Sound Advice: A Multi-Dimensional Analysis of Hearing Conservation, Knowledge, Behaviors, and Laboratory Safety Culture Among Agricultural Mechanics Teachers

by

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Abstract

Agricultural mechanics laboratories pose a continuous acoustic hazard to teachers in the field. Nevertheless, the profession continues to experience a recurring cycle of silence concerning audiological safety. This three-article dissertation examined the technical, behavioral, and cognitive barriers to hearing conservation among agricultural mechanics instructors.

Article One employed a quantitative survey targeting two distinct cohorts of agricultural mechanics educators: a group from Georgia (*n* = 97) and a second group comprising teachers whose teams qualified for the National Agricultural Mechanics Contest at the 98th National FFA Convention and Expo (*n* = 32). The purpose was to evaluate their technical understanding of sound levels. The findings revealed a significant calibration error, as teachers consistently underestimated tool decibel (dBA) levels while overestimating safe exposure durations in accordance with NIOSH guidelines.

Article Two analyzed the Modeling Paradox within the same cohorts. Results indicated that educators uphold high safety standards in professional environments where students are present; however, they often neglect the use of personal protective equipment (PPE) in non-professional settings. This observation implies that safety is predominantly regarded as a professional obligation rather than an internalized personal value.

Article Three examines the cohort's understanding of health literacy, emphasizing the relationship between noise-induced hearing loss (NIHL) and cognitive decline

associated with dementia. The results demonstrate that the majority of respondents maintained a neutral position on this correlation, while the national cohort recorded no responses in the 'Strongly Agree' category regarding the connection between NIHL and cognitive decline. The lack of awareness of long-term neurological repercussions represents a substantial barrier to behavioral change.

Recommendations include shifting professional development from traditional PPE Training towards comprehensive health literacy advocacy. By integrating neurological outcomes. into safety discussions, the profession can transition from mere compliance to building a culture of conviction, ultimately protecting the long-term health of agricultural teachers. Creating a healthy work environment is critical for increasing teacher longevity and success (Clemson et al., 2020).

Artificial Intelligence (AI) Use Disclosure

In the preparation of this dissertation, the following Artificial Intelligence tools were used: Google Gemini 3 Flash and Grammarly. These tools were primarily for the following: formatting, reference checking, grammar, and spelling. The author acknowledges full responsibility for the intellectual content for this work and has ensured that all AI-assisted sections have been reviewed and revised for accuracy and appropriate academic style. All AI-generated content was reviewed and validated for relevance, appropriateness, and accuracy before incorporation into the final document to maintain scholarly integrity of this research.

Digital Accessibility Use Disclosure Statement

In the preparation of this dissertation, the following digital accessibility tools were used to ensure this document complies with federal requirements: Microsoft Accessibility Checker and Adobe Accessibility Check. The author acknowledges full responsibility for the intellectual content of this work and has made a good faith effort to comply with digital accessibility requirements in publishing, wherein the nature of the content does not significantly change in order to do so. Furthermore, all content has been reviewed and revised to meet these requirements prior to final publication.

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and Dr. Lindner (committee member). This dissertation was reviewed by Dr. Cletzer (external reviewer).

The data analysis was done under the supervision of Dr. McKibben. All other work for this dissertation was completed independently by the student.

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ATMS	Agriculture Technology and Mechanical Systems
CDC	Centers for Disease Control and Prevention
CDE	Career Development Event
dB	Decibel
dBA	A-weighted Decibels
GVATA	Georgia Vocational Agricultural Teachers Association
NIHL	Noise Induces Hearing Loss
NIOSH	National Institute for Occupational Safety and Health
PPE	Personal Protective Equipment
SBAE	School-Based Agricultural Education
SLT	Social Learning Theory
TPB	Theory of Planned Behavior

Chapter One

Introduction

On any given day, the teacher most at risk of injury is likely a school-based agriculture instructor. Pryer and Williams (1977) observed that instructing in vocational agriculture inherently exposes teachers to danger. Dyer and Andreasen (1999) highlight that agriculture education laboratories serve as both learning environments and hazard zones. Hard (1989) reported that the majority of accidents occur in woodworking and welding/metals laboratories. These considerations collectively suggest that the role of teaching agricultural mechanics may represent one of the most perilous positions within school facilities. Researchers such as Chumbley et al. (2019), Dyer & Andreasen (1999), Johnson et al. (1990), Lawver and Fraze (1995), and Saucier et al. (2014) have all identified concerns regarding insufficient safety instruction in agriculture education. Zohar (1980) observed that organizations with effective safety programs benefit from management support. Chumbley et al. (2019) and Cox and Flin (1998) indicated that safety climate is “the product of individual or group attitudes, perceptions, and values regarding workplace behaviors and processes that collectively derive from safety work units and organizational outputs" (Chumbley et al., 2019, p. 56). Cohen et al. (1975) and Shafai-Sahrai (1973) documented that companies exhibiting low accident rates demonstrated active management involvement in safety discussions. Conversely, organizations where management was absent from safety deliberations and decision-making processes experienced higher accident rates.

In School-Based Agricultural Education (SBAE), specifically agriculture mechanics laboratories, teachers assume management roles in both the classroom and laboratory domains. Hancock & McKibben (2024) demonstrated that SBAE mechanics instructors believe they foster a safety-oriented environment for their students. This goal can be achieved if teachers actively foster a secure environment in the agricultural laboratory through a practical approach to safety, as detailed by the previously mentioned authors. Such efforts can diminish both audible and silent injuries to students and personnel, while cultivating a safety culture characterized by a safety climate within agricultural education.

Background

Agriculture presents inherent risks and hazards. According to the Occupational Safety and Health Administration (OSHA), agriculture ranks tenth among the most hazardous professions in the United States, with a reported twenty fatal injuries per one hundred thousand workers (Purser, n.d.). The National Institute for Occupational Safety and Health (NIOSH, 2024b) emphasizes that agricultural workers face an elevated risk of on-the-job injuries and fatalities. In 2014, approximately 893,000 individuals under the age of 20 resided on farms, with over 51% of them also engaged in agricultural work.

Through their research, Schafbuch et al. (2016) observed a pattern reported by Darragh et al. (1998), indicating that farm youth frequently neglect safety precautions. Similarly, Murphy (2003) summarized that, due to their frequent exposure to farm hazards, they tend to accept accidents as a normal aspect of daily farm operations. Farm youth constitute a significant proportion of students enrolled in SBAE programs. If these young individuals are raised in an environment where accidents are considered commonplace, it falls to others to emphasize the importance of safety and ensure it is taken seriously.

Agriculture mechanics courses are highly favored among secondary students across the United States (Anderson et al., 2011; Perry et al., 2012). In Georgia, agriculture mechanics content courses accounted for 6,028 student enrollments, or 14.9% of total enrollments in Georgia Agriculture Education for the 2024-2025 academic year. This positions the agriculture mechanics pathway as the third most popular in the state (Georgia Department of Education, 2024). Nationally, agriculture remains the third most popular pathway, with 59 percent of agricultural education programs offering some form of agriculture mechanics program (National FFA Organization, n.d.).

This raises the question of whether students in SBAE are receiving the safety education they need to be safe on the farm at home. As noted by Darragh (1998), Murphy (2003), and Schafbuch et al. (2016), where are students going to learn safety concepts that can be applied throughout their lives, from the farm to the workshop? Who is going to teach students safety habits and demonstrate the proper use of personal protective equipment (PPE)? According to McMahon (1975), that responsibility falls to the SBAE teacher, who must instill a sense of safety in their classrooms and lab areas. As noted by Hubert et al. (2003), instruction on safety and the establishment of an extensive safety culture are mandatory within the agriculture mechanics program. "Agriculture education programs supported with laboratories are designed to present real-world situations to students in safe learning environments" (Hubert et al., 2003, p. 3).

To ensure that learning environments are regarded as safe for student access, it is imperative that teachers maintain a comprehensive understanding of safety principles and that a robust safety culture is fostered within the mechanical classroom (Chumbley et al., 2019; Dyer & Andreasen, 1999; Hancock & McKibben, 2024; Hubert et al., 2003; Perry et al., 2021; Shinn, 1987). Faulk et al. (2024) reported that agricultural mechanics teachers recognize safety as a major instructional priority in the mechanics curriculum. (Dyer and Andreasen, 1999) highlight that, according to Lawver (1995), eye protection constitutes one of the most critical safety instructional topics. Moreover, Dyer and Andreasen (1999) investigated noise levels in the agricultural laboratory, presenting both perspectives in the debate. One viewpoint holds that noise is a significant issue in the laboratory environment, while the opposing stance argues that it is not. Conversely, a more substantiated position emphasizes the dangers of exposing students and instructors to high-noise environments and to extended exposure to elevated decibel levels. Researchers such as Hancock et al. (2023, 2024), Miller (1987, 1989), and Woodford et al. (1993, 1996) have demonstrated that students and instructors are exposed to excessive decibel levels in the agricultural mechanics laboratory. Woodford (1993) specifically observed that all seven teachers exhibited high-frequency hearing thresholds exceeding 25 dBHL, with over 70% indicating they did not wear hearing protection when in their agricultural laboratory. Following his 1993 study, Woodford (1996) found that among a sample of 46 male West Virginia agriculture instructors, 78.6% presented some form of high-frequency hearing loss.

With the enactment of the Occupational Safety and Health Act of 1970, the National Institute for Occupational Safety and Health (NIOSH) was established. (NIOSH, 2024b). Now integrated within the Centers for Disease Control and Prevention (CDC), NIOSH’s mission is “To develop new knowledge in the field of occupational safety and health and to transfer that knowledge into practice.” (NIOSH, 2024b). In

1972, NIOSH published the inaugural Criteria for a Recommended Standard: Occupational Exposure to Noise (NIOSH, 1998). The recommended occupational exposure limit is 85 decibels, A-weighted (dBA), averaged over an 8-hour period. This limit is notably lower than OSHA's recommended threshold. By adopting this lower exposure limit, we aim to ensure the utmost safety for our students in the agricultural mechanics laboratory (Shinn, 1987).

Statement of the Problem

Teachers involved in agricultural mechanics face numerous hazards during their daily activities. Many safety concerns are also inadvertently conveyed to students enrolled in agricultural mechanics courses because of the educational setting. Dyer and Andreasen (1999) identified several safety issues warranting further investigation, particularly regarding the safety climate in laboratory environments related to hearing and eye protection. It is essential to evaluate whether agricultural teachers serve as appropriate role models by demonstrating proper laboratory safety protocols to promote a safety-conscious environment. Furthermore, emphasis should be placed on whether teachers fully comprehend the importance of decibel (dB) levels to which they are exposed and the permissible duration of safe exposure. Given evidence that agriculture is a sector characterized by high noise levels, it is crucial to determine whether teachers understand the sound levels encountered in their routine activities.

Statement of Purpose and Research Questions

The Purpose of these studies is to enhance understanding of the SBAE's perspective on safety culture as it relates to soundness. To achieve this purpose, three articles were developed, centered on specific questions about key concepts related to safety in an agricultural laboratory environment and driven by specific objectives. The three key concepts related to safety within a laboratory environment: (1) Is there a significant disparity between teachers' confidence or their self-efficacy in instructing agricultural mechanics and their technical knowledge of noise produced by common agricultural mechanics tools? (2) Is there a relationship between teachers' use of safety equipment in a personal setting (home or farm) compared to a professional setting, such as a school? (3) Do teachers understand the presence of a link between Noise-Induced Hearing Loss (NIHL) and Cognitive Decline, specifically dementia?

Theoretical and Conceptual Framework

These three studies were designed and interpreted using two primary theories: the Theory of Planned Behavior (Ajzen, 1991) and Social Learning Theory (Bandura, 1977a). The Theory of Planned Behavior (TPB) is one of the foundational theoretical frameworks for the three articles included in this dissertation. It was developed by Icek Ajzen in 1991. The TPB, which Ajzen describes as an extension of his prior work on the theory of reasoned action (Ajzen & Fishbein, 1980; Fishbein & Ajzen, 1975), underscores that an individual's intention is a vital component within this framework. Their behavior demonstrates an individual's intention; generally, the stronger the intention, the greater the likelihood of its realization. Ajzen identified three antecedent factors that directly influence an individual's intention: attitude toward behavior, subjective norms, and perceived behavioral control.

