachers is imperative to the success of the United States as a country (Wallis, 2008; Leiby et al., 2013). It is imperative that agricultural education teachers become skilled in agricultural mechanics coursework to better prepare the future teachers currently enrolled in secondary programs (Burris, Robinson, & Terry, 2005; Wells et al., 2013). Moreover, agriculture is one of the most dangerous occupations in the United States, and unlike other industries, children and adolescents make up a substantial portion of the agricultural workforce (Rivara, 1997; Perry, 2010). Agricultural teachers must make sure that they are keeping the environment as safe as possible; just as important, they need to make sure students are properly taught how to work safely in such an environment (Ewing, 2016). If agricultural educators are to complete their moral and legal obligation to the students, it is essential for agricultural teachers to exhibit safe practices and behaviors, thus, creating a positive safety climate, not only while the student is in school, but also when they enter the workforce (Hubert et al., 2000). Agricultural laboratories are vital educational tools for agriculture mechanic courses and provide students with the opportunity to develop skills and knowledge pertaining to agriculture mechanics (Phipps et al., 2008). Agricultural mechanical laboratories are filled with potentially dangerous tools, equipment, processes, materials, and supplies, within a wide range of environmental conditions, which are difficult to control (Threeton et al., 2015). According to Phipps et al. (2008), agricultural science teachers should ensure that laboratory facilities and equipment comply with OSHA standards and should keep SDS files for reference as needed. Likewise, Chumbley et al. (2019) stated that identifying and cultivating a culture of safety in students will allow those students entering the classroom to have appropriate safety competencies, ultimately, helping to lead to reduced accidents in the workplace. Moreover, there is a strong demand for individuals with knowledge and skills in agricultural, food, and natural resources (AFNR) paired with proficiency in science, technology, engineering, and mathematics (STEM) concepts (Scherer et al., 2019). To more fully prepare students in the United States to enter the globally competitive workforce, STEM integration allows students to make connections between the abstract concepts learned in core subject classrooms and real-world situations (Wooten et al., 2013).

CHAPTER III

Methodology

This chapter is comprised of the procedures and methods utilized to collect, measure, and analyze data. Specifically, the research design, population, accounting for measurement error, and data collection. Additionally, data analysis for each research question in this study was addressed.

Purpose of the Study

The purpose of this study is to determine the safe working conditions in Texas agricultural mechanics laboratories. Also, this study will determine the personal (age, gender and ethnicity), professional (highest degree earned, type of teaching certification, years of agricultural mechanics teaching experience, and what grade levels are taught), and program demographics (total number of students in high school, total number of students enrolled in agricultural program, total number of students enrolled in agricultural mechanics classes, agricultural mechanics classes offered, square footage of agricultural mechanics laboratory, age of agricultural mechanics laboratory, budget allotments for the agricultural mechanics laboratory, source of money for the budget, presence of an adult support group, and number of students per agricultural mechanics laboratory class) of Texas school-based agricultural mechanics programs and the instructors who teach within them. Furthermore, this study will evaluate the self-assessed safety conditions (general safety conditions, general appearance, personal protective equipment, condition of hand and power tools, electrical, fire safety, compressed gas cylinders safety, and storage) in selected Texas school-based agricultural mechanics laboratories.

Research Objectives

This study will be guided by the following research objectives:

1. Determine the personal (age, gender, and ethnicity), professional (highest degree earned, type of teaching certification, years of agricultural mechanics teaching experience, and grade levels taught), and program demographics (school's UIL ranking, total number of students enrolled in the agricultural program, total number of students enrolled in agricultural mechanics classes, agricultural mechanics classes offered, square footage of the agricultural mechanics laboratory, age of the agricultural mechanics laboratory, budget allotment for the agricultural mechanics laboratory, source of budget, the presence of an adult support group, the average number of students enrolled in each agricultural mechanics laboratory class, and the safety procedures if there is a student emergency) of selected Texas school-based agricultural mechanics programs and the instructors who teach within them.
2. Determine the self-assessed safety conditions (general safety conditions, general appearance, personal protective equipment, condition of hand and power tools, electrical, fire safety, compressed gas cylinders safety, and storage) in selected Texas school-based agricultural mechanics laboratories.

Research Design

This study utilized descriptive research methods. To accomplish the purpose and objectives of this study, a survey was distributed to agricultural mechanics teachers who instruct in school-based agricultural mechanic laboratories in Texas. As research methodologies describe it, descriptive research is defined as a research method used to describe the existing phenomena as accurately as possible (Atmowardoyo, 2018). *Existing phenomena* makes descriptive research contrary to experiment research which observes not only the existing phenomena, but also the phenomena after a certain treatment (Atmowardoyo, 2018). This method of research is useful for investigating a variety of educational problems and issues (Gay & Airaisan, 2003). Atmowardoyo states that a researcher must collect the available data using research instruments such as test, questionnaire, interview, or even observation. According to Ary, Jacobs, and Sorensen (2009) a survey permits the researcher to summarize the respondent's demographics and to measure their attitudes and opinions toward an issue. An electronic approach towards data collection was used via an online web-based instrument to gather data.

As with all descriptive research, internal and external validity of the study must be addressed. Internal validity ensures that the data collected is accurate and true. To ensure internal validity, measurement error must be minimized, and the researcher must be confident that the instrument used for data collection is precise. According to Burkholder, Cox, Crawford, & Hitchcock (2020) the validity of a research instrument depends on its intended purpose and whether it is used for that purpose. Concerns with validity will be addressed in the validity section.

Population and Sampling

Population

The target population consisted of agricultural science teachers in Texas that taught agricultural mechanics in the 2020-2021 school year. The frame for this study was obtained from Texas teachers that are registered on www.JudgingCard.com for the 2020-2021 school year. To arrive at the target population, all Texas school-based agricultural science teachers (N = 2,407) were surveyed to determine if they taught any agricultural mechanics courses in the 2020-2021 school year. This group was contacted up to five times using the Tailored Design Method (Dillman, Smyth, & Christian, 2014). The Tailored Design Method (2014) was used for its multiple motivational features in supportive ways to encourage high quantity and quality of response to a survey. The first contact was an e-mail pre-notice. Next, there was up to three invitations for participants to complete the online data collection instrument. This process yielded a response rate of 44% (N = 1,066). Of those who responded, 617 (58%) of the agricultural science teachers stated that they taught agricultural mechanics in the 2020-2021 school year. This group formed the population for this study.

A random sample of the population was used for multiple reasons. First, all teachers were accessible because of the availability of their school e-mail addresses through JudgingCard.com. JudgingCard.com is a website where Agriculture Science Teachers register for events for their students to participate in. Secondly, by administering the instrument online, there was a no cost factor as well as convenience and a fast data collection process. The sample size (N= 242) of the population was determined by using the Krejcie and Morgan (1970) sample size table. The Krejcie and Morgan table explains what sample size is needed from the population size to have adequate data collection. From the sample size, 55% (N= 133) of the respondents completed the survey, forming the response rate for this research.

Instrumentation

In developing the instrument for this study, the first step taken was to review and evaluate instruments used in related studies and other resources. Those specifically reviewed included ones by Heinrich, Peterson, and Roos (1980), Ullrich (1996), Perry (2010), OSHA Fact Sheet (n.d.), and OSHA laboratory safety guidance (n.d.). Upon the completion of reviewing the selected resources, the researcher compiled and revised questions and specific items addressing eight major components of safety in agricultural mechanics laboratory programs.

A link to the instrument used for data collection titled *Selected Texas School-Based Agricultural Mechanics Laboratory Condition Survey* (Appendix A) was sent to the participants to gather information. A web-based instrument was used due to the advantages it offers over other data collection methods in terms of response, data analysis, expenses, and accessibility. The instrument developed by the researcher was distributed using Qualtrics TM, a web-hosted software application.

The *Selected Texas School-Based Agricultural Mechanics Laboratory Condition Survey* included questions concerning the demographics of the school-based agricultural mechanics teacher and the agricultural education program. Participants were asked personal demographic questions such as age, sex, ethnicity, highest level of education, type of teaching certification completed, grade levels taught during the 2020-2021 academic school year, and years of teaching agricultural mechanics related Career Technology Education (CTE) courses. The survey also requested information concerning the school and agricultural program such as the University Interscholastic League (UIL) ranking of the high school. The UIL ranking of the school is determined by how many students are enrolled, a 6A school has the most students while a 1A ranked school has the least. Also, the average number of students per agricultural mechanics class, total number of students enrolled in the agricultural education program and the total number of students enrolled in agricultural mechanic classes. The survey also asked what agricultural mechanics classes were offered, the annual budget allocated for agricultural mechanics instruction and related activities, the source of that budget for agricultural mechanics instruction, and if there is an adult support group for the program.

The next questions of the demographic section asked if an incident report is required by the school district after an accident occurs in the laboratory, whether the safety issue is corrected if an accident occurs, and if students are required to pass a safety exam with 100% accuracy before they are allowed to work in the agricultural mechanics laboratory. Next, it was asked if prior to students working with power and hand tools if they are required to demonstrate safe working practices, and if that demonstration is documented. Finally, participants were asked what the school's procedure is for handling a student medical emergency that occurs in the agricultural mechanics laboratory, as well as the size in square footage and the age of the agricultural mechanics laboratory used for educational purposes at their school.

The survey sought to determine information regarding eight specific sections of the school-based agricultural mechanics laboratory. Section One was compiled of general safety questions concerning the agricultural mechanics laboratory such as is if SDS were current, if student evacuation plans were posted, if first aid supplies were available, if emergency shower and eye wash stations were present, if there was painted safety lanes around breaker boxes and stationary power tools, and if there was safety signage posted in the agricultural mechanics laboratory. The next part of this section sought to determine whether the laboratory had at least two exits with signs, the presence of ventilation systems, and if the lighting was safe and shielded. Furthermore, the survey asked if there was welding flash shields and if they were portable, if there was a cooling bucket for hot metal work, and the placement of trash cans were not near working areas in the agricultural mechanics laboratory.

The following section of the survey focused on the general appearance of the agricultural mechanics laboratory such as if stairways were safe from any obstructions and if they were illuminated and if the laboratory appeared neat/orderly. Next, it was asked if the color of the walls reflected welding flash, if there was currently any tripping hazards, and if the hand washing facilities were clean/functional in the agricultural mechanics laboratory.

The third section of the survey included questions about personal protective equipment (PPE) available in the agricultural mechanics laboratory. For instance, if ANSI Z87 safety glasses were provided to the students and how they were stored, it was also asked if clear face shields were provided, and if hearing protection was provided to the students. Furthermore, the participants were asked if there was welding gloves, aprons, jackets and overalls available for the students to use in the agricultural mechanics laboratory. Next, I was asked if breathing protection was available to the students, if arc welding helmets were provided, and if oxyfuel goggles/face shields were provided to students in the agricultural mechanics laboratory.

Moreover, the next section of the survey focused on the tools in the agricultural mechanics laboratory. The participants were asked if the stationary power tools had mounting holes and if they were anchored to the floor, and if emergency stop switches were within easy reach on the stationary power tools. It was also asked if proper kickback devices and push stick were used and available at the table saw, and if factory guards were in place on stationary power tools. Next the participants were asked if roller units or stands were available to assist in moving materials, and if all handheld powered tools were equipped with a constant pressure switch that shuts off power when released. If the participants answered no to not all handheld powered tools were equipped with a constant pressure switch, they were asked to list the tools. Moreover, it was asked if all portable electrically powered and stationary power tools were properly grounded, portable power tools and equipment were stored when not in use. Finally, the participants were asked to rate the condition of the stationary power tools, handheld power tools, and hand tools in the agricultural mechanics laboratory by using a Likert-type scale. The response scale included: (a) Excellent, (b) Good, (c) Fair, and (d) Not Functional/Unsafe.

The fifth section of the survey included the electrical components of the agricultural mechanics laboratory, the participants were asked if circuit breaker box/electrical cabinets were present and if they were locked/inaccessible to students as well as properly marked/covered. Additionally, it was asked if Ground Fault Circuit Interrupter (GFCI) outlets were installed in the agricultural mechanics laboratory, if extension cords were in safe working conditions, and if each welder was equipped with a disconnecting switch with overcurrent protection.

In addition, the next section included questions about fire safety in the agricultural mechanics laboratory. These questions were if there were fire alarms installed in the agricultural mechanics laboratory and how often they were checked. Next it was asked if fire extinguishers were available, how many there was and if they were the proper type, and available at locations where flammable or combustible liquids were stored. Lastly, participants were asked if there was a fire blankets readily available in the agricultural mechanics laboratory.

Section seven consisted of questions related to compressed gas cylinders. Such as if oxyfuel cylinders were being stored separately at least 20' apart or separated by a 5' wall, if the cylinders were secured and capped in an upright position when not in use, and the cylinder labeling was clearly marked. Next, it was asked if the cylinders were stored away from highly flammable substances, if the cylinders were upright/anchored when in use, if all cylinder's equipment was kept free from oily/greasy substances, and if the gauges on the oxygen bottles were marked *use no oil*.

Finally, the last section included questions about storage in the agricultural mechanics laboratory. Participants were asked if an approved flammable storage cabinet and brooms and dust pans were available. Participants were also asked to rate how safely organized their tool room was by using a Likert-type scale. The response scale included: (a) Excellent, (b) Good, (c) Fair, and (d) Poor. Next, it was asked if lumber and metal was organized when not in use, if chemicals were stored correctly according to Safety Data Sheets, if there were safety cans used for flammable and/or combustible liquids and if those cans were labeled correctly. Lastly, it was asked if combustible wastes such as rags were kept in covered metal containers, all flammable storage cabinets were labeled in conspicuous lettering stating *flammable-keep fire away*, if all chemical containers were properly labeled, and if there was an falling hazards in the agricultural mechanics laboratory.

Accounting for Measurement Error

When conducting research and data collection, a researcher must consider the possibility of error. Measurement error depends on the methods employed to gather information and the way that information is used (Miller, P. V., 2011). Unfortunately, error can never be fully eliminated, but if measurement error is recognized, it can be minimized. According to P. V. Miller (2011), the way in which questions are communicated to respondents can influence measurement error. To improve the response rate, self-administered questionnaires should be easily understood and clear because there is no interviewer present to answer questions or provide clarification (Burkholder et al., 2020). In this study, several steps were taken to minimize the amount of measurement error and to ensure validity and reliability. One step taken included writing the questions in the instrument in a format so the participants would understand what was being asked of them.

Validity of the Selected Texas School-Based Agricultural Mechanics Laboratory Condition Survey

According to (Fraenkel, Wallen, & Hyun, 2012) validity is the most important idea to consider when preparing an instrument for use. For this study, the researcher focused on face and content validity to determine the validity of the *Selected Texas School-Based Agricultural Mechanics Laboratory Condition Survey.*

Validity refers to the degree to which evidence supports any inferences a researcher makes based on the data that is collected (Fraenkel et al., 2012). Face validity refers to whether a survey instrument appears to reasonably measure what it claims to measure (Burkholder et al., 2020). Also, according to Muijs (2013), face validity is used to determine if the survey looks valid. Content validity refers to whether the content of the survey is appropriate to measure the concept of what is trying to be measured. The validity of a research instrument depends on its intended purpose and whether it is used for that purpose (Burkholder et al., 2020).

To ensure that the instrument used was carefully designed to minimize systematic error, a panel of experts in the field reviewed it. The panel of experts (Appendix B) were comprised of four university faculty members familiar with agricultural mechanics and agricultural education, as well as two experienced high school agricultural mechanics teachers. These individuals were chosen for the panel because of their expertise in the field. The researcher provided the panel with an explanation of the purpose and research objectives which the instrument was structured around (Appendix C). The purpose and research objectives were given to the panel so they would have a better understanding of the reason for the study. The panel of experts were asked to give feedback based on the overall instrument, so systematic error could be reduced (Appendix D).

Pilot Testing

Pilot testing is frequently used to determine the reliability of an instrument and data collection. The objective of a pilot test is to identify potential problems and address them prior to the survey to reduce the amount of measurement error (Rothgeb, 2011). Pilot testing is one of the most critical aspects of a survey to result in reliable survey data

(Rothgeb, 2011). According to Rothgeb, the pilot test procedures should mirror the procedures that will be used in the distribution of the actual survey.

Prior to distributing the online survey to the target population, a pilot study was conducted with 30 agricultural mechanics teachers in Texas. These teachers were chosen at random using randomizer.org from the target population, and because they were chosen from the same population, they will not be included in the official survey data.

Members of the pilot test were asked, via e-mail, to complete the survey. Of the 30 teachers contacted, 15 (50%) completed the instrument.

Reliability of the Selected Texas School-Based Agricultural Mechanics Laboratory Condition Survey

Reliability refers to the extent to which findings and results are consistent across research using the same method of data collection and analysis (Burkholder et al., 2020). There are multiple methods utilized for determining the reliability of an instrument, for this study, *Cronbach's Alpha* was used to calculate the pilot test data. *Cronbach's alpha* was developed by Lee Cronbach in 1951 from an earlier internal consistency formula (Johnson & Christensen, 2012). Cronbach's alpha, also known as coefficient alpha, provides a reliability estimate that can be thought of as the average of all possible correlations (Johnson & Christensen, 2012). Coefficient alpha can also be explained as a measurement of internal consistency, which is how closely related a set of items are as a group (Institute for Digital Research & Education, n.d.). The alpha coefficient of reliability ranges from 0 to 1 in providing an overall assessment of a measure's reliability, the higher the coefficient, the more the items have shared covariance (University of Virginia Library, 2020). Johnson and Christensen explain a popular rule of thumb is that the size of the coefficient alpha should generally be between .70 and 1. Based on the resulting coefficients, it was found that the instrument was deemed reliable.

Institution Approval

Before implementing the survey, the researcher submitted a plan of the data collection to the Sam Houston State University Institutional Review Board (IRB). After receiving approval, data collection began, and a project number, 2019-347, was given to identity the study.

Data Collection

For this survey, a modified version of the Tailored Designed Method for web survey implementation was used. Usually, this method is used with mailed surveys and includes up to five potential contacts: first contact- a pre-notice letter, second contact- the survey is mailed, third contact- a thank you post card and a reminder to finish the survey, fourth contact- replacement of the survey to non-respondents and urges the recipient to respond, and finally the fifth contact- expressing the importance of a response to the researcher (Dillman et al., 2014). Since this survey was administered using the internet, the five points of contact were modified slightly. Participants were contacted up to five potential times through email from the researcher. Each e-mail that was sent was personalized to the recipients according to the recommendation of Dillman et al. The first contact (Appendix E) with participants was an e-mail message sent four days prior to the beginning of the data collection period on October 22, 2020. In this e-mail, a summary of the research was provided, and participants were asked to contribute to the study.