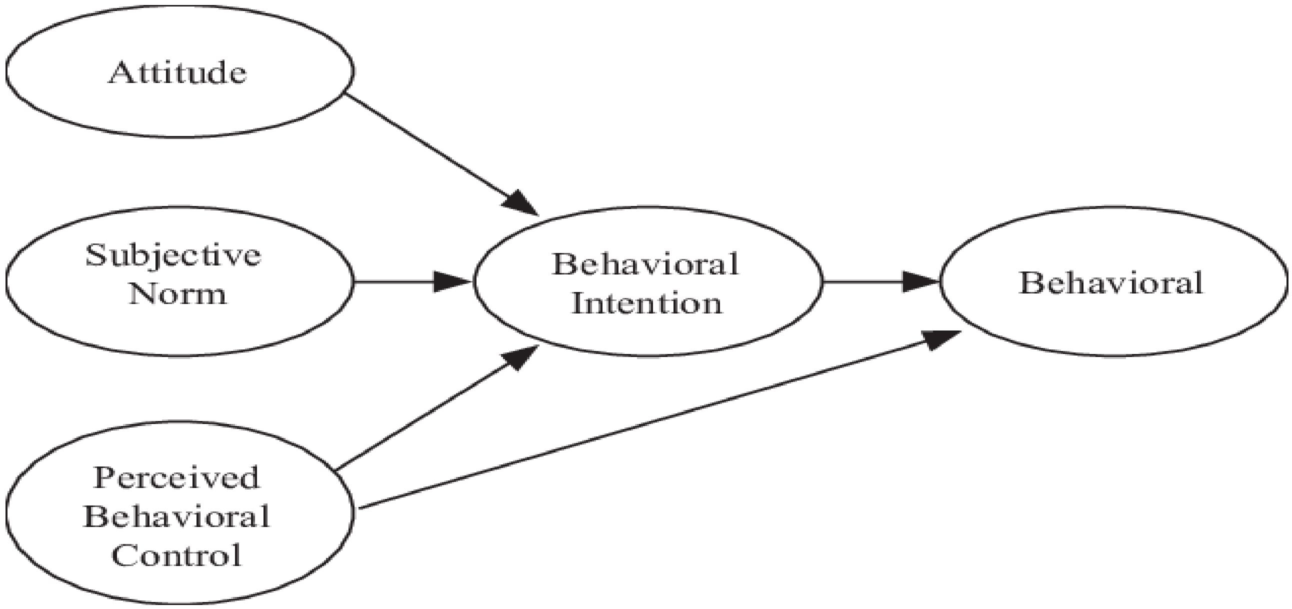

Figure 1.1. *Theory of Planned Behavior (Derived from Ajzen, 1991)*

Social Learning Theory (SLT), developed by Albert Bandura, serves as a foundational pillar of educational psychology. Bandura proposed that behavior can be shaped into new patterns through the consequences of reinforcement and punishment, noting that learning may become both laborious and perilous (Bandura, 1977). The majority of observable behaviors in individuals are acquired through modeling. This process is facilitated by models, which enable individuals to practice and learn complex, hazardous tasks through observation before performing them in real-life situations. Complex behaviors, such as language acquisition, can be learned exclusively through modeling. Bandura (1977b) emphasized that behavior is learned. Regarding the application of Personal Protective Equipment (PPE) in agricultural mechanics environments, the targeted behavior is the correct selection and utilization of PPE. Self-efficacy research has suggested that confidence in mechanics-related skills is experiential and domain-specific (Hanagriff et al., 2010; McKibben et al., 2022; Smith et al., 2024). By observing a model demonstrating the correct use of PPE, an individual develops an understanding of proper application. It is the responsibility of the agricultural instructor to provide such models.

Significance of Studies

As a result of these articles, we anticipate identifying the following: 1) SBAE mechanics teachers are prioritizing the safety of their students to the best of their ability. SBAE mechanics teachers assert that they are fostering a culture of safety within and around their workshops and laboratories. 2) SBAE agriculture education teachers have insufficient awareness of the intensity of sound exposure they experience daily in laboratory or workshop environments. This lack of awareness poses a daily safety hazard to themselves and their students, unintentionally endangering both. 3) SBAE mechanics teachers do not have an understanding of the link between NIHL and cognitive decline

Population

This dissertation analyzes two distinct populations of agricultural education teachers: Georgia Agricultural Mechanics Teachers and Agriculture Mechanics Teachers who participated in the National FFA Agricultural Technologies and Mechanical Systems Career Development (ATMS CDE). This comparative descriptive study evaluates how experience and knowledge influence the safety of teachers and students, as well as dimensions of the safety culture within the secondary agricultural mechanics laboratory. The first cohort comprises teachers in Georgia who taught an agricultural mechanics course in fiscal year 2025 (N = 125). The second cohort comprises instructors and advisors whose teams participated in the National Agricultural

Technologies and Mechanical Systems Career Development event, held concurrently with the 98th National FFA Convention and Expo in Indianapolis, Indiana (*N* = 46).

In order to determine whether the phenomena observed within the state of Georgia are comparable to those experienced by agricultural mechanics teachers across the United States, a representative sample of nationally recognized agricultural mechanics instructors was selected. To prevent imposing undue burden on respondents, it was decided that teachers who have trained ATMS teams progressing to the National FFA contest would not be considered typical representatives of the National ATMS teacher population but rather exemplars of the “best of the best." Consequently, comparisons between this group and the general population facilitate an evaluation of whether the phenomena observed in Georgia are unique or prevalent nationwide. Systematic comparisons have been conducted between the National ATMS advisors and the average ATMS instructor in Georgia.

Structure of the Studies

The three articles in this dissertation are organized to further the dissertation's overarching goal: to improve comprehension of the SBAE's viewpoint on safety and safety culture as they pertain to soundness.

Article One: The Sound of Silence: Evaluating Technical Knowledge of Noise-Induced Hearing Loss Risks and NIOSH Standards Among Secondary Agricultural Mechanics Teachers.

This article aims to evaluate the technical literacy of Secondary Agricultural Mechanics Teachers concerning noise levels and safe exposure durations, to identify specific “knowledge gaps." The research sought to determine whether a significant discrepancy exists between teachers' confidence in instructing agricultural mechanics and their actual technical knowledge of hearing safety standards. Among the objectives of this study are: 1) Assessing the teachers' ability to correctly identify safe exposure durations for specific decibel levels and determining acceptable time limits for these exposure levels; 2) Evaluating accuracy in identifying maximum average decibel levels for common laboratory tools such as circular saws, grinders, and stationary power equipment; 3) Investigating teachers' awareness of the official NIOSH guidelines concerning an eight-hour exposure limit.

Article Two: Bridging the Personal and Professional: A Comparative Study of Hearing Protection Behaviors Among Secondary Agricultural Mechanics Teachers

This study investigates the consistency, or potential discrepancy, between teachers’ personal safety practices and their professional enforcement in the classroom environment. The research aims to determine the extent to which home-based personal safety routines and the professional safety routines of agricultural teachers influence students' use of hearing protection in a secondary school setting. The objectives of this investigation include: 1) Comparing the use of hearing protection in domestic versus school laboratory contexts; 2) Analyzing the correlation between teachers' self-assessment of safety demonstration believing they exemplify safety 100% of the time and their actual enforcement of safety measures among students; and 3) Evaluating safety behaviors with specific tools, including hand-held, pneumatic, and stationary power tools.

Article Three: Cultivating a Culture of Safety: The Impact of Teacher Proficiency and Long-Term Health Literacy on Hearing PPE Provision

Finally, this research examines the overarching safety culture among secondary agricultural mechanics teachers. How does a teacher's background, expertise in agricultural mechanics, and awareness of long-term health risks, such as dementia, influence the resources they allocate to their students? Is there an association between teachers' awareness of the long-term health implications of hearing loss? Specifically, this study aims to determine: 1) whether a correlation exists between a teacher's self-efficacy of safety in agriculture mechanics laboratories and a culture of safety within agriculture mechanics; 2) determine if a relationship exists between understanding of long-term health outcomes and exposure to high levels of sound.

Scope of Investigation, Assumptions, and Limitations

These studies focused on agricultural mechanics teachers in the state of Georgia who attended the summer teachers' conference and on teachers who had a qualifying team at the National Agricultural Mechanics Career Development at the National FFA Convention.

Several assumptions can be made from this body of evidence. First, we can assume that all participants gave honest responses to the best of their knowledge. Second, it can be assumed that teachers taking part in the study were appropriate representatives of the survey populations. Lastly, it was assumed that the NIOSH (1998) standards for occupational noise exposure represent the appropriate benchmark for evaluating teachers' technical knowledge of hearing safety.

While this research offers meaningful insights into hearing safety practices among mechanics teachers, several limitations should be discussed. The Georgia cohort represents a single state, which may restrict the generalizability of the findings to agricultural mechanics teachers within the state or region. The national cohort provides geographic diversity; however, it selectively included teachers who had achieved prominence in agricultural mechanics competitions within the National FFA organization. This high level of achievement does not constitute a representative cross-section of national agricultural mechanics teachers. Furthermore, all data were obtained via self-reporting methods, which may introduce social desirability bias, considering that safety compliance constitutes a professional expectation within the agricultural mechanics discipline. Finally, this cross-sectional investigation also solely encompasses data collected at a single time point and does not occur within a true agricultural mechanics setting.

Chapter Two: Article One

The Sound of Silence: Evaluating Technical Knowledge of Noise-Induced Hearing Loss Risks and NIOSH Standards Among Secondary Agricultural Mechanics Teachers

Abstract

This study investigated the relationship between agricultural mechanics teachers' self-efficacy and their technical knowledge of tools' decibel levels. Using a multidimensional instrument, data was collected from cohorts of teachers in Georgia (n = 97) and nationally (n = 32). The findings revealed a significant discrepancy: high self-perceived safety competence did not correspond with technical proficiency. While over 76% of respondents reported consistent safe performance and more than 80% expressed confidence in teaching mechanics, their understanding of noise levels was insufficient. Notably, zero respondents in the National cohort accurately identified the maximum decibel level for a power hand drill. Additionally, both cohorts demonstrated confusion regarding NIOSH's eight-hour exposure limits, with Georgia teachers generally underestimating and National teachers overestimating the 85 dBA threshold. Although teachers can recognize the relative loudness of tools, their inability to accurately assess acoustic risks indicates that reliance on high self-efficacy may mask hazardous knowledge deficits. These results underscore the importance of targeted hearing safety education to ensure a safe learning environment for both students and educators.

Introduction

While agricultural education laboratories are often noisy and lively, they can sometimes seem surprisingly silent. According to Woodford (1996) and Bunch (1937), agricultural activities often produce noise that can damage hearing. High-frequency hearing damage has been recorded in various labs, including agricultural mechanics labs (Plakke, 1985; Roeser, 1980; Woodford, 1981; Woodford & O'Farrell, 1983; Woodford et al., 1993; Woodford et al., 1996). Reynolds (1990) found peak decibel levels exceeding 129 dB near students. Dyer and Andreasen (1999) noted that students and teachers are exposed to loud, potentially harmful noise. Studies by Burke (1987, cited in Dyer & Andreasen, 1999) and Woodford et al. (1993) indicate that teachers are at risk of hearing loss. Woodford et al. (1996) reported that about 78.3% of West Virginia agricultural teachers exhibit hearing impairment, particularly in high-frequency sounds. Miller (1989) suggests the use of hearing protection during arc welding to improve student performance. All these studies recorded noise levels at or above the 85 dB safety threshold recommended by NIOSH (2024a; 2024b).

The issue of hearing safety within agricultural and industrial education has been extensively examined in prior research (Hancock et al., 2023; Miller, 1989; Plakke, 1985; Reynolds, 1990; Roser, 1980; Woodford et al., 1993). A noticeable gap persists between teachers' understanding of the decibel (dB) output of various tools and equipment used in agricultural laboratories and the long-term implications of hearing impairment from exposure to high sound levels, as emphasized by Hancock & McKibben (2024). Several scholars, including Chumbley et al. (2019), Dyer & Andreasen (1999), and Hard (1989), have identified safety concerns related to student participation in laboratory activities. Chumbley et al. (2019) reported that teachers generally feel moderately to highly prepared to provide safety instruction; this finding aligns with Hancock & McKibben (2024), who observed that teachers perceive the work environment as safe. Roeser (1980) indicated that virtually all high schools offering industrial arts programs, which furnish students with both practical and structured instruction, incorporate some form of safety education. This observation is supported by numerous prior studies. Additionally, Roeser (1980) noted that few, if any, offer specific instruction on hearing conservation, a point also highlighted by the aforementioned research.

Noise-induced hearing loss (NIHL) constitutes a prevalent and preventable injury among farmers (Ehlers & Graydon, 2011). Ehlers & Graydon (2011) rightly emphasize that auditory damage frequently begins in early childhood. This observation is corroborated by studies such as Broste et al. (1989) and Woodford et al. (1993). As teachers in agricultural mechanics, we are responsible for ensuring that our laboratories provide a safe learning environment for our students, as highlighted by Shinn (1987). An often-neglected aspect of safety involves protecting students from hazards that may otherwise go unnoticed, such as NIHL.

Prospective and Conceptual Framework

The foundation of this research is rooted in the work of Dyer and Andreasen (1999), which analyzed deficiencies in agricultural education. This investigation focuses on the lack of hearing safety, as outlined by Dyer & Andreasen (1999) and Langley et al. (2018). It is well established that the agricultural mechanics and agricultural mechanics laboratories are associated with high noise levels (Miller, 1989; Reynolds, 1990), and there have been documented instances of hearing loss among agricultural mechanics instructors (Woodford et al., 1996) due to exposure to decibel (dB) levels exceeding the standards set by the National Institute for Occupational Safety and Health (NIOSH) for safe noise exposure. These studies provide the foundation for this research.

This study investigates the calibration of self-efficacy among agricultural mechanics instructors through the lens of Bandura (1977a). Prior needs assessment research has emphasized the importance of examining teachers' technical expertise and content needs as priorities rather than assumptions of professional roles or program participation (Clemons et al., 2018). It is hypothesized that a teacher's perceived competence in instructing agricultural mechanics, particularly regarding safety procedures, may not correspond with their technical knowledge related to NIOSH (1998) standards. Competence is defined as the knowledge, skills, and abilities needed by teachers in the conduct of their jobs (Dooley, et al., 2002). Teacher efficacy can vary by instructional domain, with educators reporting varied levels of confidence across STEM subjects (Hendrix et al., 2024; Lindner, et al., 2004). Such discrepancies pose considerable risks; teachers who overestimate their ability to accurately evaluate A-weighted decibel (dBA) levels may inadvertently expose themselves and their students to noise levels ranging from elevated to hazardous (Miller, 1989; Reynolds, 1990). This inadvertent exposure could lead to permanent noise-induced hearing loss, a condition that has been observed at higher rates among vocational agricultural students (Broste et al., 1989; Woodford et al., 1993) and agricultural education teachers (Woodford, 1996).

Purpose and Objectives

The objective of this study is to examine whether a significant discrepancy exists between teachers' confidence in instructing agricultural mechanics and their actual technical knowledge of hearing safety standards as delineated in NIOSH (1998). The teachers' understanding of these safety protocols significantly influences the safety of their hearing and that of their students. This research endeavors to evaluate both Georgia agricultural mechanics teachers and those who attended the National Agricultural Mechanics Career Development Event. The following are the specific objectives of this investigation:

1. Assess teachers' perceived self-efficacy regarding their ability to instruct and manage agricultural mechanics laboratory safety.
2. Evaluate teachers' awareness of the official NIOSH-recommended 8-hour exposure limits.
3. Determine whether teachers can accurately identify the maximum average A-weighted decibel (dBA) levels of commonly used laboratory tools in agricultural mechanics.

Methods

This research aims to evaluate the extent of knowledge possessed by secondary agricultural mechanics teachers concerning sound, sound levels, and sound limits. The objective is to enhance understanding of safety deficiencies within agricultural education relating to hearing protection. The study population consists of secondary teachers in Georgia who instructed at least one agricultural mechanics class during the fiscal year

2025 (N = 125). This population is a well-recognized and thoroughly studied group of agricultural mechanics instructors familiar to the research team. It was specifically selected to facilitate the formulation of targeted recommendations relevant to this cohort. To ascertain whether the knowledge regarding sound, sound levels, and sound limits in Georgia reflects a broader or more specific understanding, a more broadly representative group of agricultural mechanics instructors was also included. Data were collected from instructors participating in the Agricultural Technologies and Mechanical Systems Career Development Event (ATMS CDE), held concurrently with the 98th National FFA Convention and Expo in Indianapolis, Indiana (N = 46). Participants in the National ATMS CDE were chosen because this event offers the potential for representation from every state or territory within the United States, thereby providing the most comprehensive pool of instructors to determine whether the data collected from Georgia teachers indicate general national trends or are specific to the state of Georgia.

Instrumentation

This study employed a comprehensive instrument, meticulously developed and validated by the research team, to evaluate knowledge of sound, sound levels, and sound exposure limits among agricultural mechanics instructors. The instrument incorporated multiple constructs and collected characteristic data. This report will discuss the process used to assess teachers' perceived self-efficacy in instructing and managing an agricultural mechanics laboratory, the constructs measuring participants' ability to accurately identify safe exposure durations for specific decibel levels, and teachers' awareness of the official NIOSH-recommended 8-hour exposure limits.

The instrument was developed as a multidimensional assessment tool comprising three distinct sections. A self-efficacy subscale utilized a 5-point Likert scale to evaluate participants' perceived confidence in their safety knowledge and abilities. Teachers' responses in this section were categorized as follows: 100% of the time = (1), Not 100%, but close = (2), Most of the time = (3), Sometimes = (4), and Never = (5). Additionally, teachers were requested to rate their confidence in the use of common tools in agricultural mechanics and in teaching. Both questions employed the same Likert scale, with response options as follows: Very Confident = (1), Somewhat Confident = (2), Neither Confident Nor Not Confident = (3), Somewhat Not Confident = (4), and Not Confident = (5). True limits and interpretations were made based on Lindners' Convention (2024).

A criterion-referenced assessment of technical knowledge was conducted, focusing on NIOSH standards. Teachers were presented with questions concerning the duration of exposure to specific decibel levels and the maximum average decibel (dBA) levels. They were also asked whether hearing protection should be used when operating certain tools for 30 minutes. Except for one tool, all listed tools have a dBA level that warrants hearing protection for a 30-minute exposure. By employing a criterion-referenced assessment, the research team was able to draw definitive conclusions regarding teachers' understanding of the maximum average A-weighted decibel (dBA) levels of common tools and equipment employed in agricultural laboratories, as well as their awareness of the NIOSH-recommended 8-hour exposure limit. Furthermore, a demographic profile was established to facilitate cohort comparisons. This streamlined item design enables the calculation of discrepancies, thereby identifying gaps between teachers' perceived mastery and their technical proficiency. The dates and locations for administering the instrument were selected to ensure access to two distinct cohorts. The initial administration took place at the Georgia Vocational Teachers Conference, held in Athens, Georgia, in July 2025. The research team compiled a list of agricultural teachers who instructed at least one agricultural mechanics class during the 2024–2025 academic year. Utilizing this compiled list, the research team distributed paper copies of the instrument to as many teachers as feasible from the identified list. The use of a paper-based administration was selected over digital distribution to maximize the response rate during the face-to-face time at the conference and convention. Agricultural education research consistently relies on survey distribution methods emphasizing the importance of response optimization and attention to non-response error (Lindner et al., 2001; McKibben et al., 2025). Teachers were recorded as having received a copy of the instrument. Instruments were either collected in person after completion or left at a designated unmonitored drop-off location within the conference premises, ensuring that the research team could not link specific responses to individual instructors. Teachers whose instruments were known to have been collected were marked as having received them and were included with other completed instruments, enabling responses to be gathered without any identifying markings and thereby maintaining the utmost possible anonymity. Of the total number of teachers identified as potential participants in the study (N = 125), the research team distributed and collected responses from 97 teachers (*n* = 97), resulting in a response rate of 78%.

The second administration of the study instrument was conducted in October 2025 at the Agricultural Technologies and Mechanical Systems Career Development Event (ATMS CDE), which coincided with the 98th National FFA Convention and Expo in Indianapolis, Indiana. Each state within the National FFA organization is provided the opportunity to send a team to participate in the CDE during the convention. A total of 46 teams were involved during the 98th National FFA Convention. On the second day of the CDE, teams were divided into three flights. Instruments were supplied to the advisors in the event holding area during the students' participation in the competition. Paper copies were employed, and the research team distributed and collected these instruments from each instructor. Following completion of the CDE, (n = 32) responses were received, yielding a response rate of 69%.

Findings

Demographic data for the two cohorts, Georgia agriculture mechanics teachers and National agriculture mechanics teachers, are as follows. Respondents of the Georgia agricultural mechanics cohort (n = 97) were predominantly male, comprising 82 individuals (84.5%), with 12 individuals (12.4%) female, and three non-respondents. Years of teaching experience ranged from two years to 38 years (M = 15.72, Mo = 12, SD = 9.04). The age of respondents ranged from 23 to 59, with one respondent aged 62 (M = 39.26, Mo = 51, SD = 10.05). Our national cohort (n = 32) reflected similar demographics, with respondents being predominantly male 23 individuals, (71.9%), 8 (25%) identifying as female, and 1 non-respondent. Years of teaching experience ranged from two years to forty-six years (M = 16.06, Mo = 11, SD = 11.60). The age of the national cohort ranged from 23 to 68 (M = 42.87, Mo = 28, SD = 11.60).

The self-efficacy responses were gleaned from the use of a 5-point Likert scale to assess participants' perceived confidence in their safety knowledge and abilities. Information concerning experience in agricultural mechanics, respondents' confidence in tool usage, and teaching proficiency in agricultural mechanics is detailed in Table 2.1.

Table 2.1
Self-efficacy of Safety, Skills, Tool Usage, and Teaching Confidence Among Agricultural Mechanics Teachers.

	Georgia Cohort				National Cohort			
	f	%	*M*	*SD*	*f*	%	*M*	*SD*
Do you believe you demonstrate proper workplace safety?	97		2.08	.66	32		1.78	.66
100% of the time	16	16.5			10	31.3		
Not 100%, but close	58	59.8			20	62.5		
Most of the time	22	22.7			1	3.1		
Sometimes	1	1.0			1	3.1		
Never	-	-			-	-		
How would you describe your experience with agricultural mechanics skills	97		3.99	.57	32		4.13	.79
No experience	-	-			-	-		
Limited experience	-	-			2	6.3		
Basic experience: perform simple tasks	16	16.5			2	6.3		
Proficient; performed various tasks independently	65	67.0			18	56.3		
Expert can perform complex tasks and troubleshoot	15	15.5			10	31.3		
Confidence in Common Tool Usage	97		1.34	.56	32		1.13	.42
Very Confident	67	69.1			29	90.6		
Somewhat Confident	28	28.9			2	6.3		
Neither Confident nor Not Confident	1	1.0			1	3.1		
Somewhat Not Confident	1	1.0			-	-		
Not Confident	-	-			-	-		
Confidence in Teaching	97		1.56	.56	32		1.63	.91
Very Confident	52	53.6			18	56.3		
Somewhat Confident	38	39.2			10	31.3		
Neither Confident nor Not Confident	5	5.2			3	9.4		
Somewhat Not Confident	2	2.1			-	-		
Not Confident	-	-			1	3.1		

Note: Georgia Cohort (*n* = 97), National Cohort (*n* = 32). Lower mean scores indicate higher confidence/self-efficacy.

All items in this subscale were scored so that 1 represents the most favorable response and 5 the least; lower mean scores indicate higher perceived self-efficacy. The responses suggest that both groups of educators perceive themselves as implementing appropriate safety measures and express confidence in their capacity to instruct agricultural mechanics proficiently. They also report competence across various agricultural mechanics skills, along with confidence in their instructional abilities and tool utilization. Educators from Georgia (M = 2.08, SD = .66) and nationwide (M = 1.78, SD = .66) indicate that teachers regard workplace safety as effectively maintained, with the national cohort reporting a higher mean score. Both groups believe they are proficient in executing tasks related to agricultural mechanics. The Georgia cohort's mean score (M = 3.99, SD = .57) and the national cohort's mean score (M = 4.13, SD = .79) indicate that both groups exhibit a high level of comfort performing tasks within an agricultural mechanics laboratory, with the national cohort demonstrating slightly greater confidence. Both the Georgia (M = 1.34, SD = .56) and national (M = 1.13, SD = .42) cohorts reported being able to confidently utilize tools common to agricultural mechanics. Additionally, the Georgia (M = 1.56, SD = .56) and national (M = 1.63, SD = .91) cohorts indicate a high level of confidence in their ability to effectively teach agricultural mechanics. With a slightly higher confidence rate again, going to the National cohort.

Participants from both cohorts were surveyed regarding the sound levels of commonly utilized tools in agricultural laboratories. The initial question posed to respondents concerned their understanding of exposure time limits under NIOSH guidelines for a specific decibel level. The results indicate that, for both cohorts, a minority of respondents—34% for Georgia and 37.5% for the National cohort—provided correct responses. Conversely, the majority of responses—66% for Georgia and 62.5% for the National cohort—were incorrect. Among the incorrect responses, two error directions are evident. The largest share of respondents (46.4% in Georgia and 43.8% nationally) selected a shorter time than the correct 30-minute limit, a cautious error that errs on the side of safety. The greater concern, a subset of respondents selected exposure times longer than the correct limit, up to eight hours, indicating a belief that prolonged exposure at this intensity level is safe. This overestimation of permissible exposure time represents the more hazardous misunderstanding of the safe limits established by the NIOSH, as detailed in Table 2.2.

Although a specific sound-level standard is referenced in Table 2.2, it does not provide insight into how agricultural mechanics teachers perceive the risks associated with the equipment typically found in agricultural mechanics laboratories.

Table 2.2
Agricultural Mechanics Teachers' Responses to Safe Exposure Time Limits to Sound at 97 Decibels.

	Georgia Cohort				National Cohort			
	f	%	*M*	*SD*	*f*	%	*M*	*SD*
Safe Exposure Time Limits to Sound at 97 Decibels	97		.79	1.32	31		.79	1.50
16 Hours	-	-			-	-		
8 Hours	2	2.1			1	3.1		
4 Hours	4	4.1			1	3.1		
2 Hours	4	4.1			-	-		
1 Hour	9	9.3			3	9.4		
30 Minutes	33	34			12	37.5		
15 Minutes	45	46.4			14	43.8		

Note:Georgia Cohort (*n* = 97), National Cohort (*n* = 32); National Cohort percentages are calculated on valid responses to this response (*n* = 31). Line indicates NIOSH recommended hearing limit for 97 dBA.