The second contact (Appendix F) occurred on October 27, 2020. In this e-mail, it explained the importance of their participation in the study and it provided a link to the web-based survey. The e-mail also provided information explaining that participation in the study was voluntary, in accordance with Sam Houston State University IRB policies.

On October 30, 2020, a third contact email was sent with another URL link to the survey. This email (Appendix G) explained the importance of a response and explained that if the participants haven't completed the survey it was urged to do so. According to Dillman et al. (2014), a survey that does not have follow-up contact with the participants typically has lower response rates than those obtained with follow-up.

The fourth contact (Appendix H), with the participants occurred on November 4, 2020, a few days after the last contact. This email was sent to the members of the population that had yet to respond to the survey. They were encouraged to complete the survey prior to the end of the data collection period, November 9, 2020, so they may be included in the drawing for an auto-darkening welding hood. On the day of the deadline, an appreciation email (Appendix I) was sent to everyone that had responded to the survey thanking them for completing the survey.

The instrument features allowed the participants to begin the survey from where they last were instead of requiring them to start over. An incentive was offered to encourage the participants to complete the survey. This incentive was a chance to win one of three auto darkening welding hoods. The participants were told to email the researcher once they completed the survey to have their name put into a drawing for a welding hood. This process was done in correspondence with SHSU IRB guidelines. To ensure a fair process of selecting the winners, Randomizer.org website was used to randomly pick three winners. Once the winners were chosen, they were contacted via email to discuss how to receive the welding hood.

Data Analysis

Data was analyzed primarily using the IBM Statistical Package for the Social Sciences (SPSS) 25.0 for Windows ™. Data analysis methods were determined based upon the scale of measurements for the variables that were analyzed.

Research Objective One

Determine the personal (age, gender and ethnicity), professional (highest degree earned, type of teaching certification, years of agricultural mechanics teaching experience, and grade levels taught), and program demographics (school's UIL ranking, total number of students enrolled in the agricultural program, total number of students enrolled in agricultural mechanics classes, agricultural mechanics classes offered, square footage of the agricultural mechanics laboratory, age of the agricultural mechanics laboratory, budget allotments for the agricultural mechanics laboratory, source of budget, and funds presence of an adult support group, the average number of students enrolled in each agricultural mechanics laboratory class and the safety procedures if there is a student emergency) of the selected Texas school-based agricultural mechanics programs and the instructors who teach within them.

Descriptive statistics were used to describe the data associated with this research question. More specifically, frequency counts and percentages were used to analyze all of the demographic information besides the average number of students enrolled in each agricultural mechanics classes and the size of the agricultural mechanics laboratory. Measures of central tendency (mean) and measures of variability (standard deviation) were used to analyze these demographics.

Research Objective Two

The second research objective was: Determine the self- assessed safety conditions (general safety conditions, general appearance, personal protective equipment, condition of hand and power tools, electrical, fire safety, compressed gas cylinders safety, and storage) in the selected Texas school-based agricultural mechanics laboratories. Descriptive statistics were used to describe data associated with this research question. More specifically, frequency counts and percentages were used to adequately describe nominal and ordinal data.

Nonresponse Analysis

According to Dillman et al. (2014), nonresponse error is the difference between the estimate produced when only some of the sampled units respond compared to when all of them respond. Nonresponse error exists because the people included in the sample fail to provide usable responses (Linder, Murphy, & Briers, 2001). Tuckman (1999) recommended that if the survey response rate is less than 80%, the researcher must try to reach 5 to 10% of the nonrespondents and obtain some data from them. According to Linder et al., nonresponse error should be handled through the systematic application of statistically sound and professionally accepted procedures. Based on results from a study conducted by Linder et al., they recommended three methods to evaluate nonresponse error. The three methods suggested were (a) compare early to late respondents, (b) run a regression using days to respond as the dependent variable, and other key variables as independent, and (c) sample at least twenty nonrespondents in a separate contact for comparison with respondents. Linder et al., indicated that any of these methods are defensible and generally accepted procedures for evaluating nonresponse error.

For this study, the comparison of early to late respondents was used. Miller and Smith (1983) identified that there is a similarity between nonrespondents and late respondents, so one way to estimate the nature of the replies of nonrespondents is through late respondents. To determine if any statistically significant differences were evident, an independent samples t-test was used. The last 30 respondents were compared to the first 103 respondents; it was determined this way based on when the respondents completed the survey. The 103 respondents completed the survey within one week of it being sent to them, the last 30 respondents took longer than that week. There was no statistically significant difference found between the early and late respondents on most of the questions asked. However, there was a significant difference between certain questions from the survey.

An independent samples t-test required the assumption of homogeneity of variance, to run this test, SPSS conveniently included a test called Levene's Test. When the results were computed, the researcher looked at the significance from the Levene's Test, since the significance was lower than 0.05 on the following questions, the researcher read the line of Equal variances not assumed.

In the first section of the survey, general safety, there was a significant difference between early respondents ($M = 1.50$, $SD = .502$) and late respondents ($M = 1.37$, $SD = .49$) conditions; $t\,(92.12) = 2.157$, $p = .034$ for the question *Are the placement of trash cans in the agricultural mechanics laboratory not near working areas?*

Next, the personal protective equipment section had two questions with significant difference. For the question, *Is hearing protection provided for the students in the agricultural mechanics laboratory?* there was a significant difference between early respondents (*M* = 1.40, *SD* = .732) and late respondents (*M* = 1.10, *SD* = .305) conditions; *t* (115.49) = 3.27, *p* = .001. Next, there was a significant difference between early respondents (*M* = 1.29, *SD* = .709) and late respondents (*M* = 1.07, *SD* = .365) conditions; *t* (95.05) = 2.326, *p* = .022 for *Are welding gloves provided for the students in the agricultural mechanics laboratory?*

Furthermore, from the tools section of the survey, results indicated from the *Are proper kickback devices used on the table saw in the agricultural mechanics laboratory?* question showed there was a significant difference between early respondents (*M* = 1.27, *SD* = .447) and late respondents (*M* = 1.10, *SD* = .310) conditions; *t* (64.36) = 2.323, *p* = .023. The following question was *Are push sticks available at the table saw in the agricultural mechanics laboratory?* The results from this question displayed there was a significant difference between early respondents (*M* = 1.17, *SD* = .373) and late respondents (*M* = 1.03, *SD* = 1.86) conditions; *t* (94.34) = 2.591, *p* = .011. Also, there was a significant difference between early respondents (*M* = 1.05, *SD* = .217) and late respondents (*M* = 1.00, *SD* = .000) conditions; *t* (101) = 2.282, *p* = .025 for the question *Are all portable electrically powered tools properly grounded in the agricultural mechanics laboratory?*

Moreover, results from the independent t test from the compressed gas cylinder section showed there was a significant difference between early respondents (*M* = 1.05, *SD* = .219) and late respondents (*M* = 1.00, *SD* = .000) conditions; *t* (99) = 2.283, *p* = .025 for the question of *Are the cylinders secured in an upright position in the agricultural mechanics laboratory when stored?* Next, there was a significant difference between early respondents (*M* = 1.06, *SD* = .239) and late respondents (*M* = 1.00, *SD* =

.000) conditions; *t* (99) = 2.514, *p* = .014 for *Are all cylinders in the agricultural mechanics laboratory upright/anchored when in use?* Finally, there was a significant difference between early respondents (*M* = 1.28, *SD* = .451) and late respondents (*M* = 1.08, *SD* = 2.72) conditions; *t* (65.23) = 2.908, *p* = .005 when asked *Are the gauges on oxygen regulators in the agricultural mechanics laboratory marked USE NO OIL*? This information is displayed below in Table 1.

Overall, a significant difference between early and late respondents was found in nine of the 105 questions on the survey. Based on these findings, it can be concluded that the late respondents, hence the nonrespondents, are not significantly different from the early respondents besides the specific questions stated above.

Table 1

Results of nonresponse error for early versus late respondents (n = 133)

Nonresponse error	Early Respondents		Late Respondents		Equal variances not assumed		
	M	*SD*	*M*	*SD*	*df*	*t*	*p*
General Safety							
Are the placement of trash cans in the agricultural mechanics laboratory not near working areas	1.50	.502	1.37	.490	92.12	2.157	.034
PPE							
Is hearing protection provided for the students in the agricultural mechanics laboratory	1.40	.732	1.10	.305	115.49	3.27	.001

(continued)

Nonresponse error	Early Respondents		Late Respondents		Equal variances not assumed		
	M	*SD*	*M*	*SD*	*df*	*t*	*p*
PPE							
Are welding gloves provided for the students in the agricultural mechanics laboratory	1.29	.709	1.07	.365	95.05	2.326	.022
Tools							
Are proper kickback devices used on the table saw in the agricultural mechanics laboratory	1.27	.447	1.10	.310	64.36	2.323	.023
Are push sticks available at the table saw in the agricultural mechanics laboratory	1.17	.373	1.03	1.86	94.34	2.591	.011
Are all portable, electrically powered tools properly grounded in the agricultural mechanics laboratory	1.05	.217	1.00	.000	101	2.282	.025
Compressed Gas Cylinders							
Are the cylinders secured in an upright position in the agricultural mechanics laboratory when stored?	1.05	.219	1.00	.000	99	2.283	.025

(continued)

Nonresponse error	Early Respondents		Late Respondents		Equal variances not assumed		
	M	*SD*	*M*	*SD*	*df*	*t*	*p*
Are all cylinders in the agricultural mechanics laboratory upright/anchored when in use	1.06	.239	1.00	.000	99	2.514	.014
Are the gauges on oxygen regulators in the agricultural mechanics laboratory marked USE NO OIL	1.28	.451	1.08	2.72	65.23	2.908	.005

Note: 1 = Yes, 2 = No, $p < .05$

Chapter IV

Findings

Chapter Four is a report of the findings from this study. For each research objective, a description of the results of the data analysis is reported.

Purpose of the Study

The purpose of this study is to evaluate the safe working conditions in Texas agricultural mechanics laboratories. Also, this study will determine the personal, professional, and program demographics of the Texas school-based agricultural mechanics programs and the instructors who teach within them. Furthermore, this study will evaluate the self- assessed safety conditions in the selected Texas school-based agricultural mechanics laboratories.

Research Objectives

1. Determine the personal (age, gender, and ethnicity), professional (highest degree earned, type of teaching certification, years of agricultural mechanics teaching experience, and grade levels taught), and program demographics (school's UIL ranking, total number of students enrolled in the agricultural program, total number of students enrolled in agricultural mechanics classes, agricultural mechanics classes offered, square footage of the agricultural mechanics laboratory, age of the agricultural mechanics laboratory, budget allotment for the agricultural mechanics laboratory, source of budget, the presence of an adult support group, the average number of students enrolled in each agricultural mechanics laboratory class, and the safety procedures if

there is a student emergency) of selected Texas school-based agricultural mechanics programs and the instructors who teach within them.

2. Determine the self-assessed safety conditions (general safety conditions, general appearance, personal protective equipment, condition of hand and power tools, electrical, fire safety, compressed gas cylinders safety, and storage) in selected Texas school-based agricultural mechanics laboratories.

Results

Research Objective One

The first research objective sought to describe the personal (age, gender, and ethnicity), professional (highest degree earned, type of teaching certification, years of agricultural mechanics teaching experience, and grade levels taught), and program demographics (total number of students in the high school, total number of students enrolled in the agricultural program, total number of students enrolled in agricultural mechanics classes, agricultural mechanics classes offered, square footage of the agricultural mechanics laboratory, age of the agricultural mechanics laboratory, budget allotment for the agricultural mechanics laboratory, source of budget, and presence of an adult support group, and the average number of students enrolled in each agricultural mechanics laboratory class) of selected Texas school-based agricultural mechanics programs and the instructors who teach within them. Frequencies and percentages were used to analyze most of these demographic questions. Mean and standard deviation were used to analyze the average number of students enrolled in each agricultural mechanic class and the size of each agricultural mechanic laboratory.

Of the 133 agricultural mechanics teachers who instruct in school-based agricultural mechanics laboratories who participated in this study, 27.1% self-identified in the age range of 40 to 49 (*n* = 36), 24.1% were teachers between the ages of 30 to 39 years (*n* = 32), 21.1% were between the ages of 20 to 29 years (*n* = 28), 18% were between the ages of 50 to 59 years (*n* = 24) and finally, 9.8% of the teachers were older than 60 years of age (*n* = 13). This information is displayed in Table 2.

Table 2

Age of selected agricultural mechanics teachers who instruct in school-based agricultural mechanics laboratories (n = 133)

Age	*f*	%
20-29	28	21.1
30-39	32	24.1
40-49	36	27.1
50-59	24	18.0
60+	13	9.8

The agricultural mechanics teachers who instruct in school-based agricultural mechanics laboratories who participated in this study (*n* = 133), were 90.2% male (*n* = 120) and 9.8% female (*n* = 13). See Figure 4 for an illustration of this information.

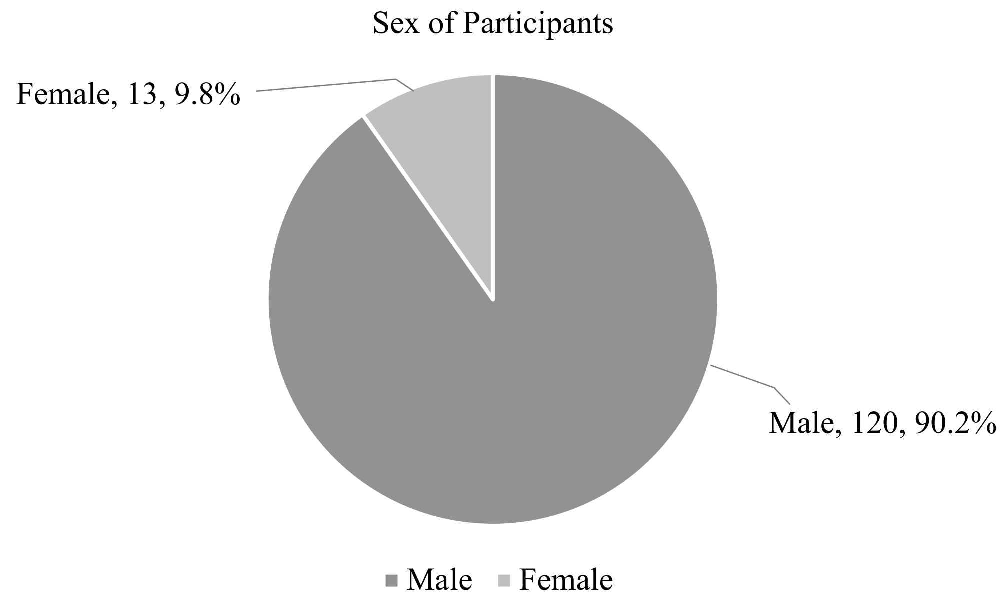

Figure 4

Sex of selected agricultural mechanics teachers who instruct in school-based agricultural mechanics laboratories (n = 133)

Results indicated the agricultural mechanics teachers who instruct in school-based agricultural mechanics laboratories who responded to this survey were 94.7% white/non-Hispanic (*n* = 126), 3% were Latino/ Hispanic (*n* = 4), 0.8% were African American/ Black (*n* = 1), 0.8% were Native American/ Indian (*n* = 1), 0.8% indicated other (*n* = 1). Also, 0% were Asian (*n* = 0), 0% were Pacific Islander (*n* = 0), and 0% were Bi-Racial (*n* = 0). A summary of this data is displayed in Table 3.

Table 3

Ethnicity of selected agricultural mechanics teachers who instruct in school-based agricultural mechanics laboratories (n = 133)

Ethnicity	*f*	%
White/ Non-Hispanic	126	94.7
Latino/ Hispanic	4	3.0
African American/Black	1	0.8
Native American/ Indian	1	0.8
Other	1	0.8
Asian	0	0.0
Pacific Islander	0	0.0
Bi – Racial	0	0.0

Of the 133 agricultural mechanics teachers who instruct in school-based agricultural mechanics laboratories included in this study, 63.9% of them earned a bachelor’s degree (*n* = 85), 33.1% earned a master’s degree (*n* = 44), 1.5% earned a doctorate degree (*n* = 2), 0.8% earned an associate degree (*n* = 1), and similarly 0.8% of the participants noted that they earned a different degree other than the provided choices (*n* = 1). A summary of these results are presented in Table 4.

Table 4

Highest level of education of selected agricultural mechanics teachers who instruct in school-based agricultural mechanics laboratories (n = 133)

Highest level of education	*f*	%
Bachelor	85	63.9
Master	44	33.1
Doctorate	2	1.5
Associate	1	0.8
Other	1	0.8

Majority of the agricultural mechanics teachers who instruct in school-based agricultural mechanics laboratories, received their teaching certification traditionally (n = 109; 82%), while 18% received it alternatively (n = 24). Table 5 shows a summary of this data.

Table 5

Teaching certification programs of selected agricultural mechanics teachers who instruct in school-based agricultural mechanics laboratories (n = 133)

Type of teaching certification program	*f*	%
Traditional	109	82.0
Alternative	24	18.0

Furthermore, the agricultural mechanics teachers who instruct in school-based agricultural mechanics laboratories who participated in this study indicated that 98.5% of them taught 11th grade (n = 131), 97.7% taught 12th grade (n = 130), 95.5% taught 10th

grade (n = 127), 65.4% taught 9th grade (n = 87), 19.5% taught 8th grade (n = 26), and finally 7.5% taught 7th grade (n = 10). A summary of these results is displayed in Table 6.

Table 6

Grade levels taught by selected agricultural mechanics teachers who instruct in school-based agricultural mechanics laboratories (n = 133)

Grade levels taught during the (2020-2021) academic school year	*f*	%
7	10	7.5
8	26	19.5
9	87	65.4
10	127	95.5
11	131	98.5
12	130	97.7

Of the (n = 133) agricultural mechanics teachers who instruct in school-based agricultural mechanics laboratories who participated in this study, 25.6% had 0-4 years of teaching CTE related course experience (n = 34), 15% had 15-19 years of teaching experience (n = 20), while 13.5% had 5-9 years of experience (n = 18), and another 13.5% had 20-24 years of experience (n = 18). Next, 12.8% had 10-14 years of experience (n = 17), 11.3% had over 30 years of teaching experience (n = 15), and finally 8.3% had 25-29 years of teaching CTE related course experience (n = 11). A summary of the information is provided in Table 7.