Teachers were asked whether 30 minutes of unprotected use of tools common to agricultural mechanics laboratories would lead to permanent hearing impairment. These responses are presented in Table 2.3, categorized by cohort and tool type.

Table 2.3
Agricultural Mechanics Teachers' Responses: Will 30 minutes of Unprotected Tool Usage Result in Permanent Hearing Impairment?

	Georgia Cohort						National Cohort					
	Yes		No		*M*	*SD*	Yes		No		*M*	*SD*
	f	%	*f*	%			*f*	%	*f*	%		
Circular Saw	72	75.8	23	24.2	1.24	.43	25	78.1	7	21.9	1.22	.42
Power Hand Drill	29	30.5	66	69.5	1.69	.46	8	25	24	75	1.75	.44
Hand Angle Grinder	84	88.4	11	11.6	1.12	.32	28	87.5	4	12.5	1.13	.34
Hammer Drill	77	81.1	18	18.9	1.19	.39	27	84.4	5	15.6	1.16	.37
Pneumatic Impact Wrench	74	78.7	20	21.3	1.21	.41	27	84.4	5	15.6	1.16	.37
Jig Saw	40	42.1	55	57.9	1.58	.50	9	28.1	23	71.9	1.72	.46
Miter Saw	67	70.5	28	29.5	1.29	.46	21	65.6	11	34.4	1.34	.49
Reciprocating Saw	59	62.1	36	37.9	1.38	.49	12	38.7	19	61.3	1.61	.50
Electric Screwdriver	22	23.2	73	76.8	1.77	.42	4	12.5	28	87.5	1.88	.34

Note:Georgia Cohort (*n* = 97); valid responses for this response (*n* = 95), National Cohort (*n* = 32); valid responses to this response (*n* = 31).

Table 2.3 presents a consensus among both cohorts on high-impact machinery, specifically machinery that produces elevated dBA levels. The majority of both the Georgia (88.4%) and National (87.5%) cohorts acknowledged that using tools such as a hand angle grinder, hammer drill, and pneumatic impact wrench for 30 minutes without hearing protection could result in permanent hearing damage. Both groups exhibited a considerably lower level of concern about the hand drill, with 30.5% of Georgia teachers and 25% of National teachers indicating that using these tools could lead to hearing impairment. A discrepancy is observed between the two groups regarding the reciprocating saw: 62.1% of Georgia teachers reported that 30 minutes of unprotected use could cause hearing damage, compared to 38.7% of the National cohort.

While Table 2.3 provides some insight into the teachers' perspectives on the extended usage of these tools, we would also like to understand their opinions regarding the maximum dBA output of these tools. Table 2.4 presents the responses from the Georgia cohort (n = 97) , while Table 2.5 displays the responses from the national cohort (n = 32).

Table 2.4
Georgia Teachers' Perceptions of Maximum Average Decibel (dBA) for Tools Common in Agricultural Mechanics Laboratories.

	Circular Saw		Power Hand Drill		Hand Angle Grinder		Hammer Drill		Pneumatic Impact Wrench		Jig Saw		Miter Saw		Reciprocating Saw		Electric Screwdriver	
Maximum dBA	*f*	%	*f*	%	*f*	%	*f*	%	*f*	%	*f*	%	*f*	%	*f*	%	*f*	%
30	2	2.2	10	10.9	2	2.2	3	3.3	3	3.3	5	5.4	3	3.3	4	4.3	18	19.6
40	5	5.4	8	8.7	2	2.2	4	4.3	2	3.3	9	9.8	5	5.5	5	5.4	9	9.8
50	4	4.3	7	7.6	4	4.3	4	4.3	5	5.4	5	5.4	4	4.4	4	4.3	12	13.0
60	2	2.2	12	13	-	-	3	3.3	1	1.1	10	10.9	3	3.3	4	4.3	12	13.0
70	7	7.6	15	16.3	5	5.4	7	7.6	7	7.6	8	8.7	6	6.6	9	9.8	15	16.3
80	13	14.1	7	7.6	8	8.7	10	10.9	16	17.4	14	15.2	14	15.4	15	16.3	9	9.8
90	20	21.7	21	22.8	16	17.4	15	16.3	12	13.0	16	17.4	17	18.7	19	20.7	13	14.1
100	15	16.3	10	10.9	12	13.0	21	22.8	19	20.7	20	21.7	15	16.5	15	16.3	4	4.3
110	11	12	2	2.2	16	17.4	9	9.8	10	10.9	3	3.3	10	11.0	11	12.0	-	-
120	10	10.9	-	-	15	16.3	9	9.8	9	9.8	2	2.2	13	14.3	5	5.4	-	-
130	1	1.1	-	-	9	9.8	5	5.4	5	5.4	-	-	1	1.1	1	1.1	-	-
140	2	2.2	-	-	3	3.3	2	2.2	2	2.2	-	-	-	-	-	-	-	-

Note: Missing Responses of (*n* = 5), which is 5.2% of the total respondents. Percent values expressed in Table 2.4 are Valid Percents. Values that received no responses are indicated with a dash. Maximum average dBA levels were developed using the NIOSH database of sound power levels.

Table 2.5
National Agricultural Teachers' Perceptions of Maximum Average Decibel (dBA) for Tools Common in Agricultural Mechanics Laboratories.

	Circular Saw		Power Hand Drill		Hand Angle Grinder		Hammer Drill		Pneumatic Impact Wrench		Jig Saw		Miter Saw		Reciprocating Saw		Electric Screwdriver	
Maximum dBA	*f*	%	*f*	%	*f*	%	*f*	%	*f*	%	*f*	%	*f*	%	*f*	%	*f*	%
30	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	3	9.5
40	-	-	1	3.7	-	-	-	-	-	-	-	-	-	-	-	-	3	9.4
50	-	-	5	18.5	-	-	-	-	-	-	7	25.9	2	7.4	5	18.5	8	25
60	1	3.7	7	25.9	-	-	-	-	1	3.7	6	22.2	1	3.7	3	11.1	6	18.8
70	3	11.1	7	25.9	-	-	2	7.4	1	3.7	6	22.2	4	14.8	5	18.5	5	15.6
80	2	7.4	2	7.4	-	-	1	3.7	4	14.8	3	11.1	7	25.9	4	14.8	2	6.3
90	4	14.8	3	11.1	6	22.2	5	18.5	3	11.1	2	7.4	3	11.1	3	11.1	-	-
100	7	25.9	-	-	8	29.6	6	22.2	4	14.8	1	3.7	5	18.5	4	14.8	-	-
110	6	22.2	2	7.4	6	22.2	4	14.8	3	11.1	2	7.4	1	3.7	2	7.4	-	-
120	3	11.1	-	-	6	22.2	5	18.5	5	18.5	-	-	3	11.1	1	3.7	-	-
130	-	-	-	-	1	7.4	2	7.4	6	22.2	-	-	1	3.7	-	-	-	-
140	1	3.7	-	-	-	-	2	7.4	-	-	-	-	-	-	-	-	-	-

Note: Missing Responses of (*n* = 5), which is 15.6% of the total respondents. Percent values expressed in Table 2.5 are Valid Percents. Values that received no responses are indicated with a dash. Maximum average dBA levels were developed using the NIOSH database of sound power levels.

The findings presented in Table 2.3 indicate that teachers generally recognize tools that produce high dBA levels and consequently respond in an appropriate manner. Table 2.4 and Table 2.5 show a substantial disparity in teachers' capacity to accurately assess the dBA levels of the tools listed. Participants were tasked with identifying the maximum average dBA of nine tools commonly employed in agricultural mechanics laboratories, with results compared against the actual dBA levels established by the National Institute for Occupational Safety and Health (NIOSH, 2006). Table 2.4 reveals that the Georgia cohort tends to underestimate sound levels. An illustrative example is the power hand drill, which has a maximum sound level of 99 dBA; only 10.9% of respondents correctly identified it at the nearest response option, 100 dBA. This trend is even more evident within the National cohort, as shown in Table 2.5. Notably, no respondent correctly identified the dBA level for the power hand drill. Furthermore, 92.6% of the respondents in the National cohort underestimated the dBA level of the power hand drill.

It is evident that both groups exhibit enhanced proficiency in recognizing the “loudness” of the tools used within the laboratory setting; however, teachers face significant challenges in precisely determining the true characteristics of the sounds. This inadequacy in sound identification hampers their ability to maintain a safe learning environment for students and a secure workspace for themselves.

Table 2.6 presents the responses from both the Georgia and National cohorts to the question of what the maximum allowable eight-hour exposure limit is under the NIOSH guidelines.

Table 2.6
Responses to dBA eight-hour exposure limit according to NIOSH guidelines.

	Georgia Cohort				National Cohort			
	f	%	*M*	*SD*	*f*	%	*M*	*SD*
			77.66	11.61			79.66	10.26
60	17	18.5			2	6.9		
65	6	6.5			2	6.9		
70	9	9.8			4	13.8		
75	5	5.4			3	10.3		
80	16	17.4			5	17.2		
85	21	22.8			5	17.2		
90	11	12			7	24.1		
95	6	6.5			-	-		
100	-	-			1	3.4		
105	1	1.1			-	-		
110	-	-			-	-		
115	-	-			-	-		
120	-	-			-	-		

Note: Missing Responses for Georgia Cohort of (*n* = 5), which is 5.2% of the total respondents. Missing Responses for National Cohort of (*n* = 3), which is 9.4% of the total respondents. The line represents the NIOSH-recommended safe exposure limit for an eight-hour period. Values receiving no response are indicated by a dash.

Georgia and national teachers generally underestimated the duration required to reach an equivalent of an eight-hour exposure limit. NIOSH (1998) lists the permissible noise level for an eight-hour exposure as 85 dBA. In the Georgia cohort, 21 respondents (22.8%) correctly identified this limit, whereas 18 respondents (19.6%) overestimated the permissible dBA level for an eight-hour workday. In the national cohort, five respondents (17.2%) accurately selected the correct response. However, both the Georgian and national cohorts had nearly one-quarter of their responses exceeding the established NIOSH safety limits. Within the Georgia cohort, 18 respondents (19.6%) and in the national cohort, eight respondents (27.5%) overestimated the limit, with seven respondents (24.1%) choosing 90 dBA as the appropriate exposure level for an eight-hour period.

Discussion and Conclusion

The purpose of this study was to explore the relationship between agricultural mechanics teachers' self-efficacy and their technical knowledge related to noise hazards. The findings demonstrate a calibration gap across both the Georgia and National cohorts. Respondents demonstrated high confidence in their ability to demonstrate and teach safety in an agricultural mechanics laboratory, as seen in Table 2.1. Teachers were able to identify the louder tools from the quieter tools. The gap begins to form when teachers are asked to accurately identify the acoustic intensity of tools commonly used in agricultural mechanics laboratories. This inability to accurately identify these acoustic levels suggests that teachers' technical safety, specifically related to sound and intensity levels, is creating a hazardous learning environment for themselves and the students under their care.

Concerning our primary objective, which is evaluating the self-efficacy of agricultural education instructors regarding their ability to instruct and safely manage the agricultural mechanics laboratory, respondents reported their compliance with workplace safety standards. Specifically, 74 respondents (76.3% of those from Georgia) stated that they are consistently safe or nearly entirely safe while performing their duties. The cohort from the national sample exhibits comparable results: 30 respondents, accounting for 93.8%, affirm that they are invariably safe or nearly entirely safe in their work environment. Regarding teachers' experience and confidence in instructing agricultural mechanics and tool usage, respondents again indicated that they possess either proficient or expert levels of experience in teaching agricultural mechanics, with eighty respondents (80.5%) in Georgia and twenty-eight respondents

(87.6%) nationally. The confidence levels in tool usage within the national cohort, with a response of Very Confident (90.6%), suggest that these teachers can be regarded as experts in tool utilization within their field.

Objective Two: To evaluate whether teachers can precisely identify the maximum average A-weighted decibel (dBA) levels of commonly utilized tools in agricultural mechanics, respondents demonstrated their ability to recognize which tools generate the highest sound levels. Teachers were able to determine which tools require hearing protection when operated for 30 minutes. According to NIOSH (2006), tools such as grinders, hammer drills, and circular saws produce higher dBA levels compared to tools such as power hand drills and electric screwdrivers. This indicates that respondents tend to wear hearing protection when using tools that emit higher dBA levels rather than lower ones. However, the teachers failed to correctly identify the actual sound levels produced by these common tools in agricultural mechanics laboratories. National respondents had difficulty determining correct sound levels (Table 2.5). Not a single respondent accurately identified the maximum dBA for a power hand drill. This constitutes a significant finding, especially considering that National respondents reported over 90% confidence in their tool usage and over 75% confidence in their ability to teach agricultural mechanics as safely as possible.

Objective three aimed to evaluate educators' awareness of the official NIOSH-recommended eight-hour exposure limits. It was observed that the majority of teachers across both cohorts selected responses below the NIOSH-established 85 dBA threshold. Specifically, the mean response for Georgia respondents was (M = 77.66), whereas the national cohort had a mean of 79.66. The mean for the national cohort was higher than that in Georgia and closer to the NIOSH standard. For this item, the two error directions carry opposite safety implications: establishing a threshold below 85 dBA is a conservative error that would lead teachers to adopt protection sooner than required, whereas estimating a threshold above 85dBA is a hazardous error, as it implies a belief that louder environments are safe for a full workday. This may suggest that teachers nationwide have a greater understanding of the NIOSH limits compared to their counterparts in Georgia. Additionally, approximately one-quarter of respondents in each cohort exceeded the recommended NIOSH limits, the hazardous direction error. These findings of predominant underestimation imply two possible explanations: first, that educators in both cohorts are making efforts to prioritize safety in their laboratories; second, that teachers may lack a comprehensive understanding of the NIOSH exposure limits.

Future Research Questions and Applications

The findings of this study revealed calibration errors among agricultural mechanics teachers. High confidence in laboratory safety coexists with a defined inability to identify the acoustic intensity of common agricultural mechanics tools. This gap and the pattern underlying it suggest several directions for future research.

The most distinctive finding of this study was that teachers' errors were not random but patterned. Teachers accurately recognized tools that are visibly or audibly aggressive, yet drastically underestimated tools that are dangerous but unremarkable in appearance, most notably the power hand drill, for which no respondents in the National cohort identified correctly. Future research should test whether interventions that render decibel levels perceptible can correct this calibration error. A study comparing teachers who receive visual aids, such as a sound level meter in the laboratory, a dosimeter, or color-coded decibel labels affixed to tools, against a control group could test whether making acoustic hazards visible improves the accuracy of teachers' risk assessments, and whether that improvement persists once the aids are removed.

A second direction would move from perceived risk to clinically documented reality. Following the approach of Woodford et al. (1996), a study employing clinical audiometry could test whether the knowledge effects identified here are associated with measurable hearing loss. Specifically, correlating teacher audio test results with both their years of exposure and their performance on the decibel identification test would establish whether the teachers least able to identify acoustic hazards are also those showing the greatest high-frequency hearing loss. This would help shift the calibration error from a knowledge gap to a documented health consequence.

A third direction concerns the validity of self-reported knowledge. Future work should compare those perceptions against objectively measured sound levels in teachers' laboratories. Pairing self-reported tool knowledge with sound level readings taken during typical instruction activities would establish how closely teachers' estimates align with the actual acoustic environment in which they and their students are operating.

Finally, the National cohort in this study consisted of highly accomplished teachers at a national competition, yet the calibration error appeared even among this group. Future research should determine whether the gap is comparable or more pronounced among less experienced teachers, preservice teachers, or a randomly selected sample. If the most accomplished teachers in the profession misjudge acoustic hazards, establishing the size of the gap in less specialized groups would clarify the full scope of the problem.

These findings also carry direct implications for practice. Preservice teachers' preparation should incorporate explicit, tool-specific instruction on decibel levels and NIOSH exposure limits, with particular emphasis on quiet but hazardous tools. This study found that teachers are most likely to misjudge. Professional development could involve NIOSH standards with hands-on assessment, allowing established teachers to compare their estimates against actual readings and address the calibration gap directly.

Chapter Three: Article Two

Bridging the Personal and Professional: A Comparative Study of Hearing Protection Behaviors Among Secondary Agricultural Mechanics Teachers

Abstract

This study examines the behavioral consistency and modeling of agricultural mechanics educators by comparing their safety practices in both professional and personal settings. Data was gathered from cohorts in Georgia (n = 97) and nationally (n = 32) to assess the influence of professional safety mandates on personal habits. The findings revealed a notable discrepancy: while educators reported high levels of safety modeling and strict enforcement of Personal Protective Equipment (PPE) for students in school laboratories, their reported use of hearing protection in both personal and professional settings was substantially lower than their reported safety modeling, with no significant difference between home and professional settings. A strong correlation was identified in both cohorts between teachers' professional PPE usage and their students' compliance, supporting Bandura's Social Learning Theory regarding the importance of modeling. Nonetheless, the gap between what teachers report modeling and what they report practicing suggests that many educators perceive hearing conservation as a professional obligation rather than an internalized personal health priority. These results indicate that, despite achieving workplace compliance, the profession has yet to foster a genuine, holistic safety identity. Targeted interventions are necessary to bridge this gap, ensuring that educators prioritize their long-term auditory health beyond the professional setting.

Introduction

According to laboratory safety regulations, the agricultural mechanics instructor assumes the role of the chief safety officer. The instructor bears the responsibility not only for maintaining a secure learning environment but also for ensuring adherence to the standards mandated for industry practice. Prior studies suggest that although most agricultural mechanics teachers are confident in their ability to teach safety, a knowledge gap exists between their perceived expertise and their technical understanding of hazards associated with sounds in a laboratory setting. Technical knowledge is merely one component of a safe laboratory environment; the capacity to physically demonstrate safety protocols, especially the consistent use of personal protective equipment (PPE), constitutes the most observable form of instruction for students. Harper (1984) observed that students are more attentive to safety practices when teachers demonstrate safe behaviors.

The noise levels present in agricultural and industrial arts laboratories have been identified as excessive. Miller (1989) reported that students are subjected to OSHA maximum sound levels exceeding 110 dBA. Similarly, Roeser (1980) observed that students are exposed to sound levels surpassing 90 dBA, which OSHA considers excessive. Additionally, Roeser (1980) emphasized that the use of hearing protection could be advantageous for students, who are exposed for approximately one hour daily. However, the benefit would be even greater for instructors due to their extended daily exposure. Teachers participating in Roeser’s study reported exposure to as many as five or six classes per day. Consequently, this exposure results in teachers being subjected to excessive sound levels for five to six hours each day. Responses from Georgia Agriculture Mechanics Teachers (*n* = 94) show a (*M* = 3, *SD* = 1.38) hours spent per day in the laboratory setting, and National (*n* = 32) show a (*M* = 3.53, *SD* = 1.97) hours spent per day in a laboratory setting.

Dyer and Andreasen (199) indicated some evidence suggesting that teachers involved in agricultural mechanics are at risk of experiencing hearing loss. According to Burke (Burke, 1987, as cited in Dyer & Andreasen, 1999), hearing loss is more prevalent among agricultural education instructors compared to their peers of similar age. Folmer (2006) observes that, despite the increasing body of evidence indicating a rise in noise-induced hearing loss among children and adults, fundamental information regarding hearing loss prevention remains absent from the educational curriculum. The inclusion of basic hearing loss prevention education could potentially mitigate numerous cases of noise-induced hearing loss (NIHL).

Folmer emphasizes the absence of hearing loss prevention measures within the school curriculum; this deficiency may also influence the personal practices of agricultural mechanics teachers. Safety behaviors are seldom restricted to the school environment; rather, they often mirror an internalized safety culture. Transitioning between home or farm settings and a professional classroom environment presents significant challenges. Consequently, insufficient use of personal protective equipment (PPE) at home could potentially lead to inadequate PPE usage in laboratory contexts.

Hubert et al. (2003) emphasize that if an agricultural mechanics instructor does not establish and uphold safety standards within the laboratory environment, students are likely to emulate this behavior. A teacher's personal practices can substantially impact their safety-related conduct. Hubert et al. (2003) found that ultimately, it is essential for teachers to serve as exemplary role models in the laboratory to guarantee that students utilize safety equipment appropriately. The students under our care will follow their teacher's lead when it comes to safety. If agricultural mechanics teachers repeatedly disregard safety and misuse safety equipment, we increase the likelihood that our students will also misuse this equipment and put themselves in dangerous situations where proper supervision is absent, with outcomes that may not be favorable.

Prospective and Conceptual Framework

The foundation of this research is rooted in the work of Dyer and Andreasen (1999), who identified systemic safety challenges within agricultural education. Central to these challenges is the utilization of Personal Protective Equipment by agricultural mechanics instructors, whose behaviors vary between personal and professional contexts. Langley et al. (2018) observe that students demonstrate the lowest levels of PPE training related to hearing protection. Additionally, with the documentation of hearing loss among elementary and secondary students by Broste et al. (1989), Folmer (2006), and Roeser (1980), there is a critical need for change. Students are enrolling in agricultural mechanics courses with already diminished hearing capabilities, only to be further exposed to noise levels exceeding 90 to 110 dBA (Miller, 1989; Reynolds, 1990). As discussed by Hubert et al. (2003), instructors who exhibit disregard for safety inadvertently perpetuate the cycle of unsafe practices. This further reinforces the notion that neglecting PPE among students is considered acceptable professional practice.

This study employed Ajzen's (1991) Theory of Planned Behavior (TPB). The TPB posits that behavioral intentions are the primary predictor of action, influenced by three fundamental constructs: attitude, subjective norms, and perceived behavioral control. Within this context, 'Attitude' pertains to the instructor's personal belief regarding the necessity of hearing protection. Such beliefs are often impacted by a lack of awareness concerning decibel risk levels and teachers' tendencies to underestimate these hazards. 'Subjective Norms' refer to social pressures, or the lack thereof, to adhere to safety standards. Teachers bear responsibility for safety within a school laboratory environment, where they are more inclined to enforce safety standards upon their students and themselves. Nonetheless, their capacity to uphold these standards may be constrained by the level of supervision available. These social pressures can differ markedly between professional settings, such as a school laboratory, and personal environments, including home workshops or farms. 'Perceived Behavioral Control' refers to teachers' perceptions of how feasible or challenging it is to utilize personal protective equipment (PPE) across various contexts. As emphasized by Fishbein and Ajzen (1975), and corroborated by industrial hearing research conducted by Quick et al. (2008), an individual's attitude toward a task constitutes a critical element influencing their willingness to engage in that task. While TPB focuses on the teacher's intent, the impact is seen in the laboratory environment.

This study contends that teachers' conduct within a laboratory environment constitutes the observable outcome of their Theory of Planned Behavior (TPB) process. If an instructor does not possess a robust positive safety attitude—indicated by low personal Protective Equipment (PPE) usage in private settings—they are consequently more inclined to demonstrate reduced compliance with safety protocols in a formal classroom context. When a teacher fails to exemplify proper PPE utilization, it alters the subjective norm of the classroom. Students may then perceive that safety is less important and that associated risks are minimal, ultimately leading to decreased PPE use and potentially long-term safety consequences.

Purpose and Objectives

The purpose of this study is to examine the alignment between the personal safety practices and professional Personal Protective Equipment (PPE) protocols of agricultural mechanics teachers. Specifically, this research investigates the consistency between safety behaviors in non-professional settings (home or farm) and adherence to safety standards within the professional environment of a laboratory among teachers in Georgia and those who participated in the National Agricultural Mechanics Career Development Event. The subsequent objectives will guide the research team in evaluating how the safety behaviors of both Georgia and National agricultural mechanics teachers influence the modeling and enforcement of PPE usage among their students.

1. Identify discrepancies between agricultural mechanics teachers' use of PPE in personal contexts (such as home or farm) and their application of PPE in a professional laboratory context.
2. Analyze the correlation between instructors' self-modeling behaviors and their enforcement of PPE compliance among students during laboratory activities.

3. Evaluating safety behaviors with specific tools, including hand-held, pneumatic, and stationary power tools.

Methods

The objective of this research is to assess the correlation between personal safety practices and the professional Personal Protective Equipment (PPE) protocols employed by agricultural mechanics teachers. This investigation examines the consistency between safety behaviors in non-professional environments (such as at home or on farms) and compliance with safety standards within professional laboratory settings. The study population comprises secondary education teachers in Georgia who taught at least one agricultural mechanics class during the fiscal year 2025 (N = 125). This cohort is well known to the research team. To evaluate whether these behaviors reflect a broader national pattern, a secondary cohort was included, consisting of instructors participating in the National Agricultural Technologies and Mechanical Systems Career Development Event held at the 98th National FFA Convention and Expo in Indianapolis, Indiana (N = 46). This national cohort offers a comprehensive pool of teachers representing diverse geographical regions across the United States.

Instrumentation

This study utilized a multidimensional instrument to assess behavioral constructs of the Theory of Planned Behavior (TPB) and the frequency of PPE utilization across diverse personal and professional settings. The instrument primarily emphasizes the subscales measuring Personal PPE usage, Professional PPE modeling, Student Enforcement, and tool-specific hearing protection usage.

The instrument employed a 5-point Likert scale to assess the frequency of personal protective equipment (PPE) utilization. For items concerning the use of hearing protection and safety glasses in both personal and professional contexts, teachers responded based on frequency: 1 = Always, without exception; 2 = When students perform an activity that could pose an eye or hearing hazard; 3 = Most of the time, as students work in the workshop, with occasional exceptions for low-risk activities; 4 = Sometimes, depending on the specific activity and my risk assessment; 5 = Never. Respondents were also queried regarding their use of hearing protection when operating specific tools commonly employed in agricultural mechanics laboratories. A 4-point Likert scale was utilized to evaluate the frequency of hearing PPE use with tools typical to agricultural mechanics education: 1 = Yes, I wore hearing protection the last time I used this tool; 2 = Not the last time I used this tool; 3 = Not ever when using this tool; 4 = I have never used this tool.