Table 7

Years of teaching agricultural mechanics related courses of selected agricultural mechanics teachers who instruct in school-based agricultural mechanics laboratories (n = 133)

Years teaching agricultural mechanics related CTE courses	*f*	%
0-4	34	25.6
5-9	18	13.5
10-14	17	12.8
15-19	20	15.0
20-24	18	13.5
25-29	11	8.3
30+	15	11.3

In addition, the agricultural mechanics teachers who instruct in school-based agricultural mechanics laboratories who participated in this study indicated that 21.8% worked at a 3A University Interscholastic League (UIL) ranked school (*n* = 29), 21.1% worked at a 2A school (*n* = 28), 19.5% worked at a 4A ranked school (*n* = 26), 15% worked at a 1A school (*n* = 20), 11.3% worked at a 5A (*n* = 15), and another 11.3% worked at a 6A UIL ranked school (*n* = 15). A summary of the data is presented in Table 8.

Table 8

School's UIL ranking of selected agricultural mechanics teachers who instruct in school-based agricultural mechanics laboratories (n = 133)

School's UIL ranking	*f*	%
1A	20	15.0
2A	28	21.1
3A	29	21.8
4A	26	19.5
5A	15	11.3
6A	15	11.3

Next, of the agricultural mechanics teachers who instruct in school-based agricultural mechanics laboratories who responded to this survey indicated that 23.3% had an average of 15 students in each agricultural mechanics laboratory class ($n = 31$), 12% indicated they had 12 students in each class ($n = 16$), 11.3% responded they had 20 students ($n = 15$), and 8.3% had 18 students ($n = 11$). Likewise, 6.8% had 10 students in each class ($n = 9$), 3% had 6 students ($n = 4$), and another 3% had 9 students ($n = 4$). Next, 3% had 16 students per agriculture mechanics laboratory class ($n = 4$), while another 3% had 25 students ($n = 4$). Furthermore, 2.3% of the agricultural mechanics teachers who instruct in school-based agricultural mechanics laboratories who responded to this survey had 5 students per agricultural mechanics class ($n = 3$), 2.3% had 7 students ($n = 3$), another 2.3% had 13 students ($n = 3$), 2.3% had 17 students ($n = 3$), and another 2.3% had 22 students per agricultural mechanics class ($n = 3$). Respondents indicated that 1.5% had 8 students per class ($n = 2$), 1.5% had 11 students ($n = 2$), 1.5% had 14 students per class (*n* = 2), 1.5% had 24 students (*n* = 2), 1.5% had 30 students per class (*n* = 2), 1.5% had 50 students (*n* = 2), and 1.5% did not answer the question (*n* = 2). Additionally, 0.8% of the participants had 21 students (*n* = 1), 0.8% had 28 (*n* = 1), 0.8% had 35 (*n* = 1), 0.8% had 40 (*n* = 1), 0.8% had 60 (*n* = 1), and another 0.8% had 68 students per agricultural mechanics class (*n* = 1). This data is displayed in Table 9.

Table 9

Average number of students enrolled in agricultural mechanics laboratories of selected agricultural mechanics teachers who instruct in school-based agricultural mechanics laboratories (n = 133)

Average number of students enrolled in each agricultural mechanics laboratory class	*f*	%
5	3	2.3
6	4	3.0
7	3	2.3
8	2	1.5
9	4	3.0
10	9	6.8
11	2	1.5
12	16	12.0
13	3	2.3
14	2	1.5
15	31	23.3
16	4	3.0
17	3	2.3

(continued)

Average number of students enrolled in each agricultural mechanics laboratory class	*f*	%
18	11	8.3
20	15	11.3
21	1	0.8
22	3	2.3
24	2	1.5
25	4	3.0
28	1	0.8
30	2	1.5
35	1	0.8
40	1	0.8
50	2	1.5
60	1	0.8
68	1	0.8
Missing	2	1.5

The mean of students enrolled in each agricultural mechanics laboratory of agricultural mechanics teachers who instruct in school-based agricultural mechanics laboratories class was 15.23 while the standard deviation was 5.456. This information is displayed in Table 10.

Table 10

Mean and standard deviation of the average number of students enrolled in agricultural mechanics laboratories (n = 133)

	M	*SD*
Average number of students enrolled in each agricultural mechanics laboratory class	15.23	5.456

Agricultural mechanics teachers who instruct in school-based agricultural mechanics laboratories noted that 19.5% had a range of 100-150 students enrolled in the AFNR program (*n* = 26), 18.8% had 150-200 students (*n* = 25), another 18.8% had more than 300 enrolled (*n* = 25), 16.5% had 50-100 students (*n* = 22), 13.5% had 0-50 students (*n* = 18), and 12.8% had 250-300 students enrolled in the AFNR program (*n* = 17). This information is displayed below in Table 11.

Table 11

Total number of students in AFNR programs of selected agricultural mechanics teachers who instruct in school-based agricultural mechanics laboratories (n = 133)

Total number of students enrolled in the AFNR program	*f*	%
0-50	18	13.5
50-100	22	16.5
100-150	26	19.5
150-200	25	18.8
250-300	17	12.8
300+	25	18.8

In Table 12, the number of students enrolled in agricultural mechanics teacher's agricultural mechanic classes are displayed. Of the respondents, 43.6% indicated that they had a range of 0-50 students enrolled (*n* = 54), 39.8% had 50-100 students (*n* = 53), 15.8% had 100-150 students (*n* = 21), and 3% had 150-200 students enrolled in agricultural mechanic classes (*n* = 4).

Table 12

Total number of students enrolled in agricultural mechanics classes of selected agricultural mechanics teachers who instruct in school-based agricultural mechanics laboratories (n = 133)

Total number of students enrolled in agricultural mechanics classes	*f*	%
0-50	54	43.6
50-100	53	39.8
100-150	21	15.8
150-200	4	3.0

Of all the classes offered from agricultural mechanics teachers, who participated in this survey responded that 96.2% taught Agricultural Mechanics and Metal Technologies (*n* = 128), 81.2% taught Agricultural Structures Design and Fabrication (*n* = 108), 67.7% taught Agricultural Equipment Design and Fabrication (*n* = 90), and 27.1% taught Agricultural Power Systems (*n* = 36). A summary of these results are displayed in Table 13.

Table 13

Agricultural mechanics classes taught by selected agricultural mechanics teachers who instruct in school-based agricultural mechanics laboratories (n = 133)

Agricultural mechanics course instructed	*f*	%
Agricultural Mechanics and Metal Technologies	128	96.2
Agricultural Structures Design and Fabrication	108	81.2
Agricultural Equipment Design and Fabrication	90	67.7
Agricultural Power Systems	36	27.1

Slightly over half of the agricultural mechanics teachers who instruct in school-based agricultural mechanics laboratories who responded, 54.9%, indicated they had a budget of more than $5,000 for agricultural mechanics instruction and related activities (*n* = 73), 16.5% indicated they had $1,000-$2,000 (*n* = 22), 9% had $2,000-$3,000 (*n* = 12), another 9% had $3,000-$4,000 (*n* = 12), 6% had $4,000-$5,000 for a budget (*n* = 8), 3% indicated they had $0-$1,000 (*n* = 4), and 1.5% did not indicate a budget for agricultural mechanics instruction and related activities (*n* = 2). A summary of this information is provided in Table 14.

Table 14

Budget allocated for selected agricultural mechanics teachers who instruct in school-based agricultural mechanics laboratories (n = 133)

Budget allocated for agricultural mechanics instruction and related activities	*f*	%
$0-$1,000	4	3.0
$1,000-$2,000	22	16.5
$2,000-$3,000	12	9.0
$3,000-$4,000	12	9.0
$4,000-$5,000	8	6.0
$5,000+	73	54.9
Missing	2	1.5

Participating agricultural mechanics teachers who instruct in school-based agricultural mechanics laboratories noted that 63.2% had a source of money from CTE local funds (n = 84), 18% had a source from CTE Perkins funds (n = 24), 12% of participants indicated they did not know the source of money (n = 16), 6% indicated they received money from other sources (n = 8), 0.8% had an FFA booster club (n = 1), and 0% indicated FFA Alumni was the source of money (n = 0). A summary of this data is displayed below in Table 15.

Table 15

Source of budget for selected agricultural mechanics teachers who instruct in school-based agricultural mechanics laboratories (n = 133)

Source of budget	*f*	%
FFA Booster Club	1	0.8
FFA Alumni	0	0.0
CTE Local Funds	84	63.2
CTE Perkins Funds	24	18.0
Other	8	6.0
Unknown	16	12.0

Agricultural mechanics teachers who instruct in school-based agricultural mechanics laboratories who participated in this survey were asked if they had another source of money to specify it, these results are shown in Table 16.

Table 16

Other types of budgets for selected agricultural mechanics teachers who instruct in school-based agricultural mechanics laboratories (n = 133)

Other sources of budget
• CTE Local/Perkins – Amount is unknown, given if requested
• FFA funds
• Fundraiser
• Local Budget
• School Budget

Of the (n = 133) agricultural mechanics teachers who instruct in school-based agricultural mechanics laboratories who participated in this study indicated 65.4% had an adult support group for the AFNR program (*n* = 87), while 34.6% indicated that they did not have an adult support group (*n* = 46). This information is shown below in Figure 5.

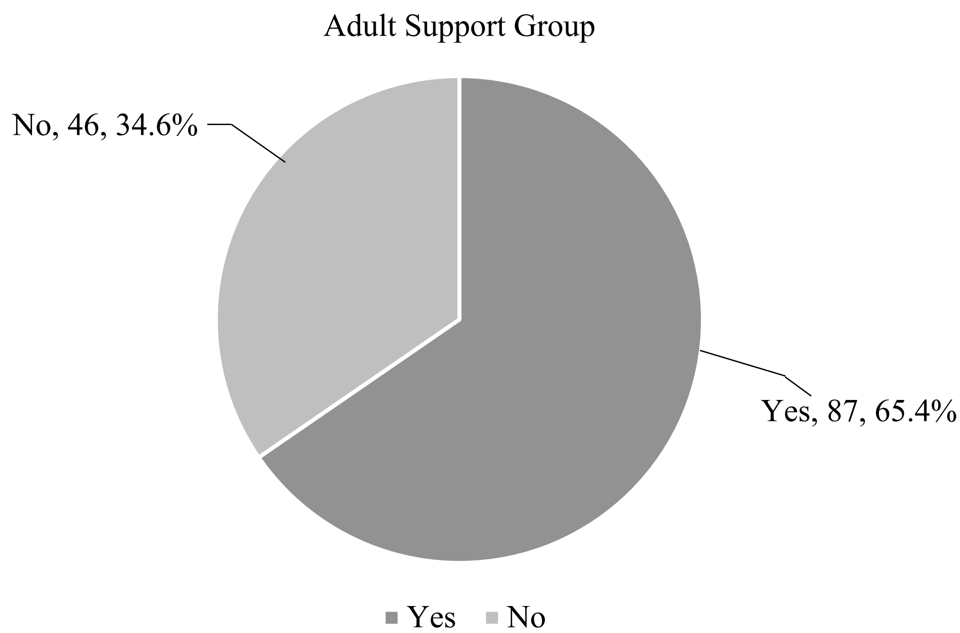

Figure 5

Adult support group for AFNR program of selected agricultural mechanics teachers who instruct in school-based agricultural mechanics laboratories (n = 133)

Agricultural mechanics teachers who instruct in school-based agricultural mechanics laboratories who participated in this study were asked the size of their agricultural mechanics laboratory at the school where they taught in square footage, the mean was 4,888.44 square feet with a standard deviation of 5,433.881. This information is displayed below in Table 17.

Table 17

Square footage of the laboratory of selected agricultural mechanics teachers who instruct in school-based agricultural mechanics laboratories (n = 133)

	M	*SD*
What is the size (square footage) of the agricultural mechanics laboratory at your school?	4,888.44	5,433.881

Participating agricultural mechanics teachers who instruct in school-based agricultural mechanics laboratories indicated that 44.4% had an agricultural mechanics laboratory older than 25 years old (*n* = 59), 16.5% had a laboratory 15-20 years old (*n* = 22), and 12% had a laboratory of 21-25 years old (*n* = 16). Next, 9.8% had a 11-14 years old laboratory (*n* = 13), 8.3% had a laboratory 5-10 years old (*n* = 11), another 8.3% had a laboratory less than 5 years old (*n* = 11), and 0.8% did not respond to the question (*n* = 1). A summary of this data is displayed in Table 18.

Table 18

Age of the oldest laboratory used for educational purposes for selected agricultural mechanics teachers who instruct in school-based agricultural mechanics laboratories (n = 133)

Age of agricultural mechanics laboratory	*f*	%
<5	11	8.3
5-10	11	8.3
11-14	13	9.8
15-20	22	16.5

(continued)

Age of agricultural mechanics laboratory	*f*	%
21-25	16	12.0
>25	59	44.4
Missing	1	0.8

Agricultural mechanics teachers who instruct in school-based agricultural mechanics laboratories were asked several questions about their safety procedures in the agricultural mechanics laboratory, 72.2% indicated that when an accident occurs in the agricultural mechanics laboratory an incident report is required by the school district (n = 96), while 27.8% indicated a that an incident report was not required (n = 37). Of the participants, 100% indicated that when an accident occurs that the safety issue is corrected (n = 133), whereas 0% indicated that the issue was not corrected (n = 0). Results indicate that 85.7% declared that prior to working in the agricultural mechanics laboratory, students were required to pass a safety exam with 100% accuracy (n = 114), 14.3% said the students were not required to pass an exam before working in the laboratory (n = 19). Moreover, 97.7% stated that prior to working in the agricultural mechanics laboratory, students were required to demonstrate safe working practices with each power tool (n = 130), while 2.3% indicated that the students did not have to demonstrate safe working practices (n = 3). Next, 85% of the participants indicated that students were required to demonstrate safe working practices with hand tools before working in the agricultural mechanics laboratory (n = 113), while 15% stated that the students did not have to demonstrate safe working practices (n = 20). Furthermore, 54.1% indicated the student's demonstrations of each tool is not documented (n = 72), while

45.9% respondents indicated that the student's demonstration of each tool is documented (*n* = 61). A summary of this data is displayed below in Table 19.

Table 19

Safety procedures of selected agricultural mechanics teachers who instruct in school-based agricultural mechanics laboratories (n = 133)

Safety Procedures	Yes		No	
	f	%	*f*	%
When an accident occurs in the agricultural mechanics laboratory, is completing an incident report required by the school district?	96	72.2	37	27.8
When an accident occurs, is the safety issue corrected?	133	100.0	0	0.0
Prior to working in the agricultural mechanics laboratory, are students required to pass a safety exam with 100% accuracy?	114	85.7	19	14.3
Prior to students using power tools in the agricultural mechanics laboratory, are students required to demonstrate safe working practices with each power tool?	130	97.7	3	2.3
Prior to students using hand tools in the agricultural mechanics laboratory, are students required to demonstrate safe working practices with each hand tool?	113	85.0	20	15.0
Are the student's demonstrations of each tool documented?	61	45.9	72	54.1

The agricultural mechanics teachers who instruct in school-based agricultural mechanics laboratories who participated in this survey were asked what the procedure was for handling a student medical emergency that occurs in the agricultural mechanics laboratory. Results indicated, 86.5% stated that calling the nurse was the procedure (*n* = 115), 78.9% was to use a first aid kit (*n* = 105), 48.1% procedure was to call 911 (*n* = 64), and 11.3% indicated another procedure takes place in the event of a student medical emergency (n = 15). This data is displayed in Table 20.

Table 20

Procedure for handling student medical emergency of selected agricultural mechanics teachers who instruct in school-based agricultural mechanics laboratories (n = 133)

Procedure for handling a student medical emergency	*f*	%
Call Nurse	115	86.5
Use First Aid Kit	105	78.9
Call 911	64	48.1
Other	15	11.3

Details for the agricultural mechanics teachers who instruct in school-based agricultural mechanics laboratories who participated in this survey that indicated another procedure for a student medical emergency in the agricultural mechanics laboratory is expressed below in Table 21.

Table 21

Selected agricultural mechanics teachers who instruct in school-based agricultural mechanics laboratories other procedures for handling a student medical emergency (n = 133)

Other student medical emergency procedures
• 911 if needed - all class work stops and all students not affected go to the other ag teachers class
• call Admin
• call Admin and parent
• call Admin if 911 is being called
• call parent, call high school office, determine if 911 and call if need be
• dependent of severity

(continued)

Other student medical emergency procedures
• depends based on teacher evaluation • depends on the level emergency • depends on the severity of the emergency. If it is something the nurse can handle she is our first line of contact. Otherwise 911 • it depends on the severity of the accident. A variety of procedures could occur, depends on the accident. • medical Emergency Response Team • notify admin, take necessary action • notify Parents • take student to local hospital

Research Objective Two

The second research objective was to determine the self - assessed safety conditions (general safety conditions, general appearance, personal protective equipment, condition of hand and power tools, electrical safety, fire safety, compressed gas cylinders safety, and storage) in the selected Texas school-based agricultural mechanics laboratories. Descriptive statistics were used to describe data associated with this research question. More specifically, frequency counts and percentages were used to adequately describe nominal and ordinal data.

Agricultural mechanics teachers who instruct in school-based agricultural mechanics laboratories involved in this study were asked questions pertaining to general safety concerns in the agricultural mechanics laboratory. Participants were asked if there were current SDS files available in the agricultural mechanics laboratory for all chemical and materials present, 52.6% stated yes (*n* = 70), and 47.4% stated there was not current SDS available (*n* = 63). Of the respondents, 78.2% stated there were student evacuation procedures posted in the agricultural mechanics laboratory (*n* = 104), while 21.8% stated there was not evacuation procedures posted (*n* = 29). Results indicate that 95.5% of the agricultural mechanics teachers stated there was first aid supplies available in the agricultural mechanics laboratory (*n* = 127), while 4.5% indicated there was not first aid supplies available (*n* = 6). Of the (*n* = 133) participants, 63.2% expressed there was not an emergency shower accessible in the agricultural mechanics laboratory (*n* = 84), while 36.8% indicated there was a shower available (*n* = 49). The next question asked was if there was an eye wash station available in the agricultural mechanics laboratory, 75.2% stated yes (*n* = 100) while 24.8% indicated there was not an eye wash station available (*n* = 33). Results indicated that 76.7% of the respondents stated that their agricultural mechanics laboratory did not have safety painted lanes around breaker boxes and stationary power tools (*n* = 102) while 23.3% did have safety painted lanes (*n* = 31). Of the respondents, 75.5% indicated their agricultural mechanics laboratory had safety signage posted (*n* = 100), while 24.8% did not have safety signage posted (*n* = 33). Next, 95.5% stated their agricultural mechanics laboratory had at least two exits with signs (*n* = 123), whereas 7.5% said there was not at least two exits present (*n* = 10). In addition, 92.5% agricultural mechanics teachers who instruct in school-based agricultural mechanics laboratories who responded to this survey indicated their agricultural mechanics laboratory is equipped with ventilation systems (*n* = 123), while 7.5% stated they did not have ventilation system in their laboratory (*n* = 10). Majority of the participants, 89.5%, stated their agricultural mechanics laboratory's lighting is safe (*n* = 119), unlike 10.5% that stated the lighting in the laboratory was not safe (*n* = 14). Slightly over half, 60.9%, indicated the lighting in the laboratory was shielded (*n* = 81), rather than 39.1% stated their lighting in the agricultural mechanics laboratory was not shielded (*n* = 52). Results indicated, 74.4% respondents expressed there were welding flash shields in the agricultural mechanics laboratory (*n* = 99), however 25.6% indicated there was no welding flash shields present (*n* = 34). Next, it was asked if the welding shields in the agricultural mechanics laboratory were portable, 53.4% stated no (*n* = 71), while 46.6% stated that the welding shields in the laboratory were portable (*n* = 62). Of the participants, 79.7% expressed there was a cooling bucket for hot metal available in the agricultural mechanics laboratory (*n* = 106), whereas 20.3% did not have a cooling bucket available (*n* = 27). Finally, 88.7% indicated that the placement of trash cans were not near working areas in the agricultural mechanics laboratory (*n* = 118), while 11.3% stated the placement of trash cans were near working areas (*n* = 15). A summary of this data is displayed in Table 22.