The dates and locations for administration were selected to ensure access to two distinct cohorts. The initial administration took place at the Georgia Vocational Teachers Conference in Athens, Georgia, in July 2025. The research team distributed paper copies of the instrument to teachers identified as having taught agricultural mechanics during the 2024-2025 school year. Paper-based administration was chosen over digital distribution to maximize the response rate during face-to-face interactions. To maintain anonymity, instruments were collected in person or left at unmonitored drop-off locations, ensuring responses could not be linked to individuals. Of the identified potential participants ($N = 125$), 97 completed the instrument ($n = 97$), resulting in a response rate of 78%.

The second administration was conducted in October 2025 at the National ATMS CDE in Indianapolis, Indiana. During the second day of the event, paper instruments were provided to the 46 participating advisors during their students' competition flights. The research team personally distributed and collected these instruments from the instructors. This administration yielded 32 usable responses, for a response rate of 69%. Collectively, these two cohorts supplied the data necessary to analyze the correlation between teachers' self-modeling behaviors and their subsequent enforcement of PPE compliance among their students.

Findings

An assessment of the professional safety climate within the Georgia cohort (n = 97) reveals a strong belief in their adherence to safety protocols. Teachers reported a high level of safety demonstration in their professional environment (M =2.08, SD = .66), with 58 individuals (59.8%) reporting that they consistently demonstrate safety practices in their professional setting.

However, a concerning discrepancy emerges when comparing this perception with their actual use of personal protective equipment (PPE) at both personal and professional levels. As illustrated in Table 3.1, the mean for both personal and professional hearing protection usage at home is notably lower than their reported demonstration of safety behaviors. No statistically significant difference was found between personal and professional hearing PPE usage within the Georgia cohort (t(95) = .57, p = .57), suggesting teachers hearing protection habits are consistent across both settings, they are neither more nor less likely to wear hearing protection at home than in a professional setting.

Table 3.1

Responses of the Georgia Cohort in relation to Hearing PPE use in Personal and Professional settings.

	Personal (non-professional)				Professional			
	f	%	*M*	*SD*	*f*	%	*M*	*SD*
			3.66	1.07			3.57	1.13
Always	7	7.3			7	7.2		
Whenever students perform eye hazards (cutting, grinding)	8	8.3			12	12.4		
Most of the time	10	10.4			13	13.4		
Sometimes, depending on the specific activity and my risk assessment	57	59.4			49	50.5		
Never	14	14.6			16	16.5		

Note: (n = 97). Missing Responses for personal (non-professional) of (*n* = 1), which is 1% of the total respondents. Percentages are calculated using the Valid Percent.

The contrast between the Georgia cohort's perceived professional safety (*M* = 2.08, *SD* = .66) and their reported personal and professional habits (*M* = 3.66, *SD* = 1.07) (*M* = 3.57, *SD* = 1.13) constitutes a major finding. Statistically significant differences were found between personal hearing PPE use and demonstration of safety behaviors ($t(95) = 13.96$, $p = <0.01$) and between professional hearing PPE use and demonstration of safety behaviors ($t(95) = 12.96$, $p = <0.01$), confirming that teachers report demonstrating safe hearing practices to students at significantly higher rates than they report using hearing protection themselves. Teachers believe they are safe within the school environment; however, their self-reported behavior at home suggests a tendency to perceive safety only as intermittent. This suggests that safety is viewed as a requirement of their professional duties rather than a core personal value.

Furthermore, the data demonstrate that over 50% of the Georgia cohort rely on individual risk assessments to determine whether they will wear hearing personal protective equipment (f = 57, 59.4%). Compared with the findings of article one, which established a lack of technical understanding of the decibel hazards, it becomes evident that teachers lack a comprehensive understanding of the decibel ratings of common tools used in teaching agricultural mechanics. This indicates that their risk assessments may be flawed, potentially exposing them to unnecessary and hazardous levels of noise in personal settings.

Similar to the assessment conducted in Georgia, the research team performed an additional evaluation on the national cohort (n = 32), which demonstrated a high level of confidence in safety demonstrations (M = 1.78, SD = .66). Teachers perceived that they demonstrate safety, although not consistently 100% of the time (f = 20, 62.5%), indicating that they believe they exhibit safety practices at a high standard within a professional environment. Nonetheless, the same discrepancy reemerges when comparing their use of personal protective equipment (PPE) in both personal and professional contexts. Table 3.2 presents responses related to hearing protection in both personal and professional settings.

Table 3.2
Responses of the National Cohort in relation to Hearing PPE use in Personal and Professional settings.

	Personal (non-professional)				Professional			
	f	%	*M*	*SD*	*f*	%	*M*	*SD*
			3.47	1.05			3.28	1.17
Always	2	6.3			3	9.4		
Whenever students perform eye hazards (cutting, grinding)	4	12.5			6	18.8		
Most of the time	6	18.8			5	15.6		
Sometimes, depending on the specific activity and my risk assessment	17	53.1			15	46.9		
Never	3	9.4			3	9.4		

Note: (n = 32). Percentages are calculated using the Valid Percent.

Consistent with the Georgia cohort, no statistically significant difference was found between personal and professional hearing PPE use within the National cohort ($t(32) = 1.24$, $p = .23$), suggesting that teachers hearing protection habits remain consistent regardless of setting. Personal usage averaged ($M = 3.47$, $SD = 1.05$), with 53% of respondents indicating they used hearing protection following a self-assessed risk evaluation. Results in a professional contest showed minimal improvement, with ($M = 3.28$, $SD = 1.17$), and 47% of respondents reported relying on their own risk assessments to determine the need for hearing protection.

The pattern of statistical significance between PPE use and safety demonstration was replicated in the National cohort ($t(31) = 10.25$, $p = <0.01$) for personal usage and ($t(31) = 8.93$, $p = <0.01$) for professional PPE usage. This replication of this pattern across two independent cohorts, state and national, strengthens the conclusion that the disparity between modeled and practice safety behavior is not an isolated regional phenomenon but a characteristic of the agricultural mechanics teaching profession.

Furthermore, Article One of this dissertation indicates that teachers are insufficiently trained to accurately assess decibel levels for common tools used in agricultural mechanics settings, suggesting that the risk assessments underpinning their PPE decisions in both cohorts may be fundamentally flawed.

Secondly, the research team aimed to determine whether correlations exist between instructors' behaviors regarding their use of PPE in a professional environment and their enforcement of PPE among their students, both nationally and within the state of Georgia.

As previously reported, for the Georgia cohort, utilization of hearing PPE in a professional context was examined (M = 3.57, SD = 1.13) alongside the teachers' enforcement of PPE usage among students during laboratory activities. Specifically, the enforcement of eye protection and hearing protection was assessed. Regarding the Georgia cohort's professional situation, use of hearing PPE, a strong, statistically significant positive correlation was identified between teachers' use of hearing protection and teachers making students use hearing PPE ($r(95) = .58$, $p < .01$), indicating that teacher modeling significantly correlated with students' use of hearing protection. Interestingly, no significant relationship was observed between teachers' use of hearing PPE and making students' use eye PPE ($r(95) = .09$, $p = .39$). This suggests that modeling behaviors could be specific to the type of PPE; students do not appear to generalize safety practices from one PPE type to another but tend to emulate particular behaviors demonstrated by the teacher or that eye PPE has become entrenched as a norm in the agricultural mechanics laboratory that, as suggested by Hancock et al. (2023), few things affect eye PPE usage.

The National Cohort (*M* = 3.28, *SD* = 1.17) was examined regarding the use of hearing protection in professional environments and teachers' enforcement of eye and hearing-related PPE in laboratory settings. A comparison between the National Cohort's use of hearing protection and making their students use hearing protection as reported by their teacher reveals a strong, statistically significant positive correlation ($r(30) = .75$, $p < .01$). This correlation could indicate that students' use of hearing PPE is affected by teachers' use and modeling of proper hearing protection practices. When evaluating the relationship between the National Cohort's use of hearing PPE and making their students' use eye PPE, as was the case with the Georgia cohort, no statistically significant correlation is observed ($r(30) = .01$, $p = .95$). The correlations identified within the National Cohort are consistent with those found in the Georgia cohort; however, a markedly stronger correlation was found in the National Cohort responses concerning students' use of hearing PPE and teachers' modeling of appropriate hearing protection use.

Lastly, for Objective three, the research team evaluated safety behaviors utilizing specific tools common to the agricultural mechanics laboratory, including hand-held, pneumatic, and stationary power tools, through self-reported data collected from Georgia and National agricultural mechanics teachers. Teachers were asked to provide responses regarding their use of hearing PPE during their most recent use of various tools commonly found in agricultural education laboratories, such as handheld, pneumatic, and stationary power tools. The research team considered this information vital due to the correlations identified in Objective 2. Specifically, teachers' use of self-modeling to demonstrate proper hearing PPE shows a strong correlation with students' use of hearing protection. It can be inferred that if teachers use hearing PPE when using the specified tools, students are more likely to adopt similar safety behaviors.

A concerning pattern is apparent in the responses of the Georgia Cohort concerning hand-held tools (Table 3.3). The responses from Georgia teachers suggest that they either never employed hearing protection when using hand-held power tools or did not utilize such protection during their most recent use of these tools. This trend of neglecting hearing protection is further evidenced in the data collected for Objective One, where their reported use of hearing PPE in personal and professional habits (M = 3.66, SD = 1.07) (M = 3.57, SD = 1.13) shows that teachers are not using hearing protection in either setting.

Table 3.3
Georgia Cohorts Hearing PPE Usage When Operating Hand-Held Power Tools.

Hand-Held Power Tool	*n*	*M*	*SD*	Yes		Not Last Time		Not Ever		Never Used Tool	
				F	%	*f*	%	*f*	%	*f*	%
Circular Saw	96	2.51	.71	11	11.5	26	27.1	58	60.4	1	1.0
Jig Saw	96	2.69	.65	7	7.3	19	19.8	67	68.8	3	3.1
Reciprocating Saw	96	2.59	.69	9	9.4	23	24.0	62	64.6	2	2.1
Power Hand Drill	95	2.62	.64	7	7.4	23	34.2	64	67.4	1	1.1
Hammer Drill	94	2.53	.83	14	14.9	22	23.4	52	55.3	6	6.4
Rotary Hammer	93	2.75	.91	12	12.9	16	17.2	48	51.6	17	18.3
Electric Impact Wrench	95	2.71	.63	5	5.3	22	23.2	64	67.4	4	4.2
Electric Screw Driver	95	2.79	.60	4	4.2	17	17.9	69	72.6	5	5.3
Power Hand Plane	95	2.69	1.0	17	17.9	15	15.8	43	45.3	20	21.1
Portable Power Router	95	2.48	.86	16	16.8	24	25.3	48	50.5	7	7.4
Portable Belt Sander	94	2.74	.70	6	6.4	20	21.3	60	63.8	8	8.5
Portable Random Orbit Sander	96	2.69	.70	7	7.2	22	22.9	61	63.5	6	6.3
Palm Sander	95	2.65	.63	6	6.3	23	24.2	64	67.4	2	2.1
Detail/Finish Sander	94	2.78	.67	4	4.3	22	23.4	59	62.8	9	9.6
Hand-Held Grinder (Grinding Wheel)	97	1.98	.83	34	35.1	31	32	32	33	-	-
Hand-Held Grinder (Sanding Wheel)	96	2.15	.85	27	28.1	29	30.2	39	40.6	1	1.0
Hand-Held Grinder (Wire Cup/Wheel)	96	2.18	.89	27	28.1	29	30.2	36	37.5	4	4.2

Note: (*N* = 97). Percentages are calculated using Valid Percent. Entries with a (-) indicate no response given for that choice.

Regarding the National Cohort, the results do not indicate significant signs of improvement. National Cohort responses (Table 3.4) continue the prevailing trend of neglecting hearing PPE, with most teachers either indicating that they have never used hearing protection when operating specific tools or that they did not use it the last time. This also aligns with the findings from the national sections of Objective One. Teachers' responses concerning the use of hearing protection in personal (*M* = 3.47, *SD* = 1.05) and professional settings (*M* = 3.28, *SD* = 1.17) continue to demonstrate a disregard for hearing PPE, which contributes to the establishment of unsafe working conditions.

Table 3.4
National Cohorts Hearing PPE Usage When Operating Hand-Held Power Tools.

Hand-Held Power Tool	*n*	*M*	*SD*	Yes		Not Last Time		Not Ever		Never Used Tool	
				f	%	*f*	%	*f*	%	*f*	%
Circular Saw	31	2.32	.79	6	19.4	9	29.0	16	51.6	-	-
Jig Saw	31	2.61	.67	2	6.5	9	29.0	19	61.3	1	3.2
Reciprocating Saw	31	2.61	.67	2	6.5	9	29.0	19	61.3	1	3.2
Power Hand Drill	31	2.65	.55	1	3.2	9	29.0	21	67.7	-	-
Hammer Drill	31	2.39	.99	8	25.8	6	19.4	14	45.2	3	9.7
Rotary Hammer	31	2.74	.99	4	12.9	8	25.8	11	35.5	8	25.8
Electric Impact Wrench	31	2.65	.75	3	9.7	7	22.6	19	61.3	2	6.5
Electric Screw Driver	30	3.03	.67	1	3.3	3	10.0	20	66.7	6	20.0
Power Hand Plane	31	3.58	3.38	4	12.9	3	9.7	12	38.7	11	35.5
Portable Power Router	30	2.53	1.01	6	20.0	7	23.3	12	40.0	5	15.6
Portable Belt Sander	30	2.67	.80	3	10.0	7	23.3	17	56.7	3	10.0
Portable Random Orbit Sander	30	2.83	.79	2	6.7	6	20.0	17	56.7	5	16.7
Palm Sander	30	2.63	.72	2	6.7	9	30.0	17	56.7	2	6.7
Detail/Finish Sander	29	2.93	.88	2	6.9	6	20.7	13	44.8	8	27.6
Hand-Held Grinder (Grinding Wheel)	32	1.75	.72	13	40.6	14	43.8	5	15.6	-	-
Hand-Held Grinder (Sanding Wheel)	32	2.16	.95	10	31.3	9	28.1	11	34.4	2	6.3
Hand-Held Grinder (Wire Cup/Wheel)	32	2.47	.67	16	50.0	6	18.8	10	31.3	-	-

Note: (*N* = 32). Percentages are calculated using Valid Percent. Entries with a (-) indicate no response given for that choice.

Both the Georgia and National cohorts responded to identical questions regarding the utilization of hearing PPE, particularly given the prevalence of pneumatic tools in the agricultural mechanics laboratory. Georgia's responses (Table 3.5) exhibit a pattern consistent with that observed with hand-held power tools, wherein the majority of responses pertain to the use of hearing PPE, either indicating 'not last time' or 'not ever'.

Table 3.5
Georgia Cohort's Hearing PPE Usage When Operating Pneumatic Power Tools.

Pneumatic Tool	*n*	*M*	*SD*	Yes		Not Last Time		Not Ever		Never Used Tool	
				f	%	*f*	%	*f*	%	*f*	%
Air Compressor	95	2.60	.66	8	8.4	23	24.2	63	66.3	1	1.1
Framing Nailer	95	2.82	.68	5	5.3	17	17.9	63	66.3	10	10.5
Siding/Roofing Nailer	95	3.0	.67	3	3.2	12	12.6	62	65.3	18	18.9
Palm Nailer	93	3.03	.67	2	2.2	13	14.0	58	62.4	20	21.5
Pneumatic Impact Wrench	95	2.73	.72	7	7.4	20	21.1	60	63.2	8	8.4
Pneumatic Socket Driver	95	2.77	.72	6	6.3	20	21.1	59	62.1	10	10.5
Crown Nailer/Stapler	95	2.97	.66	3	3.2	13	13.7	63	66.3	16	16.8
Brad Nailer	95	2.88	.65	4	4.2	14	14.7	66	69.5	11	11.6

Note: (*N* = 97). Percentages are calculated using Valid Percent.

National responses (Table 3.6) follow a trend similar to that observed in earlier tables. The majority of respondents indicated "Not Last Time" or "Not Ever" when asked about hearing PPE usage for pneumatic tools. Both the Georgia and National cohorts exhibited comparable responses.

Table 3.6
National Cohort's Hearing PPE Usage When Operating Pneumatic Power Tools.

Pneumatic Tool	*n*	*M*	*SD*	Yes		Not Last Time		Not Ever		Never Used Tool	
				f	%	*f*	%	*f*	%	*f*	%
Air Compressor	32	2.47	.67	3	9.4	11	34.4	18	56.3	-	-
Framing Nailer	32	2.88	.87	3	9.4	5	15.6	17	53.1	-	-
Siding/Roofing Nailer	32	2.91	.78	2	6.3	5	15.6	19	59.4	-	-
Palm Nailer	32	3.13	.87	2	6.3	4	12.5	14	43.8	12	37.5
Pneumatic Impact Wrench	32	2.50	.88	5	15.6	9	28.1	15	46.9	3	9.4
Pneumatic Socket Driver	32	2.81	.93	3	9.4	8	25.0	13	40.6	8	25.0
Crown Nailer/Stapler	31	3.03	.84	2	6.5	4	12.9	16	51.6	9	29.0
Brad Nailer	31	3.00	.82	2	6.5	4	12.9	17	54.8	8	25.8

Note: (*N* = 32). Percentages are calculated using Valid Percent. Entries with a (-) indicate no response given for that choice.

Finally, both the Georgia and National cohorts provided responses concerning the employment of hearing protection personal protective equipment (PPE) when operating stationary power equipment. The listed tools encompassed a combination of metal and woodworking machinery, commonly present in Agricultural Mechanics laboratories and numerous personal or farm workshops. The responses from the Georgia cohort (Table 3.7) to questions about stationary power tools yielded the highest number of "Yes" responses among the three types of tools. Although instructors reported using hearing PPE while operating stationary power tools, the "Yes" responses did not constitute the majority for any of these tools.

Table 3.7
Georgia Cohort's Hearing PPE Usage When Operating Stationary Power Tools.

Pneumatic Tool	*n*	*M*	*SD*	Yes		Not Last Time		Not Ever		Never Used Tool	
				F	%	*f*	%	*f*	%	*f*	%
Radial Arm Saw	96	2.47	.74	10	10.4	35	36.5	47	49.0	4	4.2
Table Saw	96	2.33	.76	16	16.7	33	34.4	46	47.9	1	1.0
Miter Saw	95	2.43	.69	10	10.5	35	36.8	49	51.6	1	1.1
Chop Saw	96	2.19	.84	26	27.1	26	27.1	44	45.8	-	-
Vertical Band Saw	95	2.48	.68	7	7.4	38	40.0	47	49.5	3	3.2
Horizontal Band Saw	95	2.61	.73	6	6.3	33	34.7	48	50.5	8	8.4
Drill Press	96	2.58	.61	3	3.1	37	38.5	53	55.2	3	3.1
Wood Lathe	93	3.03	.93	5	5.4	22	23.7	40	43.0	26	28.0
Metal Lathe/Power Mill	94	3.03	.933	7	7.4	18	19.1	34	36.2	35	37.2
Bench Grinder	96	2.24	.86	23	24.0	30	31.3	40	41.7	3	3.1
Planer	96	2.29	1.02	29	30.2	20	20.8	37	38.5	10	10.4
Jointer	96	2.55	.95	16	16.7	26	27.1	39	40.6	15	15.6
Shaper	96	2.76	.98	13	13.5	21	21.9	38	39.6	24	25.0
Stationary Router	96	2.60	.90	13	13.5	26	26.8	43	44.8	14	14.4

Note: (*N* = 97). Percentages are calculated using Valid Percent. Entries with a (-) indicate no response given for that choice.

Responses from the National cohort (Table 3.8) concerning hearing PPE also yielded the highest number of "Yes" responses. A notable response pertains to the usage of hearing PPE when operating a chop saw, with a response rate of 53.1%. This represents the highest indicated rate of hearing PPE usage for any tool within either cohort.

Table 3.8
National Cohort's Hearing PPE Usage When Operating Stationary Power Tools.

Pneumatic Tool	*n*	*M*	*SD*	Yes		Not Last Time		Not Ever		Never Used Tool	
				f	%	*f*	%	*f*	%	*f*	%
Radial Arm Saw	32	2.59	.98	4	12.5	12	37.5	9	28.1	7	21.9
Table Saw	32	2.13	.94	10	31.3	10	31.3	10	31.3	2	6.3
Miter Saw	32	2.22	1.04	10	31.3	9	28.1	9	28.1	4	12.5
Chop Saw	32	1.84	1.02	17	53.1	5	15.6	8	25.0	2	6.3
Vertical Band Saw	32	2.66	.87	2	6.3	13	40.6	11	36.4	6	18.8
Horizontal Band Saw	32	2.53	.80	2	6.3	15	46.9	11	34.4	4	12.5
Drill Press	31	2.39	.67	2	6.5	16	51.6	12	38.7	1	3.2
Wood Lathe	31	3.06	1.06	3	9.7	7	22.6	6	19.4	15	48.4
Metal Lathe/Power Mill	31	3.06	.96	1	3.2	10	32.3	6	19.4	14	45.2
Bench Grinder	32	1.94	.91	12	37.5	12	37.5	6	18.8	2	6.3
Planer	31	2.23	1.23	12	38.7	8	25.8	3	9.7	8	25.8
Jointer	31	2.45	1.26	10	32.3	7	22.6	4	12.5	10	32.3
Shaper	31	2.75	1.24	7	22.6	7	22.6	4	12.9	12	41.9
Stationary Router	31	2.52	1.18	8	25.8	8	25.8	6	19.4	9	29.0

Note: (*N* = 32). Percentages are calculated using the Valid Percent.

One-sample t-tests were performed for both the Georgia and National cohorts, comparing each tool's mean PPE usage score against the scale midpoint (2.50) to ascertain whether teachers' hearing protection usage was significantly above or below the threshold differentiating compliance from non-compliance. Complete results for both cohorts are provided in the following: Table 3.9, Table 3.10, and Table 3.11.

Table 3.9
One-sample T-Test Results Comparing Hearing PPE usage Against Scale Midpoint (2.50) for Georgia and National Cohorts with Hand-Held Power Tools.

Hand-Held Power Tool	Georgia Cohort			National Cohort		
	t	*df*	*p*	*t*	*df*	*p*
Circular Saw	.144	95	.886	-1.29	30	.221
Jig Saw	2.81	95	.006	.942	30	.354
Reciprocating Saw	1.33	95	.186	.942	30	.354
Power Hand Drill	1.85	94	.068	1.47	30	.153
Hammer Drill	.375	93	.709	-.635	30	.530
Rotary Hammer	2.70	92	.008	1.35	30	.188
Electric Impact Wrench	3.16	94	.002	1.07	30	.293
Electric Screw Driver	4.71	94	<.001	4.37	29	<.001
Power Hand Plane	1.90	94	.061	1.78	29	.086
Portable Power Router	-.179	94	.859	.181	29	.858
Portable Belt Sander	3.38	93	.001	1.14	29	.265
Portable Random Orbit Sander	2.63	95	.010	2.31	29	.025
Palm Sander	2.35	94	.021	1.02	29	.318
Detail/Finish Sander	3.98	93	<.001	2.63	28	.014
Hand-Held Grinder (Grinding Wheel)	-6.19	96	<.001	-5.91	31	<.001
Hand-Held Grinder (Sanding Wheel)	-4.10	95	<.001	-2.04	31	.050
Hand-Held Grinder (Wire Cup/Wheel)	-3.54	95	<.001	-4.34	31	<.001

Note: t-values were calculated using a one-sample t-test against the scale midpoint (2.50). Positive t-values indicate PPE neglect (mean above the midpoint). Negative t-values indicate PPE compliance (mean below the midpoint). Georgia cohort (*n* = 97), National cohort (*n* = 32). Two-sided p-values reported.

For handheld power tools, both cohorts showed a consistent pattern of significant PPE neglect across multiple tools, particularly among sanders and electric-powered hand tools. Despite a difference in the number of significant findings between cohorts, the directional pattern of neglect was consistent across both cohorts.

A striking exception to this pattern was seen across all three handheld grinder configurations. Both cohorts showed significant PPE compliance for grinders, with the grinding wheel configuration producing the highest compliance across all tools examined. This is the most pronounced and consistent finding among the handheld tools.

Among pneumatic tools, both cohorts demonstrated significant PPE neglect across nearly all tools, with nail guns producing some of the strongest neglect results in both groups. The air compressor was the only pneumatic tool that did not reach statistical significance in either cohort, suggesting that teachers treat it differently from other pneumatic tools and equipment.

Table 3.10
One-sample T-Test Results Comparing Hearing PPE usage Against Scale Midpoint (2.50) for Georgia and National Cohorts with Pneumatic Power Tools.

Pneumatic Power Tool	Georgia Cohort			National Cohort		
	t	*df*	*p*	*t*	*df*	*p*
Air Compressor	1.48	94	.142	-0.26	31	.794
Framing Nailer	4.58	94	<.001	2.47	31	.021
Siding/Roofing Nailer	7.30	94	<.001	2.96	31	.006
Palm Nailer	7.70	92	<.001	4.06	31	<.001
Pneumatic Impact Wrench	3.06	94	.003	.000	31	1.00
Pneumatic Socket Driver	3.63	94	<.001	1.899	31	.067
Crown Nailer/Stapler	6.93	94	<.001	3.55	30	.001
Brad Nailer	5.76	94	<.001	3.41	30	.002

Note: t-values were calculated using a one-sample t-test against the scale midpoint (2.50). Positive t-values indicate PPE neglect (mean above the midpoint). Negative t-values indicate PPE compliance (mean below the midpoint). Georgia cohort (*n* = 97), National cohort (*n* = 32). Two-sided p-values reported.