Table 22

General safety concerns of selected agricultural mechanics laboratories (n = 133)

General Safety Concerns	Yes		No	
	f	%	*f*	%
Are current Safety Data Sheet (also known as Material Safety Data Sheets) available in the agricultural mechanics laboratory for all chemical/materials present?	70	52.6	63	47.4
Are student evacuation procedures posted in the agricultural mechanics laboratory?	104	78.2	29	21.8
Are First Aid supplies available in the agricultural mechanics laboratory?	127	95.5	6	4.5
Is there an emergency shower easily accessible in the agricultural mechanics laboratory?	49	36.8	84	63.2
Is there an eye wash station available in the agricultural mechanics laboratory?	100	75.2	33	24.8
Are there safety painted lanes around breaker boxes and stationary power tools in the agricultural mechanics laboratory?	31	23.3	102	76.7

(continued)

General Safety Concerns	Yes		No	
	f	%	*f*	%
Is there safety signage posted in your agricultural mechanics laboratory?	100	75.5	33	24.8
Does the agricultural mechanics laboratory have at least two exits with signs?	123	95.5	10	7.5
Is the agricultural mechanics laboratory equipped with ventilation systems?	123	92.5	10	7.5
Is the lighting in the agricultural mechanics laboratory safe?	119	89.5	14	10.5
Is the lighting shielded in the agricultural mechanics laboratory?	81	60.9	52	39.1
Are there welding flash shields in the agricultural mechanics laboratory?	99	74.4	34	25.6
Are the welding flash shields in the agricultural mechanics laboratory portable?	62	46.6	71	53.4
Is a cooling bucket for hot metal available in the agricultural mechanics laboratory?	106	79.7	27	20.3
Are the placement of trash cans in the agricultural mechanics laboratory not near working areas?	118	88.7	15	11.3

The agricultural mechanics teachers who instruct in school-based agricultural mechanics laboratories who participated in this study were asked if the stairways in the agricultural mechanics laboratory were in safe condition, 64.7% indicated they did not have stairways (n = 86), 33.8% stated their stairways were in safe conditions without any obstructions (n = 45), and 1.5% stated their stairways were unsafe (n = 2). The following question was if the stairways were illuminated, 66.2% did not have stairways (n = 88), 18.8% stated their stairways were illuminated (n = 25), and 15% expressed that their stairways in the agricultural mechanics laboratory were not illuminated (*n* = 20). A summary of these results is presented in Table 23.

Table 23

General appearance of stairs in selected agricultural mechanics laboratories (n = 133)

General Appearance of Stairs	Yes		No		No Stairways	
	f	%	*f*	%	*f*	%
Are the stairways in the agricultural mechanics laboratory in safe condition? (No obstructions)	45	33.8	2	1.5	86	64.7
Are the stairways in the agricultural mechanics laboratory illuminated?	25	18.8	20	15.0	88	66.2

The next section of the survey asked about the general appearance of the agricultural mechanics laboratory. Of the (*n* = 133) agricultural mechanics teachers who instruct in school-based agricultural mechanics laboratories who participated in this study, 85% indicated that their agricultural mechanics laboratory was currently neat/orderly (*n* = 113), while 15% indicated that it was not neat/orderly (*n* = 20). Majority of the participants, 96.2%, stated that their agricultural mechanics laboratory was clean on a normal basis (*n* = 128), whereas 3.8% declared their laboratory was not clean on a normal basis (*n* = 5). Of the participants, 66.2% stated that the color of the walls in the agricultural mechanics laboratory did not reflect welding flash (*n* = 88), while 33.8% indicated that the color of the walls did reflect the welding flash in the agricultural mechanics laboratory (*n* = 45). Slightly over half of the respondents, 57.1%, indicated that there were currently tripping hazards in the agricultural mechanics laboratory (*n* = 76), however, 42.9% stated there was not current tripping hazards in the agricultural mechanics laboratory (*n* = 57). The final question was if there were clean/functional hand washing facilities in the agricultural mechanics laboratory, which 92.5% indicated that there were (*n* = 123), and 7.5% stated there was not clean/functional hand washing facilities available (*n* = 10). This information is displayed below in Table 24.

Table 24

General Appearance of selected agricultural mechanics laboratories (n = 133)

General Appearance Concerns	Yes		No	
	f	%	*f*	%
Is the agricultural mechanics laboratory currently neat/orderly?	113	85.0	20	15.0
On a normal basis, is the agricultural mechanics laboratory cleaned?	128	96.2	5	3.8
Do the colors of the walls in the agricultural mechanics laboratory reflect welding flash?	45	33.8	88	66.2
Currently, are there any tripping hazards in the agricultural mechanics laboratory?	76	57.1	57	42.9
Are there clean/functional hand washing facilities in the agricultural mechanics laboratory?	123	92.5	10	7.5

Moreover, the next section of the survey asked the agricultural mechanics teachers who instruct in school-based agricultural mechanics laboratories who responded to this survey if there were ANSI Z87 safety glasses provided to every student in the agricultural mechanics laboratory, 87.2% answered yes, there are glasses provided (*n* = 116), 0% stated no (*n* = 0), and 12.8% expressed that the students had to bring their own safety glasses to the laboratory (*n* = 17). Of the participants, 88% indicated there was clear face shields available for the students in the agricultural mechanics laboratory (*n* =

117), 9.8% stated no, there was not face shields available (*n* = 13), and 2.3% indicated the students must provide their own clear face shield (*n* = 3). Next, results indicated that 78.2% of the respondents stated there was hearing protection provided for the students in the agricultural mechanics laboratory (*n* = 104), 10.5% stated there was not hearing protection provided (*n* = 14), and 11.3% stated the students had to provide their own hearing protection (*n* = 15). Moreover, the next question asked if welding gloves were provided to the students in the agricultural mechanics laboratory, 88% stated yes (*n* = 117), 0% indicated welding gloves were not provided (*n* = 0), and 12% of the participants indicated that students had to provide their own welding gloves (*n* = 16). The respondents indicated that 53.4% did not provide welding aprons to the students in the agricultural mechanics laboratory (*n* = 71), 25.6% indicated welding aprons were available (*n* = 34), and 21.1% declared students had to bring their own welding aprons to work in the agricultural mechanics laboratory (*n* = 28). Results indicated that 47.4% of the respondents expressed that welding jackets were available in the agricultural mechanics laboratory (*n* = 63), 30.8% indicated students had to provide their own welding jacket (*n* = 41), and 21.8% indicated that welding jackets were not provided to the students (*n* = 29). Slightly over half, 51.1%, of the agricultural mechanics teachers who instruct in school-based agricultural mechanics laboratories who responded stated there was not welding overalls available in the agricultural mechanics laboratory (*n* = 68), 36.8% indicated students had to bring their own welding overalls (*n* = 49), and 12% indicated that there was welding overalls available in the agricultural mechanics laboratory (*n* = 16). Of the participants, 44.4% indicated there was breathing protection available for the students to use in the agricultural mechanics laboratory (*n* = 59), 38.3% indicated there was not breathing protection available (*n* = 51), and 17.3% indicated students had to provide their own breathing protection (*n* = 23). Of the (*n* = 133) participants, 93.2% indicated arc welding helmets were provided to the students in the agricultural mechanics laboratory (*n* = 124), 6% indicated students had to provide their own welding helmets (*n* = 8), and 0.8% indicated welding helmets were not provided to the students (*n* = 1). Finally, 95.5% of the respondents indicated oxyfuel cutting goggles/face shields were provided to the students (*n* = 123), 3.8% stated cutting goggles/face shields were not provided (*n* = 5), and another 3.8% indicated students had to bring their own oxyfuel cutting goggles/face shields to work in the laboratory (*n* = 5). A summary of this data is shown in Table 25.

Table 25

Personal Protective Equipment of selected agricultural mechanics laboratories (n = 133)

PPE Concerns	Yes		No		Students must provide their own	
	f	%	*f*	%	*f*	%
Are ANSI Z87 safety glasses provided to every student in the agricultural mechanics laboratory?	116	87.2	0	0.0	17	12.8
Are clear face shields available to the students in the agricultural mechanics laboratory?	117	88.0	13	9.8	3	2.3
Is hearing protection provided for the students in the agricultural mechanics laboratory?	104	78.2	14	10.5	15	11.3
Are welding gloves provided for the students in the agricultural mechanics laboratory?	117	88.0	0	0.0	16	12.0

(continued)

PPE Concerns	Yes		No		Students must provide their own	
	f	%	*f*	%	*f*	%
Are welding aprons available in the agricultural mechanics laboratory?	34	25.6	71	53.4	28	21.1
Are welding jackets available in the agricultural mechanics laboratory?	63	47.4	29	21.8	41	30.8
Are welding overalls available in the agricultural mechanics laboratory?	16	12.0	68	51.1	49	36.8
Is breathing protection available for the students to use in the agricultural mechanics laboratory?	59	44.4	51	38.3	23	17.3
Are arc welding helmets provided to the students in the agricultural mechanics laboratory?	124	93.2	1	0.8	8	6.0
Are oxyfuel cutting goggle/face shields provided to the students in the agricultural mechanics laboratory?	123	95.5	5	3.8	5	3.8

Agricultural mechanics teachers who instruct in school-based agricultural mechanics laboratories who responded were asked where the ANSI Z87 student safety glasses were stored, 40.6% indicated the safety glasses were stored in the student's locker (*n* = 54), 24.1% indicated the safety glasses were stored with the student (*n* = 32), 22.6% indicated the safety glasses were stored in a sanitation locker in the agricultural mechanics laboratory (*n* = 30), and 12.8% indicated the safety glasses were stored in another location other than the choices that were provided (*n* = 17). This information is displayed in Table 26.

Table 26

Where safety glasses were stored in the selected agricultural mechanics laboratories (n = 133)

Where the ANSI Z87 student safety glasses were stored	*f*	%
With the student	32	24.1
In the student’s locker	54	40.6
In a sanitation locker in the agricultural mechanics laboratory	30	22.6
Other	17	12.8

The responses of agricultural mechanics teachers who instruct in school-based agricultural mechanics laboratories who indicated the student’s safety glasses were stored in another location is displayed below in Table 27.

Table 27

Other ways selected agricultural mechanics teachers who instruct in school-based agricultural mechanics laboratories store safety glasses (n = 133)

Safety glasses are stored

- because of covid they keep them can't use the lockers
- bin
- box with sections in classroom
- case
- due to covid each kid has own pair from school budget
- each student has their own plastic tub with sealed lid to store their PPE
- in a cabinet but it is not a sanitizing locker
- in a drawer
- in classroom
- in student’s locker and sanitation locker.
- in the classroom
- in the classroom entering the shop
- open cubbies for each student. If they choose to bring their own equipment, they

(continued)

Safety glasses are stored
• may secure it in a locker. First year here- inherited this system
• other for safety glasses stored
• storage cabinet
• tool box
• we have a class set; that is changed out with new pairs as needed

In the following section, the agricultural mechanics teachers who instruct in school-based agricultural mechanics laboratories who responded to this survey were asked if the agricultural mechanics laboratory stationary power tools were provided with mounting holes, and if the tools were anchored to the floor, 57.1% indicated the tools were not anchored to the floor (*n* = 76), 42.1% indicated the stationary tools were anchored to the floor (*n* = 56), and 0.8% did not answer the question (*n* = 1). Results indicated that, 80.5% of the respondents expressed that the stationary power tools were equipped with an emergency stop switch that was within easy reach (*n* = 107), 18.8% respondents indicated the stationary power tools did not have an emergency stop switch (*n* = 25), and 0.8% did not answer the question (*n* = 1). Of the respondents, 75.9% indicated a proper kickback device was used on the table saw in the agricultural mechanics laboratory (*n* = 101), 23.3% indicated a proper kickback device was not used on the table saw (*n* = 31), and 0.8% did not answer the question (*n* = 1). Results indicated that 85.7% of the respondents stated there were push sticks available at the table saw in the agricultural mechanics laboratory (*n* = 114), 13.5% indicated there was not a push stick available (*n* = 18), and 0.8% did not answer the question (*n* = 1). Of the respondents, 93.2% indicated the factory guards were in place on stationary power tools in the agricultural mechanics laboratory (*n* = 124), 6% indicated there was not factory guards in place (*n* = 8), and 0.8% did not answer the question (*n* = 1). Moreover, 76.7%

of the respondents indicated there were roller units or stands available in the agricultural mechanics laboratory to assist in moving materials (*n* = 102), 22.6% indicated there was not roller units or stands to assist in moving materials (*n* = 30), and 0.8% did not answer the question (*n* = 1). Next, 79.7% of the participating agricultural mechanics teachers stated that all hand-held powered tools were equipped with a constant pressure switch that shuts off power when released in the agricultural mechanics laboratory (*n* = 106), 19.5% indicated there was not a constant pressure switch on all hand-held power tools (*n* = 26), and 0.8% did not answer the question (*n* = 1). Majority of the respondents, 92.5%, indicated that all portable, electrically powered tools that were in the agricultural mechanics laboratory were properly grounded (*n* = 123), 3.8% indicated the portable power tools were not properly grounded (*n* = 5), and 3.8% did not answer the question (*n* = 5). Furthermore, 95.5% indicated that the stationary power tools were properly grounded in the agricultural mechanics laboratory (*n* = 127), 0.8% did not have the stationary power tools properly grounded (*n* = 1), and 3.8% did not answer the question (*n* = 5). This information is displayed below in Table 28.

Table 28

Tools in the selected agricultural mechanics laboratories (n = 133)

Tool Safety Concerns	Yes		No		Missing	
	f	%	*f*	%	*f*	%
If stationary power tools have mounting holes provided, are they anchored to the floor in the agricultural mechanics laboratory?	56	42.1	76	57.1	1	0.8

(continued)

Tool Safety Concerns	Yes		No		Missing	
	f	%	*f*	%	*f*	%
On stationary power tools in the agricultural mechanics laboratory, are there emergency stop switches within easy reach?	107	80.5	25	18.8	1	0.8
Are proper kickback devices used on the table saw in the agricultural mechanics laboratory?	101	75.9	31	23.3	1	0.8
Are push sticks available at the table saw in the agricultural mechanics laboratory?	114	85.7	18	13.5	1	0.8
Are factory guards in place on stationary power tools in the agricultural mechanics laboratory?	124	93.2	8	6.0	1	0.8
Are roller units or stands available to assist in moving materials in the agricultural mechanics laboratory?	102	76.7	30	22.6	1	0.8
Are all hand-held powered tools equipped with a constant pressure switch that shuts off power when released in the agricultural mechanics laboratory?	106	79.7	26	19.5	1	0.8
Are all portable, electrically powered tools properly grounded in the agricultural mechanics laboratory? (i.e. The plug has three prongs or has a double insulated case)	123	92.5	5	3.8	5	3.8
Are the stationary power tools properly grounded in the agricultural mechanics laboratory?	127	95.5	1	0.8	5	3.8

Agricultural mechanics teachers who instruct in school-based agricultural mechanics laboratories were asked to list the tools that did not have a constant switch in their agricultural mechanics laboratory. Their responses are displayed below in Table 29.

Table 29

Respondents details of tools that do not have a constant switch in the selected agricultural mechanics laboratories (n = 133)

Tools without a constant switch
• angle grinders
• angle grinders, portable band saw
• drills, grinders can be locked on
• grinder and drill
• grinders
• grinders mainly
• most also have a locking button to override constant pressure switch portable sanders, grinders
• router
• small grinders
• some angle grinders, routers
• some grinders
• two angle grinders

Agricultural mechanics teachers who instruct in school-based agricultural mechanics laboratories were asked where the tools were stored when not in use in the agricultural mechanics laboratory (*n* = 133). The participants responses are displayed in Table 30.

Table 30

Where tools are stored when not in use in selected agricultural mechanics laboratories (n = 133)

Where tools are stored when not in use
• cabinets
• cabinets in tool room
• cabinets in tool room
• cords are wrapped up and they are hung or placed in their proper home
• hanging on wall in toolroom
• in a locked cabinet
• in a locked room with a provided location

(continued)

Where tools are stored when not in use

- in a locked storage area with chain link fence
- in a locked tool room
- in a marked tool room with stored in numbered order
- in a metal storage cage
- in a toolbox or tool room
- in a tool room
- in a tool room
- in a tool room on a grinder rack.
- in a tool room or cabinet
- in a tool room with the chords wrapped neatly
- in cabinets
- in cabinets and/or locked in storage rooms
- in locked tool room
- in the storage room
- in the tool cage
- in the tool cage or tool room
- in the tool cages
- in the tool room
- in the tool room
- in the tool room in designated areas for each tool type
- in the tool room locked up
- in the tool room on a shelf
- in the tool room on a shelf
- in the tool room on shelves
- in the tool room or on a table
- in the tool room
- in the tool rooms
- in the toolroom
- in tool cabinets
- in tool closet
- in tool room
- in tool room
- in tool room on shelves
- in tool room or tool cart
- in toolroom cage
- locked tool room
- locker
- locker
- locking tool cages
- on a bookshelf or cubical
- on a designated shelf in the tool room.
- on a shelf

(continued)

Where tools are stored when not in use

- on shelves, in racks, in a storage room
- on tool carts/tool cabinets
- placed in the tool room
- rolled up and stored in one of three knack boxes
- rolled up in tool room
- shelf / containers
- shelves
- shelves
- shelves in locked tool cage
- shelves in tool room
- shelving
- shelving in tool storage
- storage space under worktables, or in tool room
- store room shelf
- stored on shelf in tool room
- supposed to be
- they are stored in a tool room or on portable cabinets in the shop.
- tool room or box
- toolbox
- toolbox/Cabinet
- tool cabinet
- tool cage
- tool room
- tool room
- tool room
- tool room
- tool room
- tool room
- tool room
- tool room locked
- tool room on shelves
- tool room or tool cart
- tool room shelf
- tool room that is locked
- tool rooms
- toolbox
- toolroom
- wall storage
- we have a tool room for the portable tools. The tools stay in there unless being used. If they are out in the shop and the students are not finished with the tools they move them against the wall.

Next, agricultural mechanics teachers who instruct in school-based agricultural mechanics laboratories who responded to the survey were asked to rank the overall condition of the stationary power tools in the agricultural mechanics laboratory, 57.9% indicated that the tools were in good condition (*n* = 77). A tool in good condition was described as the tools were working properly, had some minor wear, and all guards were intact. Of the respondents, 20.3% indicated their stationary power tools were in a fair condition (*n* = 27). Fair condition was described as the tools were somewhat working, had major wear, and guards were intact. Results indicated that 18% expressed their stationary power tools were in excellent condition (*n* = 24). Excellent was described as the tools working properly, guards were intact, no tears on cords, and almost in new condition. Of the respondents, 0% indicated the stationary power tools in the agricultural mechanics laboratory were not functional or unsafe (*n* = 0). A not functional or unsafe tool was described as not working, had no guards, and damaged cords. Finally, 3.8% respondents did not answer the question (*n* = 5). A summary of this data is displayed below in Table 31.

Table 31

Overall condition of stationary tools in the selected agricultural mechanics laboratories (n = 133)

Overall condition of stationary power tools	*f*	%
Excellent: Working properly, guards intact, no tears on cords, almost new condition	24	18.0
Good: Working properly, some minor wear, all guards intact	77	57.9
Fair: Somewhat working, major wear, guards intact	27	20.3

(continued)

Not Functional/Unsafe: Not working, no guards, damaged cords	0	0.0
Missing	5	3.8

Moreover, respondents were asked to rate the condition of the handheld power tools in the agricultural mechanics laboratory, 61.7% indicated their handheld power tools were in good condition (*n* = 82). A tool in good condition was described as the tools were working properly, some minor wear, and all guards were intact. Results indicated that 18% stated that the handheld power tools in their agricultural mechanics laboratory were in excellent condition (*n* = 24). Excellent was described as the tools were working properly, guards were intact, no tears on cords, and almost in new condition. Of the participants, 15.8% indicated that their tools were in fair condition (*n* = 21). Fair condition was described as the tools were somewhat working, had major wear, and guards were intact. Next, 0.8% indicated that their handheld power tools were not functional or unsafe (*n* = 1). A not functional or unsafe tool was described as not working, had no guards, and damaged cords. Finally, 3.8% respondents did not answer the question (*n* = 5). See Table 32 for a summary of this information.

Table 32

Overall condition of handheld power tools in the selected agricultural mechanics laboratories (n = 133)

Overall condition of handheld power tools	*f*	%
Excellent: Working properly, guards intact, no tears on cords, almost new condition	24	18.0
Good: Working properly, some minor wear, all guards intact	82	61.7

(continued)

Fair: Somewhat working, major wear, guards intact	21	15.8
Not Functional/Unsafe: Not working, no guards, damaged cords	1	0.8
Missing	5	3.8

Furthermore, respondents were asked to rate the condition of the hand tools in the agricultural mechanics laboratory. Results indicated 62.4% stated their hand tools were in good condition (*n* = 83). Good condition was described as the hand tools were working properly and had some minor wear. Moreover, 62.4% stated their hand tools were in fair condition (*n* = 83). A tool that was in fair condition was described as somewhat working and had major wear. Next, 11.3% of the respondents indicated their hand tools in the agricultural mechanics laboratory were in excellent condition (*n* = 15). Excellent condition was described as the tools were working properly and in almost new condition. Also, 0% participants indicated their tools were not functional or unsafe (*n* = 0). A not functional or unsafe condition was described as the tool was not working or broken. Finally, 3.8% respondents did not answer the question (*n* = 5). A summary of these results are displayed below in Table 33.

Table 33

Overall condition of hand tools in the selected agricultural mechanics laboratories (n = 133)

Overall condition of hand tools	*f*	%
Excellent: Working properly, almost new condition	15	11.3
Good: Working properly, some minor wear	83	62.4
Fair: Somewhat working, major wear	83	62.4

(continued)

Not Functional/Unsafe: Not working, broken	0	0.0
Missing	5	3.8

In addition, the next section of the survey was related to electricity concerns in the agricultural mechanics laboratory. The agricultural mechanics teachers who instruct in school-based agricultural mechanics laboratories who responded to this survey indicated that 91% stated there were circuit breaker box/electrical cabinets in the agricultural mechanics laboratory (*n* = 121), 5.3% indicated that they did not have circuit breaker box/electrical cabinets (*n* = 7), and 3.8% respondents did not answer the question (*n* = 5). Of the respondents, 64.7% indicated that the circuit breaker box/electrical cabinets in the agriculture mechanics laboratory were not locked/inaccessible to students (*n* = 86), 30.8% of the respondents expressed that the circuit breaker box/electrical cabinets were locked/inaccessible to students (*n* = 41), and 4.5% respondents did not answer the question (*n* = 6). Results indicated that 78.9% of the respondents declared that the electrical boxes/switches in the agricultural mechanics laboratory were properly marked/covered (*n* = 105), 16.5% expressed that the boxes/switches were not properly marked/covered (*n* = 22), and 4.5% respondents did not answer the question (*n* = 6). Of the respondents, 48.9% indicated that there were not GFCI outlets installed in the agricultural mechanics laboratory (*n* = 65), 46.6% indicated that there was GFCI outlets installed (*n* = 62), and 4.5% respondents did not answer the question (*n* = 6). Majority of the participants, 92.5%, indicated the extension cords in the agricultural mechanics laboratory were in safe working conditions (*n* = 123), 3% stated the extension cords were not in safe working conditions (*n* = 4), and 4.5% of the respondents did not answer the question (*n* = 6). Results indicated that, 65.4% of the responding agricultural mechanics teachers stated that each welder in the agricultural mechanics laboratory did not have a disconnecting switch with overcurrent protection within easy reach (*n* = 87), 30.1% indicated that the welders did have a disconnecting switch (*n* = 40), and 4.5% of the respondents did not answer the question (*n* = 6). A summary of this data is displayed below in Table 34.

Table 34

Electricity concerns in the selected agricultural mechanics laboratories (n = 133)

Electricity Concerns	Yes		No		Missing	
	f	%	*f*	%	*f*	%
Are there circuit breaker box/electrical cabinets in the agricultural mechanics laboratory?	121	91.0	7	5.3	5	3.8
If so, is the circuit breaker box/electrical cabinets locked/inaccessible to students in the agricultural mechanics laboratory?	41	30.8	86	64.7	6	4.5
Are the electrical boxes/switches properly marked/covered in the agricultural mechanics laboratory?	105	78.9	22	16.5	6	4.5
Are there Ground Fault Circuit Interrupter (GFCI) outlets installed in the agricultural mechanics laboratory?	62	46.6	65	48.9	6	4.5
Are the extension cords in safe working conditions in the agricultural mechanics laboratory?	123	92.5	4	3.0	6	4.5
Does each welder in the agricultural mechanics laboratory have a disconnecting switch with overcurrent protection within easy reach?	40	30.1	87	65.4	6	4.5

Of the (*n* = 133) agricultural mechanics teachers who instruct in school-based agricultural mechanics laboratories who responded to this survey, 79.7% indicated that there were fire alarms installed in the agricultural mechanics laboratory (*n* = 106), 15.8%

indicated that there were not fire alarms installed (*n* = 21), and 4.5% of the respondents did not answer the question (*n* = 6). Majority of the participants, 94.7%, indicated that there were fire extinguishers available in the agricultural mechanics laboratory (*n* = 126), 0% indicated that there was not fire extinguishers available (*n* = 0), and 5.3% of the respondents did not answer the question (*n* = 7). Results indicated that 87.2% of the respondents declared that the fire extinguishers locations were properly marked in the agriculture mechanics laboratory (*n* = 116), 7.5% expressed that the fire extinguisher locations were not properly marked (*n* = 10), and 5.3% of the respondents did not answer the question (*n* = 7). Moreover, 94.7% of the respondents indicated that the fire extinguishers in the agricultural mechanics laboratory were the proper type (*n* = 126), 0% indicated that the fire extinguishers were not the proper type (*n* = 0), and 5.3% of the respondents did not answer the question (*n* = 7). Next, 57.1% of the respondents indicated that the fire extinguishers were located where flammable or combustible liquids were stored in the agricultural mechanics laboratory (*n* = 76), 37.6% indicated that the fire extinguishers were not located where flammable or combustible liquids were stored (*n* = 50), and 5.3% of the respondents did not answer the question (*n* = 7). Finally, 68.4% of the respondents indicated that there was not a fire blanket readily available in the agricultural mechanics laboratory (*n* = 91), 26.3% of the respondents indicated that there was a fire blanket available (*n* = 35), and 5.3% of the respondents did not answer the question (*n* = 7). This data can be displayed below in Table 35.

Table 35

Fire safety concerns in the selected agricultural mechanics laboratories (n = 133)

Fire Safety Concerns	Yes		No		Missing	
	f	%	*f*	%	*f*	%
Are fire alarms installed in the agricultural mechanics laboratory?	106	79.7	21	15.8	6	4.5
Are there fire extinguishers available in the agricultural mechanics laboratory?	126	94.7	0	0.0	7	5.3
Are the fire extinguisher locations properly marked in the agricultural mechanics laboratory?	116	87.2	10	7.5	7	5.3
Are the fire extinguishers the proper type in the agricultural mechanics laboratory?	126	94.7	0	0.0	7	5.3
Are the fire extinguishers located where flammable or combustible liquids are stored in the agricultural mechanics laboratory?	76	57.1	50	37.6	7	5.3
Is there a fire blanket readily available in the agricultural mechanics laboratory?	35	26.3	91	68.4	7	5.3

Agricultural mechanics teachers who instruct in school-based agricultural mechanics laboratories were asked how many fire extinguishers were in the agricultural mechanics laboratory. Of the respondents, 36.1% indicated that there were four or more fire extinguishers available in the agricultural mechanics laboratory (n = 48), 29.3% declared there were two fire extinguishers available (n = 39), and 21.1% indicated that there were three fire extinguishers available (n = 28). Next, 8.3% stated there was one fire extinguisher available in the agricultural mechanics laboratory (n = 11), 5.3% of the respondents did not answer the question (n = 7), and 0% indicated that there was no fire extinguishers available (n = 0). This data is displayed below in Table 36.

Table 36

Number of fire extinguishers in the selected agricultural mechanics laboratories (n = 133)

Number of fire extinguishers	*f*	%
0	0	0.0
1	11	8.3
2	39	29.3
3	28	21.1
4+	48	36.1
Missing	7	5.3

The agricultural mechanics teachers who instruct in school-based agricultural mechanics laboratories who responded to this survey were asked how often the fire alarms were checked in the agricultural mechanics laboratory. A summary of the responses is shown below in Table 37.

Table 37

Selected agricultural mechanics teacher's response to how often fire alarms checked in the school-based agricultural mechanics laboratories (n = 133)

How often the fire alarms are checked

- 6 Weeks
- annually
- annually
- annually
- annually
- biannual
- bi-annually
- by school every 3 months

(continued)

How often the fire alarms are checked

- checked by outside business
- contract with company. Yearly I think
- currently the entire system school wide is being replaced
- district
- every 6 months
- every month
- every semester
- I am not sure on this one, I know we have fire safety people come through every summer
- monthly
- monthly
- monthly
- monthly to bi-monthly
- once a month
- once a month
- once a semester
- once a year
- once a year
- once during the summer and once each semester
- once every 2 years
- once every six weeks
- once every two months
- once or twice a year
- once yearly
- periodically
- regularly by a fire protection service
- twice a year
- twice a year
- twice per year
- twice yearly
- yearly
- yearly
- yearly
- yearly by the local fire marshal

Furthermore, 54.1% of the agricultural mechanics teachers who instruct in school-based agricultural mechanics laboratories who responded indicated that the oxygen/fuel cylinders were not stored separately at least 20’ apart, or separated by at least a 5’ wall with a minimum one hour burn time (*n* = 72), 40.6% indicated that they did have the oxygen/fuel cylinders separated properly (*n* = 54), and 5.3% of the respondents did not answer the question (*n* = 7). Majority of the respondents, 91%, indicated that the compressed gas cylinders were secured in an upright position when stored in the agricultural mechanics laboratory (*n* = 121), 3.8% indicated that the compressed cylinders were not stored upright (*n* = 5), and 5.3% of the respondents did not answer the question (*n* = 7). Of the participants, 91.7% indicated that the compressed cylinders were capped when not in use (*n* = 122), 3% indicated that the cylinders were not capped when not in use in the agricultural mechanics laboratory (*n* = 4), and 5.3% of the respondents did not answer the question (*n* = 7). Results indicated that 89.5% of the respondents stated that all the compressed gas cylinders labeling was clearly marked (*n* = 119), 5.3% indicated that the cylinders labels were not clearly marked (*n* = 7), and 5.3% of the respondents did not answer the question (*n* = 7). Of the respondents, 94.7% indicated that oxygen/fuel cylinders were stored away from highly flammable substances such as oil, gasoline, or waste (*n* = 126), 0% indicated that the cylinders were not near oil, gasoline, or waste (*n* = 0), and 5.3% of the respondents did not answer the question (*n* = 7). Next, 90.2% of the respondents indicated that all cylinders in the agricultural mechanics laboratory were upright/anchored when in use (*n* = 120), 4.5% indicated the cylinders where not upright/anchored when in use (*n* = 6), and 5.3% of the respondents did not answer the question (*n* = 7). Furthermore, 94.7% indicated that all oxygen/fuel cylinders equipment was kept free from oily/greasy substances in the agricultural mechanics laboratory (*n* = 126), 0% indicated that the cylinders were not kept free from oily/greasy substances (*n* = 0), and 5.3% of the respondents did not answer the question (*n* = 7). Results indicated that 72.2% of respondents declared that the gauges on the oxygen regulators were marked USE NO OIL in the agricultural mechanics laboratory (*n* = 96), 22.6% indicated that the oxygen regulators were not marked with USE NO OIL (*n* = 30), and 5.3% of the respondents did not answer the question (*n* = 7). This data is displayed below in Table 38.

Table 38

Compressed gas cylinder concerns in the selected agricultural mechanics laboratories (n = 133)

Compressed Gas Cylinder Concerns	Yes		No		Missing	
	f	%	*f*	%	*f*	%
In the agricultural mechanics laboratory, are the oxygen/fuel cylinders stored separately at least 20' apart, or separated by at least a 5' wall with minimum one hour burn time?	54	40.6	72	54.1	7	5.3
Are the cylinders secured in an upright position in the agricultural mechanics laboratory when stored?	121	91.0	5	3.8	7	5.3
Are the cylinders capped when not in use in the agricultural mechanics laboratory?	122	91.7	4	3.0	7	5.3
Are all the cylinders in the agricultural mechanics laboratory labeling clearly marked?	119	89.5	7	5.3	7	5.3
Are the oxygen/fuel cylinders in the agricultural mechanics laboratory stored away from highly flammable substances such as oil, gasoline, or waste?	126	94.7	0	0.0	7	5.3
Are all cylinders in the agricultural mechanics laboratory upright/anchored when in use?	120	90.2	6	4.5	7	5.3
Are all oxygen/fuel cylinders equipment in the agricultural mechanics laboratory kept free from oily/greasy substances?	126	94.7	0	0.0	7	5.3

(continued)

Compressed Gas Cylinder Concerns	Yes		No		Missing	
	f	%	*f*	%	*f*	%
Are the gauges on the oxygen regulators in the agricultural mechanics laboratory marked USE NO OIL?	96	72.2	30	22.6	7	5.3

Furthermore, 60.2% of the agricultural mechanics teachers who instruct in school-based agricultural mechanics laboratories indicated there was an approved flammable storage cabinet available in the agricultural mechanics laboratory (n = 80), 32.3% indicated there was not an approved flammable storage cabinet (n = 43), and 7.5% did not answer the question (n = 10). Majority of the respondents, 92.5%, indicated there were brooms and dust pans available in the agricultural mechanics laboratory (n = 123), 0% indicated there was not brooms and dust pans available (n = 0), and 7.5% did not answer the question (n = 10). Of the respondents, 81.2% indicated that the lumber was organized in the agricultural mechanics laboratory when not in use (n = 108), 11.3% indicated that the lumber was not organized when not in use (n = 15), and 7.5% did not answer the question (n = 10). Next, 88% stated that the metal was organized in the agricultural mechanics laboratory when not in use (n = 117), 4.5% indicated that the metal was not organized when not in use (n = 6), and 7.5% did not answer the question (n = 10). Moreover, 70.7% indicated that the chemicals in the agricultural mechanics laboratory were stored correctly according to the SDS (n = 94), 21.8% stated that the chemicals were not stored correctly according to SDS (n = 29), and 7.5% did not answer the question (n = 10). Results indicated that 47.4% of the respondents indicated that there were safety cans in the agricultural mechanics laboratory to use for flammable/combustible liquids (n = 63), 45.1% stated that there was not safety cans to use for flammable/combustible liquids (*n* = 60), and 7.5% did not answer the question (*n* = 10). Furthermore, 49.6% indicated that the safety cans in the agricultural mechanics laboratory were not labeled (*n* = 66), 42.1% of the respondents indicated that the safety cans were labeled (*n* = 56), and 8.3% did not answer the question (*n* = 11). Of the respondents, 47.7% responded that the combustible wastes in the agricultural mechanics laboratory were kept in covered metal containers (*n* = 63), 44.4% indicated that the combustible waste was not kept in covered metal containers, and 8.3% did not answer the question (*n* = 11). Slightly over half of the respondents, 52.6%, indicated that all flammable storage cabinets were labeled in conspicuous lettering: *Flammable – Keep Fire Away* (*n* = 70), 39.1% indicated that not all flammable storage cabinets were labeled with *Flammable – Keep Fire Away* lettering (*n* = 52), and 8.3% did not answer the question (*n* =11). Additionally, 60.9% responded that all chemical containers were properly labeled in the agricultural mechanics laboratory (*n* = 81), 30.1% of the respondents indicated all chemical containers were not properly labeled (*n* = 40), and 9% did not answer the question (*n* = 12). Finally, 60.2% of the respondents indicated that there were falling hazards such as lumber stored against walls and items stored in ceiling trusses in the agricultural mechanics laboratory (*n* = 80), 31.6% indicated there was no falling hazards in the laboratory (*n* = 42), and 8.3% did not answer the question (*n* = 11). A summary of this information is displayed in Table 39.

Table 39

Storage in the agricultural mechanics laboratories (n = 133)

Storage Concerns	Yes		No		Missing	
	f	%	*f*	%	*f*	%
Is there an approved flammable storage cabinet available in the agricultural mechanics laboratory?	80	60.2	43	32.3	10	7.5
Are brooms and dust pans available in the agricultural mechanics laboratory?	123	92.5	0	0.0	10	7.5
Is the lumber organized in the agricultural mechanics laboratory when not in use?	108	81.2	15	11.3	10	7.5
Is the metal organized in the agricultural mechanics laboratory when not in use?	117	88.0	6	4.5	10	7.5
In the agricultural mechanics laboratory are the chemicals stored correctly according to the Safety Data Sheets?	94	70.7	29	21.8	10	7.5
Are there safety cans in the agricultural mechanics laboratory to use for flammable/combustible liquids?	63	47.4	60	45.1	10	7.5
Are the safety cans in the agricultural mechanics laboratory labeled?	56	42.1	66	49.6	11	8.3
Are the combustible wastes in the agricultural mechanics laboratory kept in covered metal containers? (such as rags)	63	47.7	59	44.4	11	8.3
Are all flammable storage cabinets in the agricultural mechanics laboratory labeled in conspicuous lettering: *Flammable- Keep Fire Away?*	70	52.6	52	39.1	11	8.3
Are all chemical containers in the agricultural mechanics laboratory properly labeled?	81	60.9	40	30.1	12	9.0
Are there any falling hazards in the agricultural mechanics laboratory? i.e. lumber stored against walls, items stored in ceiling trusses, etc.	42	31.6	80	60.2	11	8.3

Agricultural mechanics teachers who instruct in school-based agricultural mechanics laboratories who participated in this study were asked to rate how safely organized the tool room in the agricultural mechanics laboratory currently was. Of the respondents, 39.8% stated that their tool room was fairly organized (*n* = 53). Fairly organized was explained as no outline of tools on walls, all cords were wrapped up and not hanging down, all tools and equipment were hung up or on shelves, floor had some tripping hazards, and toolboxes weren't labeled. Results indicated that 35.3% stated that their tool room in the agricultural mechanics laboratory was rated good (*n* = 47). A good rating was described as an outline of tools were on the walls, all cords were wrapped up and not hanging down, all tools and equipment were hung up or on shelves, floor had some tripping hazards, and toolboxes were not labeled. Next, 14.3% indicated the tool room was in excellent condition (*n* = 19). Excellent was described as there was an outline of tools on the walls, all cords were wrapped up and not hanging down, all tools and equipment were hung up or on shelves, floor is free of tripping hazards, and toolboxes were labeled. Furthermore, 3% responded that the tool room was poorly organized (*n* = 4). A poorly ranked tool room was described as there was no outline of tools on walls, cords were not wrapped up, tools and equipment were not hung up or on shelves, and toolboxes weren't labeled. Finally, 7.5% of the respondents did not answer the question (*n* =10). This information is displayed below in Table 40.

Table 40

Tool room organization in the selected agricultural mechanics laboratory (n = 133)

Currently, how safely organized is the tool room in the agricultural mechanics laboratory?	*f*	%
Excellent: Outline of tools is on walls, all cords are wrapped up and not hanging down, all tools and equipment are hung up or on shelves, floor is free of tripping hazards, toolboxes labeled	19	14.3
Good: Outline of tools is on walls, all cords are wrapped up and not hanging down, all tools and equipment are hung up or on shelves, floor has some tripping hazards, toolboxes not labeled	47	35.3
Fair: No outline of tools on walls, all cords are wrapped up and not hanging down, all tools and equipment are hung up or on shelves, floor has some tripping hazards, toolboxes aren't labeled	53	39.8
Poor: No outline of tools on walls, cords are not wrapped up, tools and equipment are not hung up or on shelves, toolboxes aren't labeled	4	3.0
Missing	10	7.5

CHAPTER V

Summary, Conclusions, Implications, and Recommendations

Summary

Chapter Five contains the summary, conclusions, implications, and recommendations for each research objective examined throughout this study. Also, the researcher offers recommendations for future research.

Purpose of the Study

The purpose of this study is to evaluate the safe working conditions in selected school-based Texas agricultural mechanics laboratories. Also, this study will determine the personal, professional, and program demographics of the Texas school-based agricultural mechanics programs and the instructors who teach within them. Furthermore, this study will evaluate the self-assessed safety conditions in the selected Texas school-based agricultural mechanics laboratories.

Research Objectives

This study will be guided by the following research objectives:

1. Determine the personal, professional, and program demographics of selected Texas school-based agricultural mechanics programs and the instructors who teach within them.
2. Determine the self-assessed safety conditions in the selected Texas school-based agricultural mechanics laboratories.

Summary of Findings

Research Objective One

Research objective one sought to determine the personal, professional, and program demographics of selected Texas school-based agricultural mechanics programs and the instructors who teach within them (n = 133). These teachers were primarily between 40-49 years of age (n = 36; 27.1%), male (n = 120; 90.2%), and were of the white/non-Hispanic ethnicity (n = 126; 94.7%). The respondents had a bachelor's degree (n = 85; 63.9%), completed a traditional teaching certification program (n = 109; 82%), primarily taught 11th grade (n = 131; 98.5%), and had 0-4 years of teaching CTE related courses (n = 34; 25.6%).

In addition, there was a similar number of agricultural mechanics teachers who participated in this study who taught at all six of the UIL size schools, with the majority of participants teaching at 3A ranked schools (n = 29; 21.8%). The respondents indicated they had an average of 15 students per agricultural mechanics class (n = 31; 23.3%; M = 15.23; SD = 5.456). The majority of AFNR programs had a total number of students enrolled that ranged between 100-150 students (n = 26; 19.5%). Slightly under half of the respondents had between 0-50 students enrolled in agricultural mechanics classes (n = 54; 43.6%). While all participants taught all agricultural mechanics classes, the one course that was taught the most was Agricultural Mechanics and Metal Technologies (n = 128; 96.2%). The budget allocated for agricultural mechanics instruction and related activities was over $5,000 ($n$ = 73; 54.9%) for the agricultural mechanics teachers who participated in this study. Participants indicated that the source of those budget funds was from local CTE funds (n = 84; 63.2%). Moreover, the respondents further indicated that there was an adult support group for the AFNR program at the school where they taught (*n* = 87; 65.4%). Also, the average size of the agricultural mechanics laboratory of agricultural mechanics teachers was 4,888.44 square foot (*SD* = 5,433.881). Additionally, the age of the oldest agricultural mechanics laboratory for educational purposes was older than 25 years old (*n* = 59; 44.4%).

Agricultural mechanics teachers who instruct in school-based agricultural mechanics laboratories indicated completing an incident report was required by the school district when an accident occurs in the agricultural mechanics laboratory (*n* = 96; 72.2%). Participants also indicated that when an accident occurs, the safety issue is corrected (*n* = 133; 100%). Moreover, the respondents indicated that prior to working in the agricultural mechanics laboratory, students were required to pass a safety exam with 100% accuracy (*n* = 114; 85.7%). Also, prior to students using power tools in the agricultural mechanics laboratory, they were required to demonstrate safe working practices with those tools (*n* = 130; 97.7%). Students also had to demonstrate safe working practices with hand tools before working in the laboratory (*n* = 113; 85%). Responding teachers also indicated that the student's demonstration of each tool was not documented (*n* = 72; 54.1%). Also, the majority of respondents indicated that calling the nurse was the safety procedure when a student medical emergency occurred in the agricultural mechanics laboratory (*n* = 115; 86.5%).

Research Objective Two

Research objective two sought to determine the self-assessed safety conditions in the selected Texas school-based agricultural mechanics laboratories. The agricultural mechanics teachers who participated in this study indicated they had Safety Data Sheets available in the agricultural mechanics laboratory for all chemical/materials present (*n* = 70; 52.6%). Next, respondents indicated there were student evacuation procedures posted in the agricultural mechanics laboratory (*n* = 104; 78.2%) as well as first aid supplies available in the agricultural mechanics laboratory (*n* = 127; 95.5%). The agricultural mechanics teachers in this study expressed their agricultural mechanics laboratory did not have an emergency shower (*n* = 84; 63.2%). Next, the respondents also indicated there was an eye wash station available in the agricultural mechanics laboratory (*n* = 100; 75.2%). Furthermore, results indicated there was not safety painted lanes around breaker boxes and stationary power tools in their agricultural mechanics laboratory (*n* = 102; 76.7%). Additionally, the participants indicated there was safety signage posted in their agricultural mechanics laboratory (*n* = 100; 75.5%). Also, the respondents indicated that their agricultural mechanics laboratory had at least two exits with signs posted (*n* = 123; 95.5%).

Moreover, the respondents declared their agricultural mechanics laboratory was equipped with ventilation systems (*n* = 123; 92.5%). The results indicated that the agricultural mechanics teachers who instruct in school-based agricultural mechanics laboratories stated the lighting in the agricultural mechanics laboratories was safe (*n* = 119; 89.5%). As well as safe, the respondents indicated that the lighting the laboratory was shielded (*n* = 81; 60.9%). Respondents also stated the agricultural mechanics laboratory was equipped with welding flash shields (*n* = 99; 74.4%), although, those welding flash shields were not portable (*n* = 71; 53.4%). Next, the participants noted there was a cooling bucket for hot metal available in the agricultural mechanics laboratory (*n* = 106; 79.7%). Furthermore, the respondents indicated that the placement of trash cans were not near working areas in the agricultural mechanics laboratory (*n* = 118; 88.7%). Finally, results indicated that the participants in this study did not have stairways (*n* = 88; 66.2%) in the agricultural mechanics laboratory.

The next section of the survey sought to determine the general appearance of the agricultural mechanics laboratory. The participating teachers indicated the agricultural mechanics laboratory was currently neat/orderly (*n* = 113; 85%). Also, the respondents stated that their agricultural mechanics laboratory was clean on a normal basis (*n* = 128; 96.2%). Participants stated that the color of the walls in the agricultural mechanics laboratory did not reflect welding flash (*n* = 88; 66.2%). Additionally, the agricultural mechanics teachers who instruct in school-based agricultural mechanics laboratories indicated there were currently tripping hazards in the agricultural mechanics laboratory (*n* = 76; 57.1%). Finally, the respondents indicated that there were clean/functional hand washing facilities in the agricultural mechanics laboratory (*n* = 123; 92.5%).

The following section included questions about the PPE available in the agricultural mechanics laboratory. The respondents indicated there were safety glasses provided to every student (*n* = 116; 87.2%) and clear face shields available in the agricultural mechanics laboratory (*n* = 117; 88%). Next, respondents stated there was hearing protection (*n* = 104; 78.2%), welding gloves (*n* = 117; 88%), welding jackets (*n* = 63; 47.4%), provided for the students in the agricultural mechanics laboratory. Furthermore, the respondents indicated that welding aprons (*n* = 71; 53.4%) and welding overalls (*n* = 68; 51.1%) were not available in the agricultural mechanics laboratory. Next, the participants indicated there was breathing protection (*n* = 59; 44.4%), welding helmets (*n* = 124; 93.2%), and oxyfuel cutting goggles/face shields provided to the students (*n* = 123; 95.5%) in the agricultural mechanics laboratory. Finally, respondents indicated the ANSI Z87 safety glasses were stored in the student's locker (*n* = 54; 40.6%).

Participants further specified the details about the stationary and portable power tools in the agricultural mechanics laboratory. The participants responded that the stationary power tools were not anchored to the floor in the agricultural mechanics laboratory (*n* = 76; 57.1%). Furthermore, most stationary power tools were equipped with an emergency stop switch that was within easy reach (*n* = 107; 80.5%). Next, respondents indicated a proper kickback device (*n* = 101; 75.9%) and push sticks were available (*n* = 114; 85.7%) at the table saw in the agricultural mechanics laboratory. Additionally, agricultural mechanics teachers indicated the factory guards were in place on stationary power tools in the agricultural mechanics laboratory (*n* = 124; 93.2%). Respondents further indicated there were roller units or stands available in the agricultural mechanics laboratory to assist in moving materials (*n* = 102; 76.7%). Next, it was noted that all hand-held powered tools were equipped with a constant pressure switch that shuts off power when released in the agricultural mechanics laboratory (*n* = 106; 79.7%). The respondents further indicated that all portable, electrically powered tools (*n* = 123; 92.5%) and stationary power tools (*n* = 127; 95.5%) in the agricultural mechanics laboratory were properly grounded.

Agricultural mechanics teachers who instruct in school-based agricultural mechanics laboratories noted the overall condition of the stationary power tools in the agricultural mechanics laboratory were in good condition (*n* = 77; 57.9%). Next, the overall condition of the handheld power tools were also in good condition (*n* = 82;

61.7%). The respondents noted the overall condition of hand tools were in good (*n* = 83; 62.4%) as well as in fair condition (*n* = 83; 62.4%) in the agricultural mechanics laboratory.

In addition, the respondents indicated there were circuit breaker box/electrical cabinets in agricultural mechanics laboratory (*n* = 121; 91%). However, it was indicated that those circuit breaker box/electrical cabinets in the agriculture mechanics laboratory were not locked/inaccessible to students (*n* = 86; 64.7%). Even though the electrical boxes/switches in the agricultural mechanics laboratory were properly marked/covered (*n* = 105; 78.9%). The respondents indicated that there were no GFCI outlets installed in the agricultural mechanics laboratory (*n* = 65; 48.9%). Next, the participants indicated the extension cords in the agricultural mechanics laboratory were in safe working conditions (*n* = 123; 92.5%). Finally, results indicated that the respondents stated that each welder in the agricultural mechanics laboratory did not have a disconnecting switch with overcurrent protection within easy reach (*n* = 87; 65.4%).

Furthermore, the respondents indicated there were fire alarms installed in the agricultural mechanics laboratory (*n* = 106; 79.7%). Also, it was indicated there were fire extinguishers available in the agricultural mechanics laboratory (*n* = 126; 94.7%). Next, results indicated that the respondents declared that the fire extinguishers locations were properly marked in the agriculture mechanics laboratory (*n* = 116; 87.2%). Moreover, the participants indicated the fire extinguishers in the agricultural mechanics laboratory were the proper type (*n* = 126; 94.7%). Next, the respondents indicated that the fire extinguishers were located where flammable or combustible liquids were stored in the agricultural mechanics laboratory (*n* = 76; 57.1%). Unfortunately, the respondents indicated there was not a fire blanket readily available in the agricultural mechanics laboratory (*n* = 91; 68.4%). Finally, participants indicated that they had more than four fire extinguishers in their agricultural mechanics laboratory (*n* = 48; 36.1%).

Additionally, the respondents indicated that the oxygen/fuel cylinders were not stored separately at least 20' apart or separated by at least a 5' wall with a minimum one hour burn time (*n* = 72; 54.1%). In addition, the results indicated that the compressed gas cylinders were secured in an upright position when stored in the agricultural mechanics laboratory (*n* = 121; 91%). The respondents also indicated that the compressed cylinders were capped when not in use (*n* = 122; 91.7%), as well as clearly marked (*n* = 119; 89.5%). Also, respondents indicated that oxygen/fuel cylinders were stored away from highly flammable substances such as oil, gasoline, or waste (*n* = 126; 94.7%). Next, the respondents indicated that all the cylinders in the agricultural mechanics laboratory were upright/anchored when in use (*n* = 120; 90.2%), as well as all oxygen/fuel cylinder equipment was kept free from oily/greasy substances in the agricultural mechanics laboratory (*n* = 126; 94.7%). Finally, results indicated the respondents declared the gauges on the oxygen regulators were marked USE NO OIL in the agricultural mechanics laboratory (*n* = 96; 72.2%).

Moreover, the agricultural mechanics teachers indicated there was an approved flammable storage cabinet available in the agricultural mechanics laboratory (*n* = 80; 60.2%). Next, the participants indicated there were brooms and dust pans available in the agricultural mechanics laboratory (*n* = 123; 92.5%). Not to mention, the respondents indicated that the lumber (*n* = 108; 81.2%), and metal (*n* = 117; 88%) was organized when not in use. Additionally, the teachers indicated the chemicals in the agricultural mechanics laboratory were stored correctly according to the SDS (*n* = 94; 70.7%). Next, results indicated the respondents stated that there were safety cans in the agricultural mechanics laboratory to use for flammable/combustible liquids (*n* = 63; 47.4%), although, the safety cans were not labeled (*n* = 66; 49.6%). Next, the respondents declared that the combustible wastes were kept in covered metal containers in the agricultural mechanics laboratory (*n* = 63; 47.7%). Results from this study indicated that all flammable storage cabinets were labeled in conspicuous lettering: *Flammable – Keep Fire Away* (*n* = 70; 52.6%). Respondents also stated that all chemical containers were properly labeled in the agricultural mechanics laboratory (*n* = 81; 60.9%). Whereas the respondents indicated that there were falling hazards such as lumber stored against walls and items stored in ceiling trusses in the agricultural mechanics laboratory (*n* = 80; 60.2%). Finally, the participants also rated the organization of their tool room as in fair condition (*n* = 53; 39.8%).

Conclusions and Implications

The following conclusions and implications are made based on the results from each of the objectives within this study. For research objective one, an evaluation of the respondent's personal, professional, and program demographics were reported. Results of research objective two determined the self-assessed safety conditions in the selected Texas school-based agricultural mechanics laboratories. Conclusions and implications were developed based on the results from each research objective.

Research Objective One

Research objective one sought to determine the personal, professional, and program demographics of selected Texas school-based agricultural mechanics programs and the instructors who taught within them. Based on the results from this study, the respondents were male, between 40-49 years of age, earned a bachelor's degree and completed a traditional teaching certification program. Additionally, the respondents had 0-4 years of teaching CTE related courses as well as taught at a 3A ranked school. Students in the laboratory were required to pass a safety exam with 100% accuracy, and demonstrate safe working practices with tools in the laboratory. The demonstration of those tools was not documented by the agricultural mechanics teachers.

According to Phipps et al., (2008) documentation of safety instruction is the most important competency that a secondary agriculture teacher must possess in order to effectively manage an agricultural mechanics laboratory. Shinn (1987) also noted that the quality of an agricultural mechanics teacher's laboratory instruction directly impacts the effectiveness of the total program.

Numerous questions were raised from these results. Why are there not more teachers with more experience teaching agricultural mechanics related courses? Is there a reason for teacher's leaving the profession early? Weaver (2000) stated that the problem for the shortage of agricultural teachers is because the teachers are leaving the profession for other agriculture careers. School-based agricultural education teachers leaving the profession can lead to reduction in the size of programs or even to the closing of programs (Eck & Edwards, 2019). Allen (2005) provided evidence of the largest teacher attrition rate occurring within the first three years of teaching and that it reduces greatly after year five in the profession. Another question is, why aren't the agricultural mechanics laboratories getting updated more often? Also, are school-based agricultural mechanics teachers unaware that the demonstration of tools should be documented?

Research Objective Two

Research objective two was designed to determine the self-assessed safety conditions in the selected Texas school-based agricultural mechanics laboratories. The results from this study indicated that the majority of the teachers in this study had SDS files in the laboratory, but a great deal of them did not. Also, there was not an emergency shower or safety painted lanes, the welding flash shields were not portable, there was current tripping hazards, and the stationary power tools were not anchored to the floor.

In addition, the circuit breaker box/electrical cabinets were not locked/inaccessible to students and there was no GFCI outlets or a disconnecting switch installed. Next, the respondents indicated that there was not a fire blanket available, as well as the oxygen/fuel cylinders were not stored properly. Additionally, the safety cans in the laboratories were not labeled, there was falling hazards, and the participants rated the organization of their tool room in fair condition.

The Protection Motivation Theory played a role in the development of the theoretical foundation of this study. The objective of the Protection Motivation Theory is to recognize and assess danger, and then counter the assessment with effective and efficient options (Westcott et al., 2017). When students are working in the agricultural mechanics laboratory and there are potentially dangerous situations, students need to be able to identify those situations and be able to make the correct decision to stay safe. The Protection Motivation Theory also states that being motivated to protect oneself requires not only adequate risk perception, but also the tools and skills to take preventative action (Inouye, 2003). Those preventative action tools and skills are what the agricultural mechanics teachers should teach their students so they can react to the unsafe situation effectively.

If agricultural educators are to complete their moral obligation to the students, it is essential for agricultural teachers to display safe practices and behaviors, thus, creating a positive safety climate, not only while the students are in school, but also preparing them for when they enter the workforce (Hubert et al., 2000). The agriculture mechanics curriculum is designed to provide instruction to the students regarding safe practices in the laboratory as well as with equipment and supplies (Agricultural Science & Technology Facility Guidelines, 2001). According to Phipps et al. (2008) agricultural science teachers should ensure that laboratory facilities and equipment comply with OSHA standards and should keep SDS files for reference as needed. Along with SDS files, the agricultural mechanics laboratory should be equipped with tools and equipment to ensure the safety of students working in the laboratory. In order for the students to learn the proper safety techniques and be able to continue those safety techniques into the workforce they must be taught with the proper tools and safety equipment. The laboratory should contain equipment and supplies that will allow students to learn safely (Agricultural Science & Technology Facility Guidelines, 2001). Early exposure of a culture focused on safety will allow those students entering the classroom to have appropriate safety competencies, ultimately helping to lead to reduced accidents in the workplace (Chumbley et al., 2019). If school-based agricultural mechanics teachers do not teach their students the proper curriculum, it could lead to an accident in the laboratory.

Along with the laboratory being equipped with the right safety equipment and tools, the school-based agricultural mechanics teacher must be prepared to teach the students the skills needed for a wide array of industry jobs. It can be implied that if the teachers do not adequately prepare their students to enter the workforce, those students may not be successful in the industry. Agricultural educators are expected to manage the learning environment as well as promote safe practices to control for potential hazards, furthermore, it is also their responsibility to keep themselves, their program, and their students safe (Threeton, et al., 2015). Not only are the agricultural mechanics teachers influencing the students to work in the industry, but they are influencing the students to attend school. The teachers must instill a passion into the students for them to pursue an education in agricultural mechanics. If the teachers aren't passionate about agricultural mechanics and safety, then the students won't be either.

Several questions can be posited from these results. Is enough safety curriculum taught to school-based teachers at the university level? Do university professors adequately prepare school-based teachers to instruct safety to their students? Do the university professors have adequate knowledge of safety instruction? McKim and Saucier (2011) stated that in-service education cannot address all discrepancies at once; therefore, pertinent and continuous education should be facilitated and focus on one agricultural mechanics laboratory management competency at a time, beginning with laboratory safety. McKim and Saucier also stated that teacher education programs must provide the necessary coursework to develop well prepared and knowledgeable agriculture mechanics teachers who can safely and effectively educate students. Are the agricultural mechanics laboratories at the university level safe? For school-based agricultural mechanics teachers who are alternative certified, do they have enough safety knowledge to instruct their students? The effect and credibility of alternatively certified teachers has been questioned because they have not received formal pedagogical preparation in college, nor have they experienced the student teaching internship (Young & Edwards, 2006). Furthermore, how do school-based agricultural mechanics teachers know what safety equipment and supplies are needed in their agricultural mechanics laboratory? Do school-based agricultural mechanics teachers know how to correctly set up their laboratories? Once the equipment is set up in the agricultural mechanics laboratory, do the teachers know how to properly maintain that equipment? It is possible that AFNR teachers will not expose information and promote interest in safety if they were never taught it in their university courses or professional development workshops? Should there be state regulations for each agricultural mechanics laboratory in the state of Texas?

Recommendations

The following recommendations were made based on the results indicated by selected Texas agricultural mechanics teachers who instruct in school-based agricultural mechanics laboratories. Recommendations were offered to teacher educators, school-based agricultural mechanics teachers, state agricultural teachers' professional organizations, school-based administrators, parents, students, and state legislature.

Research Objective One and Two

Research objective one was to determine the personal, professional, and program demographics of selected Texas school-based agricultural mechanics programs and the instructors who teach within them. Research objective two sought to determine the self-assessed safety conditions in the selected Texas school-based agricultural mechanics laboratories. Based upon the results of this study, recommendations for future research are offered by the researcher.

According to the results of this study, Texas school-based agricultural mechanics teachers who instruct in agricultural mechanics laboratories need increased training regarding to safety in the laboratory. Even though the majority of the agricultural mechanics teachers were safe, there were some aspects of the agricultural mechanics laboratory that were not safe. For traditional certification programs, teachers have a certain amount of credit hours they must achieve. Unfortunately, the agricultural mechanics course load for most agricultural education undergraduate degrees in Texas is only nine hours. McKim and Saucier (2013) stated the number of university semester credit hours of agricultural mechanics coursework received during pre-service education has decreased. During those short course hours, the university professors must instruct the skills needed to properly work with the equipment that could possibly be in a laboratory. Therefore, the instructors do not have enough time to instruct the upcoming teachers on how to thoroughly teach safety to their future students. If school-based agriculture teachers who teach in an agricultural mechanics laboratory are receiving less agricultural mechanics preparation accidents are more likely to occur (McKim & Saucier, 2013). Thus, it is recommended that there be workshops and professional development concerning safety offered to agricultural mechanics teachers, from university professors and state agricultural educational staff. The researcher recommends that the Agriculture Teachers Association of Texas (ATAT) professional development conference offers workshops that focus on safety curriculum for agricultural mechanics teachers. This recommendation is offered to the alternative certified teachers as well, because if the traditionally certified teachers are not getting enough curriculum, how much are the alternative certified receiving?

Not only should teachers be taught how to teach safety and all the aspects of the curriculum, teachers should also be taught what safety tools and equipment should be in the laboratory. There are resources available to teachers explaining those tools and equipment needed, but it is unsure if the teachers are aware of those resources. It is recommended that professional development opportunities be offered for teachers to not only instruct them on what tools and equipment are needed but also how to properly maintain them. Another recommendation is for there to be a guidebook for agricultural mechanics teachers, new and experienced, explaining everything they need in an agricultural mechanics laboratory. Therefore, the teachers can self-evaluate their agricultural mechanics laboratory and determine if an existing laboratory needs to be updated or what a new laboratory should include in order for it to be as safe as possible for the students. According to Thoron, Myers and Barrick (2016), how programs utilize laboratories for learning (Shoulders & Myers, 2012) or assessment tools in the laboratory setting (Thoron & Rubenstein, 2013) will help explain the need for learning through investigations in the schools across the United States. The researcher recommends that further research be conducted to survey the teachers about their knowledge of laboratory safety equipment and how that knowledge could be improved.

Even though the agricultural mechanics teachers may know how to teach safety and have the proper tools and equipment, they may not practice safety procedures in the laboratory. If the teachers do not practice the proper safety procedures, then students will observe that resulting in the students not working safely. It could be helpful for the agricultural mechanics teachers to remember the Bandura’s Social Learning Theory, this theory suggests that people learn from one another via observation, imitation, and modeling (Nabavi, 2012). The students observe and imitate the agricultural mechanics teacher, if the teacher is not working safely in the laboratory, then the students will follow the teacher’s poor decision and not work safely as well. The agricultural mechanics teachers must practice safe working procedures, so their students have a model to look up to. Along with the Social Learning Theory, the next theory that agricultural mechanics teachers should be aware of is Operant Conditioning, meaning if the students are not working safely, and do not get punished for it, they will continue to work unsafely McLeod (2018b). It is the teacher’s responsibility to punish the students when they are not practicing the proper safety procedures and reward them for when they are. If the agricultural mechanics teachers do not punish the students for when they are working unsafe, then the students will continue to do so resulting in bad working habits.

Although teachers have the primary responsibility for ensuring the safety of vocational students, teachers have difficulty meeting this responsibility without the support of school administrators (Bear & Hoemer, 1980; McMahon, 1975; Gliem & Miller, 1993a). As stated, the administrators have a responsibility to make sure the students are being taught the proper techniques when working in an agricultural mechanics laboratory and make sure the students know how to protect themselves. The administrators of the schools where there is an agricultural mechanics laboratory should be aware of the dangerous situations that could arise. It is increasingly important for educators to properly maintain equipment, provide instruction in safety, and adequately supervise students engaged in laboratory activities (Connors, 1981; Gliem & Miller, 1993a). The researcher recommends that the administrators require the agricultural mechanics teachers to teach safety and document it, have all the proper safety equipment and tools in the laboratory, and ensure that the students are working safely. Not to mention, the parents of the students working in the agricultural mechanics laboratory should be aware of the situations as well, and not only explain to the students the importance of safety, but also enforce it while under their supervision. The researcher recommends future research be done relating to administrators views on safety in school-based agricultural mechanics laboratories.

Not only do the agricultural mechanics teachers, administrators, and parents have responsibilities to keep the students safe, the students themselves may have the most obligation to be safe while working in the agricultural mechanics laboratory. The teachers must teach the students the knowledge and skills needed to be safe, but it is the student's responsibility to comprehend those skills and use them in the laboratory. If the students are not working safely and doing what they were instructed to do, then they could get seriously injured, or cause a major accident. The researcher recommends that further research be conducted surveying the students in school-based agricultural mechanics laboratories concerning their knowledge of the safety procedures to verify that they are retaining the knowledge and using it correctly.

The final recommendation is that the agricultural mechanics laboratories have a state regulation in the state of Texas. Unfortunately, OSHA cannot inspect the laboratories in public or private schools, so it is advised to have regulations put in place, so the teachers know if their laboratory is safe or not. Instead of the individual teachers evaluating their laboratory, the researcher recommends there be a committee formed to evaluate the agricultural mechanics laboratories in the state of Texas.

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APPENDIX A

Selected Texas School-Based Agricultural Mechanics Laboratory Conditions Survey

Thank you for taking the time to complete this survey, collecting this research will help me better understand the safety needs of school-based agricultural mechanics laboratories.

This survey is divided into ten sections, starting with personal demographics about yourself and the agricultural program. It also includes sections about the agricultural mechanics laboratory such as general safety, appearance, Personal Protective Equipment, tools, electrical and fire safety, compressed gas cylinders, and storage. Please answer every question truthfully, as this survey is anonymous.

What is your age?

- 20-29
- 30-39
- 40-49
- 50-59
- 60+

What is your sex at birth?

- Male
- Female

What is your ethnicity?

- White/ Non Hispanic
- African American/Black
- Latino/Hispanic

- Native American/Indian
- Asian
- Pacific Islander
- Bi-Racial
- Other

What is your highest level of education?

- Associates
- Bachelors
- Masters
- Doctorate
- Other

What type of teaching certification program did you complete?

- Traditional
- Alternative

What grade levels will you teach during the 2020-2021 school year? (check all that apply)

- 7
- 8
- 9
- 10
- 11
- 12

How many years have you been teaching agricultural mechanics related Career Technology Education courses?

- 0-4
- 5-9
- 10-14
- 15-19
- 20-24
- 25-29
- 30+

What is your school's UIL ranking?

- 1A
- 2A
- 3A
- 4A
- 5A
- 6A

What is the average number of students enrolled in each agricultural mechanics laboratory class?

____

What is the total number of students enrolled in the Agriculture, Food, and Natural Resources (AFNR) program at the school where you currently teach?

- 0-50
- 50-100

- 100-150
- 150-200
- 250-300
- 300+

What is total number of students enrolled in all agricultural mechanic classes at the school where you currently teach?

- 0-50
- 50-100
- 100-150
- 150-200

What agricultural mechanics classes do you teach? (Check all that apply)

- Agricultural Mechanics and Metal Technologies
- Agricultural Structures Design and Fabrication
- Agricultural Equipment Design and Fabrication
- Agricultural Power Systems

What is the annual budget for Agricultural Mechanics instruction and related activities?

- $0-$1000
- $1000-$2000
- $2000-$3000
- $3000-$4000
- $4000-$5000
- $5000+

What is the source of that money for the budget?

- FFA booster club
- FFA Alumni
- CTE local funds
- CTE Perkins Funds
- Unknown
- Other

Is there an adult support group such as a FFA Booster Club, Young Farmers, or local FFA Alumni group?

- Yes
- No

When an accident occurs in the agricultural mechanics laboratory, is completing an incident report required by the school district?

- Yes
- No

When an accident occurs, is the safety issue corrected?

- Yes
- No

Prior to working in the agricultural mechanics laboratory, are students required to pass a safety exam with 100% accuracy?

- Yes
- No

Prior to students using power tools in the agricultural mechanics laboratory, are students required to demonstrate safe working practices with each power tool?

- Yes
- No

Prior to students using hand tools in the agricultural mechanics laboratory, are students required to demonstrate safe working practices with each hand tool?

- Yes
- No

Are the student's demonstrations of each tool documented?

- Yes
- No

What is the school's procedure for handling a student medical emergency that occurs in the agricultural mechanics laboratory? (Check all that apply)

- Call nurse
- Use first aid kit
- Call 911
- Other
- Explain

What is the size of the agricultural mechanics laboratory at your school? (Area= Length x Width) ______________ ft^2

What is the age of the oldest agricultural mechanics laboratory used for educational purposes at your school?

- < 5 years

- 5-10 yrs
- 11-14 yrs
- 15-20 yrs
- 21-25 yrs
- > 25 yrs

Are current Safety Data Sheet (also known as Material Safety Data Sheets) available in the in agricultural mechanics laboratory for all chemical/materials present?

- Yes
- No

Are student evacuation procedures posted in the agricultural mechanics laboratory?

- Yes
- No

Are First Aid supplies available in the agricultural mechanics laboratory?

- Yes
- No

Is there an emergency shower easily accessible in the agricultural mechanics laboratory?

- Yes
- No

Is there an eye wash station available in the agricultural mechanics laboratory?

- Yes
- No

Are there safety painted lanes around breaker boxes and stationary power tools in the agricultural mechanics laboratory?

- Yes
- No

Is there safety signage posted in your agricultural mechanics laboratory?

- Yes
- No

Does the agricultural mechanics laboratory have at least two exits with signs?

- Yes
- No

Is the agricultural mechanics laboratory equipped with ventilation systems?

- Yes
- No

Is the lighting in the agricultural mechanics laboratory safe?

- Yes
- No

Is the lighting shielded in the agricultural mechanics laboratory?

- Yes
- No

Are there welding flash shields in the agricultural mechanics laboratory?

- Yes
- No

Are the welding flash shields in the agricultural mechanics laboratory portable?

- Yes
- No

Is a cooling bucket for hot metal available in the agricultural mechanics laboratory?

- Yes
- No

Are the placements of trash cans in the agricultural mechanics laboratory not near working areas?

- Yes
- No

Are the stairways in the agricultural mechanics laboratory in safe condition? (No obstructions)

- Yes
- No
- Don't have stairways

Are the stairways in the agricultural mechanics laboratory illuminated?

- Yes
- No
- Don't have stairways

Is the agricultural mechanics laboratory currently neat/orderly?

- Yes
- No

On a normal basis, is the agricultural mechanics laboratory cleaned?

- Yes
- No

Do the color of the walls in the agricultural mechanics laboratory reflect welding flash?

- Yes
- No

Currently, are there any tripping hazards in the agricultural mechanics laboratory?

- Yes
- No

Are there clean/functional hand washing facilities in the agricultural mechanics laboratory?

- Yes
- No

Are ANSI Z87 safety glasses provided to every student in the agricultural mechanics laboratory?

- Yes
- No
- Students must provide their own

Where are the ANSI Z87 student safety glasses stored in the agricultural mechanics laboratory?

- With the student
- In the student's locker
- In a sanitation locker in the agricultural mechanics laboratory
- Other:

Are clear face shields available to the students in the agricultural mechanics laboratory?

- Yes
- No

- Students must provide their own

Is hearing protection provided to the students in the agricultural mechanics laboratory?

- Yes
- No
- Students must provide their own

Are welding gloves provided for the students in the agricultural mechanics laboratory?

- Yes
- No
- Students must provide their own

Are welding aprons available in the agricultural mechanics laboratory?

- Yes
- No
- Students must provide their own

Are welding jackets available in the agricultural mechanics laboratory?

- Yes
- No
- Students must provide their own

Are welding overalls available in the agricultural mechanics laboratory?

- Yes
- No
- Students must provide their own

Is breathing protection available for the students to use in the agricultural mechanics laboratory?

- Yes
- No
- Students must provide their own

Are arc welding helmets provided to the students in the agricultural mechanics laboratory?

- Yes
- No
- Students must provide their own

Are oxyfuel cutting goggles/face shields provided to the students in the agricultural mechanics laboratory?

- Yes
- No
- Students must provide their own

If stationary power tools have mounting holes provided, are they anchored to the floor in the agricultural mechanics laboratory?

- Yes
- No

On stationary power tools in the agricultural mechanics laboratory, are there emergency stop switches within easy reach?

- Yes
- No

Are proper kickback devices used on the table saw in the agricultural mechanics laboratory?

- Yes
- No

Are push sticks available at the table saw in the agricultural mechanics laboratory?

- Yes
- No

Are factory guards in place on stationary power tools in the agricultural mechanics laboratory?

- Yes
- No

Are roller units or stands available to assist in moving materials in the agricultural mechanics laboratory?

- Yes
- No

Are all hand-held powered tools equipped with a constant pressure switch that shuts off power when released in the agricultural mechanics laboratory?

- Yes
- No

If no, list tools that do not have a constant pressure switch in the agricultural mechanics laboratory

____

Are all portable, electrically powered tools properly grounded in the agricultural mechanics laboratory? (ie: the plug has three prongs or has a double insulated case)

- Yes

- o No

Are the stationary power tools properly grounded in the agricultural mechanics laboratory?

- o Yes
- o No

How are all portable tools stored when not in use in the agricultural mechanics laboratory?

____

What is the overall condition of stationary power tools in the agricultural mechanics laboratory?

- o Excellent: Working properly; Guards intact; no tears on cords; almost new condition
- o Good: Working; some minor wear; all guards intact
- o Fair: Somewhat working; major wear; guards intact
- o Not Functional/Unsafe: Not working; No guards; damaged cords

What is the overall condition of handheld power tools in the agricultural mechanics laboratory?

- o Excellent: Working properly; Guards intact; no tears on cords; almost new condition
- o Good: Working; some minor wear; all guards intact
- o Fair: Somewhat working; major wear; guards intact
- o Not Functional/Unsafe: Not working; No guards; damaged cords

What is the overall condition of hand tools in the agricultural mechanics laboratory?

- Excellent: Working properly, almost new condition
- Good: Working, some minor wear
- Fair: Somewhat working, major wear
- Not Functional/Unsafe: Not working, broken

Are there circuit breaker box/electrical cabinets in the agricultural mechanics laboratory?

- Yes
- No

If so, is the circuit breaker box/electrical cabinets locked/inaccessible to students in the agricultural mechanics laboratory?

- Yes
- No

Are the electrical boxes/switches properly marked/covered in the agricultural mechanics laboratory?

- Yes
- No

Are there Ground Fault Circuit Interrupter (GFCI) outlets installed in the agricultural mechanics laboratory?

- Yes
- No

Are the extension cords in safe working condition in the agricultural mechanics laboratory?

- Yes
- No

Does each welder in the agricultural mechanics laboratory have a disconnecting switch with overcurrent protection within easy reach?

- Yes
- No

Are fire alarms installed in the agricultural mechanics laboratory?

- Yes
- No

If so, how often are the fire alarms checked in the agricultural mechanics laboratory?

____

Are there fire extinguishers available in the agricultural mechanics laboratory?

- Yes
- No

How many fire extinguishers are in the agricultural mechanics laboratory?

- 1
- 2
- 3
- 4+

Are the fire extinguisher locations properly marked in the agricultural mechanics laboratory?

- Yes
- No

Are the fire extinguishers the proper type in the agricultural mechanics laboratory?

- Yes

- No

Are the fire extinguishers located where flammable or combustible liquids are stored in the agricultural mechanics laboratory?

- Yes
- No

Is there a fire blanket readily available in the agricultural mechanics laboratory?

- Yes
- No

In the agricultural mechanics laboratory, are the oxygen/fuel cylinders stored separately at least 20’ apart, or separated by at least a 5’ wall with minimum one hour burn time?

- Yes
- No

Are the cylinders secured in an upright position in the agricultural mechanics laboratory when stored?

- Yes
- No

Are the cylinders capped when not in use in the agricultural mechanics laboratory?

- Yes
- No

Are all the cylinders in the agricultural mechanics laboratory labeling clearly marked?

- Yes
- No

Are the oxygen/fuel cylinders in the agricultural mechanics laboratory stored away from highly flammable substances such as oil, gasoline, or waste?

- Yes
- No

Are all cylinders in the agricultural mechanics laboratory upright/anchored when in use?

- Yes
- No

Are all oxygen/fuel cylinders equipment in the agricultural mechanics laboratory kept free from oily/greasy substances?

- Yes
- No

Are the gauges on oxygen regulators in the agricultural mechanics laboratory marked USE NO OIL?

- Yes
- No

Is there an approved flammables storage cabinet available in the agricultural mechanics laboratory?

- Yes
- No

Currently, how safely organized is the tool room in the agricultural mechanics laboratory?

- Excellent: Outline of tools is on walls, all cords are wrapped up and not hanging down, all tools and equipment are hung up or on shelves, floor is free of tripping hazards, toolboxes labeled
- Good: Outline of tools is on walls, all cords are wrapped up and not hanging down, all tools and equipment are hung up or on shelves, floor has some tripping hazards, toolboxes not labeled
- Fair: No outline of tools on walls, all cords are wrapped up and not hanging down, all tools and equipment are hung up or on shelves, floor has some tripping hazards, toolboxes aren't labeled
- Poor: No outline of tools on walls, cords are not wrapped up, tools and equipment are not hung up or on shelves, toolboxes aren't labeled

Are brooms and dust pans available in the agricultural mechanics laboratory?

- Yes
- No

Is the lumber organized in the agricultural mechanics laboratory when not in use?

- Yes
- No

Is the metal organized in the agricultural mechanics laboratory when not in use?

- Yes
- No

In the agricultural mechanics laboratory are the chemicals stored correctly according to the Safety Data Sheets?

- Yes

- No

Are there safety cans in the agricultural mechanics laboratory to use for flammable/combustible liquids?

- Yes
- No

Are the safety cans in the agricultural mechanics laboratory labeled?

- Yes
- No

Are the combustible wastes in the agricultural mechanics laboratory kept in covered metal containers? (such as rags)

- Yes
- No

Are all flammable storage cabinets in the agricultural mechanics laboratory labeled in conspicuous lettering: “Flammable-Keep Fire Away”?

- Yes
- No

Are all chemical containers in the agricultural mechanics laboratory properly labeled?

- Yes
- No

Are there any falling hazards in the agricultural mechanics laboratory? i.e. lumber stored against walls, items stored in ceiling trusses, etc.

- Yes
- No

APPENDIX B

Panel of Experts Members

Name	University/ School	Specialty Area
Dr. Ryan Saucier	Sam Houston State University	Agricultural Engineering Technology
Dr. Richard Ford	Sam Houston State University	Agricultural Engineering Technology
Dr. Dwayne Pavelock	Sam Houston State University	Agricultural Education
Dr. Doug Ullrich	Sam Houston State University	Agricultural Education
Mr. Clint Wilson	New Waverly ISD	High school agricultural mechanics teacher
Mr. Danny Foster	Madisonville ISD	High school agricultural mechanics teacher

APPENDIX C

Purpose and Research Objectives Provided to the Panel of Experts

Purpose of the study

The purpose of this study is to evaluate the safe working conditions in Texas agricultural mechanics laboratories. Also, this study will determine the personal, professional, and program demographics of the Texas school-based agricultural mechanics programs and the instructors who teach within them. Furthermore, this study will evaluate the self- assessed safety conditions in the selected Texas school-based agricultural mechanics laboratories.

Research Objectives

This study will be guided by the following research objectives:

1. Determine the personal (age, gender, and ethnicity), professional (highest degree earned, type of teaching certification, years of agricultural mechanics teaching experience, and grade levels taught), and program demographics (school's UIL ranking, total number of students enrolled in the agricultural program, total number of students enrolled in agricultural mechanics classes, agricultural mechanics classes offered, square footage of the agricultural mechanics laboratory, age of the agricultural mechanics laboratory, budget allotment for the agricultural mechanics laboratory, source of budget, the presence of an adult support group, the average number of students enrolled in each agricultural mechanics laboratory class, and the safety procedures if there is a student emergency) of selected Texas school-

based agricultural mechanics programs and the instructors who teach within them.

2. Determine the self-assessed safety conditions (general safety conditions, general appearance, personal protective equipment, condition of hand and power tools, electrical, fire safety, compressed gas cylinders safety, and storage) in the selected Texas school-based agricultural mechanics laboratories.

APPENDIX D

Letter to Panel Members

July 15, 2020

Dear Panel Member,

Greetings, my name is Cassidy Leamon. I am a graduate student at Sam Houston State University pursing a master's degree in agricultural sciences. I am currently working on the research for my thesis that will be used to determine the safety concerns in the school-based agricultural mechanics laboratories across the state of Texas.

I am formally requesting your assistance in determining my instrument's validity. I am aware this is a busy time for you; however, I am hoping that you will be able to assist me with this matter. Due to your knowledge and expertise in the field of agricultural education, I have chosen you to serve on my "panel of experts." I really value your knowledge and time.

Specifically, I would appreciate your feedback concerning both the face and content validity of the instrument that I have posted the link to. I have also attached a copy of my study's purpose and research questions to guide you in the reviewing of my instrument. If there are any items that you do not think are addressed in this instrument, please feel free to add them.

Please write any comments or concerns on the comments page that I have also attached to this e-mail. When your review is complete, please email me the completed comments page. If you have any questions, please don't hesitate to contact me. I can be reached via e-mail at cll054@shsu.edu or by phone at (979) - 676 – 1424. I would appreciate any feedback that you can provide to me by *Thursday July 23, 2020 or as soon as possible.* I realize that this is a tight timeline, and if you are unable to assist me, I completely understand. However, your help will be greatly appreciated.

Thank you in advance for your help with this review. Hopefully with your feedback and the feedback of others, this instrument will be useful in determining the safety concerns in the school- based agricultural mechanics laboratories.

Link to instrument:

https://shsu.co1.qualtrics.com/jfe/form/SV_3BMXMdJ5czrYhbn

Sincerely,

Cassidy Leamon

APPENDIX E

Pre – Notice Email

Sam Houston
STATE UNIVERSITY
A Member of The Texas State University System

My name is Cassidy Leamon and I am a student in the School of Agricultural Sciences at Sam Houston State University (SHSU). I am conducting a study under the direction of Dr. Ryan Saucier to identify any possible safety concerns present in Texas school-based agricultural mechanics laboratories. I am asking agricultural mechanics teachers to complete a brief survey. The results will be reported in a thesis that I am completing as a requirement of my graduate program. In advance, thank you for your assistance.

In the following days, you will receive an email with the link to the survey.

Thank you,

Cassidy Leamon

IRB #2019-347

APPENDIX F

First Reminder Email

Sam Houston
STATE UNIVERSITY
A Member of The Texas State University System

Hello, my name is Cassidy Leamon and I am a student in the School of Agricultural Sciences at Sam Houston State University (SHSU). I am conducting a study under the direction of Dr. Ryan Saucier to identify possible safety concerns in Texas school-based agricultural mechanics laboratories. I am asking agricultural mechanics teachers to complete a brief survey. The results will be reported in a thesis that I am completing as a requirement of my graduate program.

The following survey includes questions concerning agricultural mechanics laboratory safety and questions about your personal demographics. It should take approximately 20 minutes of your time to complete the survey.

Your participation in this study is voluntary. If you decide to participate, your responses will be kept anonymous. Also, once you have completed the survey, if you choose to, you may email me (cll054@shsu.edu) explaining that you have completed the survey and your name will be put into a drawing to win an auto-darkening welding hood.

I appreciate your time and consideration in completing the survey. Collecting this data will help develop a better understanding of the safety needs of school-based agricultural mechanics laboratories and help prepare future and current teachers.

If you have any questions regarding this survey, please contact me at cll054@shsu.edu.

Please follow the link to the survey.

Thank you,

Cassidy Leamon

IRB #2019-347

APPENDIX G

Second Reminder Email

Sam Houston
STATE UNIVERSITY
A Member of The Texas State University System

I recently sent an email asking you to respond to a brief survey about identifying possible safety concerns in the agricultural mechanics laboratory and questions about your personal demographics. Your response to this survey is important and will help develop a better understanding of the safety needs of school-based agricultural mechanics laboratories.

This survey should only take you approximately 20 minutes to complete. If you have already completed the survey, I appreciate your participation. If you have not yet responded to the survey, I encourage you to take a few minutes and complete the survey.

Please follow the link to the survey.

If you have any questions, don't hesitate to email me at cll054@shsu.edu

Thank you,

Cassidy Leamon

APPENDIX H

Third Reminder Email

I recently sent you an email asking you to respond to a brief survey about identifying possible safety concerns in the agricultural mechanics laboratory and questions about your personal demographics.

Your response to this survey is very important for my thesis research. I urge you to please complete the survey. I plan to end the survey soon, so I wanted to email everyone who has not responded to make sure you had a chance to participate and win an auto-darkening welding hood.

Please follow the link below.

Thank you in advance for completing this survey.

Thank you,

Cassidy Leamon

APPENDIX I

Final Reminder Email

Sam Houston
STATE UNIVERSITY
A Member of The Texas State University System

Thank you for your participation in the Selected Texas School-Based Agricultural Mechanics Laboratory Condition Survey. Your response will help develop a better understanding of the safety needs of school-based agricultural mechanics laboratories.

If you completed the survey, don't forget to email me at cll054@shsu.edu to have your name put into the drawing for an auto- darkening welding hood.

Thank you

Cassidy Leamon

VITA

Cassidy Leamon

EDUCATION

Sam Houston State University, 2016-2018
M.S. Agriculture
Thesis concentration
Graduation May 2021

Sam Houston State University, 2019-2021
B. S. Agricultural Engineering Technology
Minor in Secondary Education
Graduated December 2018

Blinn College, 2014-2016
Associates of Science in Agriculture

RELEVANT COURSEWORK:

- Agriculture Structures & Environmental Control Systems, AGET 3386
- Agriculture Engines & Tractor, AGET 4387
- Advanced Agricultural Mechanics, AGET 4381
- Drafting, CAD, CNC Design, AGET 4369
- Agricultural Machinery, AGET 3380

CERTIFICATIONS:

- Completed OSHA 30 hours
- Visual Weld Inspection and Welder Qualification Certification

LEADERSHIP ROLES AND SERVICE

- Superintendent of Robertson County Fair Association Agricultural Mechanics and Mutton Bustin': 2018- Present
- Coordinator of Ethan Busby Memorial Ranch Rodeo, 2018- Present
- National Ag Honor Society, Delta Tau Alpha: Member, 2017- 2018
- SHSU Agriculture Engineering Technology Club: Chairman of Committees Officer 2017; Apparel team member 2017-2018, 2020; Member 2016-Present
- SHSU Collegiate FFA: Member, 2017
- Lifetime member of Robertson County Fair Association: 2016-Present
- Owner of welding fabrication business, Lucky U Welding: 2015-Present
- San Antonio Livestock Exposition DOT Committee: Member, 2015-Present
- Blinn College Agriculture Club: Member, 2014-2015, Agriculture Mechanics coordinator, 2015-2016

- Agriculture Mechanics judge for county and majors shows including; Blinn College, San Antonio Livestock Show and Rodeo, and Houston Livestock Show and Rodeo: 2014-Present
- Blinn College Agriculture Mechanics Judging Team: 2014-2016

PROFESSIONAL AWARDS

- National Small Gas Engine Technology Professional Development Needs Research Project, received distinguished research poster award
- Outstanding member of the Sam Houston State University Agricultural Engineering Technology club, 2018

PUBLICATIONS

Anderson, R. G., Saucier, P. R., Byrd, A. P., White, P. T., & **Leamon, C.** (2020). Identifying the tools and equipment available for career and technology education teachers to teach small gas engine skills. Research poster published in the proceedings of the 2020 National Agricultural Mechanics Professional Development Blue Ribbon Conference proceedings, Virtual.

Byrd, A. P., White, P. T., Anderson, R. G., Saucier, P. R., & **Leamon, C.** (2020). Effects of a professional development session on career and technical education teachers' importance to teach small gas engines. Research poster published in the proceedings of the 2020 National Agricultural Mechanics Professional Development Blue Ribbon Conference proceedings, Virtual.

Leamon, C., Saucier, P. R., Anderson, R. G., Byrd, A. P., & White, P. T. (2020). An evaluation of the Briggs and Stratton small gas engine technology workshop: A national focus on the professional development needs of career and technology teachers. Research poster published in the proceedings of 2020 American Association for Agricultural Education Research conference, Virtual.

Leamon, C., Saucier, P. R., Anderson, R. G., Byrd, A. P., & White, P. T. (2020). An evaluation of the Briggs and Stratton small gas engine technology workshop: A national evaluation of teacher professional development needs. Research poster published in the proceedings of 2020 North American Colleges and Teachers of Agriculture Research Conference, Virtual.

Saucier, P. R., Byrd, A. P., White, P. T., Anderson, R. G., **Leamon, C.** (2020). Effects of a professional development session on career and technical education teachers' knowledge to teach small gas engines. Research poster published in the proceedings of the 2020 National Agricultural Mechanics Professional Development Blue Ribbon Conference proceedings, Virtual.

White, P. T., Anderson, R. G., Saucier, P. R., Byrd, A. P., & **Leamon, C.** (2020). Identifying the curriculum available for career and technical education teachers to teach small gas engines skills. Research poster published in the proceedings of the 2020 National Agricultural Mechanics Professional Development Blue Ribbon Conference proceedings, Virtual.

Leamon, C., Saucier, P. R., Anderson, R. G., Byrd, A. P., & White, P. T. (2019). An evaluation of the Briggs and Stratton Small Gas Engine Technology Workshop: A national evaluation of teacher professional development needs. Research poster presented at the 2019 National Agricultural Mechanics Professional Development Blue Ribbon Conference proceedings, Indianapolis, IN.

WORK EXPERIENCE

Sam Houston State University, Huntsville, Texas, School of Agricultural Sciences

Graduate Teaching Assistant, June 2019- Dec 2020

- Organized and planned plant science and soil science laboratories
- Managed greenhouses and related facilities
- Taught curriculum related to plant science and soil science topics
- Assisted students with experimental research projects

CR Floral Designs

Florist Assistant, November 2019 - present

- Assisted with ordering floral materials
- Constructed floral arrangements
- Assisted with arranging and planning events

Allison Ranch

Ranch Hand/ Welder, January 2010 - August 2015

- Sanitation of animal housing facilities
- Vaccinated, dewormed, & palpated cattle
- Designed and fabricated pipe fence
- Constructed add on to animal and equipment facilities

7-L Ranch

Ranch Hand/ Welder, January 2005 - August 2014

- Vaccinated, dewormed, & palpated cattle
- Designed and fabricated pipe fence for working pens
- Maintained livestock nutrition