The most detailed pattern appeared for stationary power tools. Both cohorts demonstrated significant PPE compliance for the chop saw, table saw, and bench grinder. Conversely, significant PPE neglect was consistently observed with the wood lathe and metal lathe/power mill in both cohorts. The remaining stationary tools produced a mix of significant and non-significant results. Notably, the planer reached significance in the Georgia cohort ($t(95) = -2.01$, $p = .047$), but not in the National cohort ($t(30) = -1.24$, $p = .224$). This discrepancy that may reflect differences in tool availability or frequency of use across agricultural mechanics programs rather than a meaningful behavior difference between cohorts.

Table 3.11
One-sample T-Test Results Comparing Hearing PPE usage Against Scale Midpoint (2.50) for Georgia and National Cohorts with Stationary Power Tools.

Stationary Power Tool	Georgia Cohort			National Cohort		
	t	*df*	*p*	*t*	*df*	*p*
Radial Arm Saw	-.414	95	.680	.542	31	.592
Table Saw	-2.14	95	.035	-2.252	31	.032
Miter Saw	-.961	94	.339	-1.53	31	.136
Chop Saw	-3.66	95	<.001	-3.64	31	<.001
Vertical Bandsaw	-.23	94	.822	1.02	31	.315
Horizontal Bandsaw (Metal)	1.47	94	.145	.220	31	.827
Drill Press	1.34	95	.184	-.942	30	.354
Wood Lathe	4.90	92	<.001	2.96	30	.006
Metal Lathe/Power Mill	5.53	93	<.001	3.26	30	.003
Bench Grinder	-2.98	95	.004	-3.48	30	.002
Planer	-2.01	95	.047	-1.24	30	.224
Jointer	.537	95	.592	-.214	30	.832
Shaper	2.60	95	.011	1.09	30	.285
Stationary Router	1.13	95	.260	.08	30	.940

Note: t-values were calculated using a one-sample t-test against the scale midpoint (2.50). Positive t-values indicate PPE neglect (mean above the midpoint). Negative t-values indicate PPE compliance (mean below the midpoint). Georgia cohort (*n* = 97), National cohort (*n* = 32). Two-sided p-values reported.

Across all three tool categories and both cohorts, a statistically significant pattern emerges. Teachers demonstrate meaningful higher rates of PPE compliance for tools that produce visible sparks, debris, or are perceived as visually dangerous, notably grinders, the chop saw, and the bench grinder. Conversely, tools that generate significant noise but present less obvious visual hazards, such as nail guns, sanders, and lathes, are consistently associated with higher rates of PPE neglect. This pattern strongly suggests that teachers' PPE decisions are driven by visual risk perceptions rather than objective decibel-based hazard assessments. This finding directly corroborates the calibration error identified in Article One of this dissertation. These findings reinforce the flawed risk assessment argument established earlier in this article, and suggest that interventions targeting hearing conservation in agricultural mechanics settings must explicitly address the gap between perceived and actual acoustic hazard.

Discussion and Conclusion

This study aimed to assess the consistency of safety behaviors exhibited by agricultural mechanics teachers in both professional and non-professional environments, with particular emphasis on differences between these settings. Additionally, the research team examined the self-modeling behaviors of instructors regarding two distinct types of PPE—specifically, eye and hearing protection—to determine whether any correlations existed. Finally, the team evaluated the use of hearing PPE in conjunction with tools prevalent in agricultural mechanics instruction and in general use within the field.

Agricultural education teachers strongly believe they exemplify appropriate safety procedures within a professional environment. They perceive themselves as role models for safety; however, in reality, they are exposing themselves and their students to potential hazards. More than 50% of respondents (Georgia: 59.4%; National: 53.1%) reported implementing a personal risk assessment to determine the need for hearing protection at home. Similar statistics are observed in professional settings, with approximately half of the respondents (Georgia 50.5%; National 46.9%) exhibiting comparable behaviors. Furthermore, teachers demonstrate a limited understanding of sound, which hampers their ability to accurately identify suitable decibel levels. Teachers reported hearing protection use was slightly higher in professional settings than at home, but the difference was not statistically significant. Georgia ($t(95) = .57$, $p = .57$) and National ($t(32) = 1.24$, $p = .23$) indicate that teachers neglect hearing protection at comparable rates in both settings. The larger pattern of modeling correct PPE usage in the agricultural mechanics laboratory suggests that teachers hold an attitude that can influence behavioral intentions and subsequently affect the behavior of their students, in accordance with the TPB.

When the research team examined the correlations between teachers' use of hearing PPE in a professional setting and their students' use of eye and hearing PPE, they discovered that when teachers model correct PPE use, the likelihood of teachers requiring their students to use hearing PPE increases. A strong, statistically significant positive correlation was identified in both the Georgia and the National cohorts concerning hearing PPE. No correlation was found between teachers modeling correct hearing protection and their students' use of eye protection. This aligns with Hancock et al. (2023).

These correlations in Georgia and on the National level between teacher utilization of hearing PPE and the reinforcement of student use of hearing PPE indicate that the TPB exerts complete control. Ajzen (1991) delineated three constructs: Attitude, Subjective Norm, and Perceived Behavioral Control that collaboratively influence behavioral intention, ultimately leading to a specific behavior. Through the teacher’s positive attitude towards hearing PPE, the subjective norm comprising the expectations of both teachers and students wearing hearing PPE, and the teacher’s perceived behavioral control within the classroom setting, these three constructs synergistically function to achieve the objective of increased hearing PPE usage.

Finally, data was collected on respondents' use of hearing PPE when operating tools commonly used in agricultural mechanics laboratories. Three categories of tool types were identified: hand-held power tools, pneumatic tools, and stationary power tools, encompassing 39 distinct tools. Participants were asked to indicate whether they used hearing PPE during their most recent use of a tool, with options ranging from 'Yes' (1) to 'Never Used That Tool' (4).

Responses from the Georgia cohort were disheartening. With the exception of the Hand Angle Grinder (*Mo* = 1; 31.5% usage) and Metal Lathe (*Mo* = 4; 37.2% reported never using the tool), the predominant response among the Georgia cohort was 'Not Ever' (*Mo* = 3). Notably, several tools reached a 95% response rate for 'Not Ever,' providing a critical indication of the limited use of hearing PPE within the state.

The results for the National cohort showed slightly higher compliance than those for the Georgia cohort, yet a substantial deficiency persisted. Several tools move into the 'Not Last Time' category (*Mo* = 2), including the Vertical Band Saw (40.6%) and the Drill Press (51.6%). Furthermore, a few tools reached a mode 1 (“Yes”), most notably the Chop Saw (53.1%) and the Hand Angle Grinder with a wire cup (50%). However, across the National responses, 59% of the tools surveyed had a mode 3, indicating that 'Not Ever' remains the most frequent behavior for the majority of equipment common to agricultural mechanics.

We are currently observing a trend that was identified earlier by Woodford et al. (1996). Teachers often lack awareness regarding the intensity of sound exposure they experience. Teachers do not use hearing PPE within a personal setting and have no understanding of sound levels of different tools common in agricultural mechanics. Generally, teachers assume that they are in a safe environment within laboratories. They tend to rely on their individual risk assessments concerning the tools and settings they utilize. The information presented in this article indicates that teachers neglect hearing conservation practices at statistically comparable rates in both personal and professional settings. The more meaningful gap is not between settings but between teachers reporting modeling for students and what they actually practice themselves.

Teachers' utilization of specific PPE, such as hearing protection, directly influences their students' adoption of PPE (Lindner, 2016). When teachers use hearing PPE in a professional context, it substantially increases the likelihood that students will follow suit. Therefore, it is imperative that we promote and exemplify our own PPE usage to inspire teachers to utilize hearing PPE. Such advocacy will cultivate greater comfort and familiarity among teachers regarding the use of hearing PPE.

There is a significant issue of noise pollution in agricultural education. A prevailing culture of neglect towards hearing protection persists in this state. With responses to nearly every tool characterized as “Not Ever,” we have become desensitized to the noise levels in agricultural mechanics that pose a serious risk to our own and our students' health. Preservice education must ensure that prospective teachers acquire a comprehensive understanding of the dangers associated with high noise levels in agricultural mechanics. State officials, it is imperative that we instill these safety values in our current teachers; failure to address noise will result in teachers entering or remaining in the profession while suffering preventable, permanent hearing impairments, thereby perpetuating unsafe practices among future generations.

Future Research Questions and Application

The findings of this study suggest that agricultural mechanics teachers neglect hearing protection at comparable rates in personal and professional settings, while at the same time, report that they model safety for their students. This compliance vs conviction gap, together with the tool-specific patterns, suggests several areas for possible future research.

An interesting note related to the tool findings was that teachers consistently protect their hearing when operating tools that present a visible hazard, such as grinders, chop saws, and the bench grinder, while neglecting to use protective measures with tools such as different nail guns, sanders, and lathes, which do not produce a visible hazard. This pattern suggests that teachers' decisions on when to use hearing PPE are governed by what they can see rather than objective decibel levels. Future research should test whether converting an acoustic hazard into a perceptible signal alters this behavior. A study using a wearable noise dosimeter with real-time visual or auditory alerts could “make the invisible visible,” providing teachers with immediate feedback on overall exposure.

Because the behavioral findings in this study are self-reported, a second study could involve validating these self-reports against observed or measured behavior. A study pairing teachers' self-reported PPE use with observations or with a dosimeter-measured exposure would establish the extent to which self-reports reflect actual practice. This would strengthen the credibility of the compliance vs. convection gap and clarify whether teachers overreport, underreport, or accurately report their protective behavior.

These findings have direct implications for practice. Because teacher modeling influences student behavior, interventions targeting teachers may indirectly affect their students, making teachers an effective point of intervention. Teacher preparation programs should incorporate explicit instruction on tool-specific decibel hazards, focusing on the loud but not visibly dangerous tools that this study identified as most neglected. Professional development should go beyond compliance safety training and instead build a personal safety mindset, framing hearing protection as a lifelong health habit rather than just a workplace requirement. Finally, organizations that set standards for agricultural mechanics competitions and instruction, including state agricultural education programs and the National FFA Organization, are well positioned to integrate hearing protection expectations into career development events and program standards, reinforcing protective behaviors at the point where the profession defines excellence.

Chapter Four: Article Three

Cultivating a Culture of Safety: The Impact of Teacher Proficiency and Long-Term Health Literacy on Hearing PPE Provision

Abstract

This study examines the overarching safety culture among secondary agricultural mechanics teachers by investigating the cognitive motivations behind laboratory safety practices. Specifically, it analyzes the relationship between teachers' self-efficacy, their perceived competence in teaching and managing laboratory safety, and the quality of the safety climate they establish. Data was collected from two cohorts: Georgia (n = 97) and a national sample (n = 32). The findings revealed a significant correlation between teachers' self-efficacy and their safety climate scores, suggesting that perceived competence drives better use and provision of personal protective equipment (PPE). However, a critical health literacy deficit was identified concerning the long-term neurological consequences of noise exposure. Notably, none of the respondents in the national cohort “strongly agreed" that hearing loss is a significant risk factor for cognitive decline and dementia, with the majority of participants remaining neutral or unaware of the link. These results indicate a cycle of silence, where a lack of awareness related to long-term brain health impedes the transition from workplace compliance to a genuine safety culture.

Introduction

Agricultural education teachers strive to deliver high-quality instruction while upholding a steadfast commitment to the safety of both students and teachers (Dyer & Andreasen, 1999; Langley et al., 2018; Saucier et al., 2014). Specifically, teachers engaged in School-Based Agricultural Education, particularly those instructing in agricultural mechanics, are at the forefront of safety responsibilities. It has been recognized by Chumbley et al. (2019), Dyer & Andreasen (1999), and Hard (1989). Shinn (1987) noted that agricultural mechanics laboratories must be safe and well-organized to ensure a safe learning environment. Again, this falls to the teacher to ensure correct laboratory maintenance. It is incumbent upon SBAE teachers to ensure their own safety during periods of student presence and absence and to maintain student safety during instructional times.

In the 1989 Delphi study, Johnson & Schumacher identified competencies that agricultural mechanics specialists considered important for secondary agricultural teachers. The provision and documentation of safety instruction were identified as the top competency identified by these specialists. Johnson & Schumacher went on to explain that these identified competencies reflect perceptions of recognized experts and are important skills for managing an agricultural mechanics laboratory. Teachers' beliefs and attitudes regarding safety and the use of different PPE influence students' attitudes toward safety and PPE use, according to Perry et al. (2012). Hubert et al. (2003) observe that safety education is addressed to varying degrees and with varying depth depending on the tool or subject matter under discussion. Furthermore, Hubert et al. (2003) explain that, in reducing the risk of student injuries in workshops and laboratories, a robust safety climate must be established.

Cox and Flin (1998) examined the distinction between safety climate and safety culture, noting that the two terms have frequently been used interchangeably in the literature since early foundational studies such as Zohar (1980). Cox and Flin (1998) argued that "perhaps in relation to safety the possible difference between the two concepts are insufficient to support their independence, one of the other. Perhaps there is but one" (p. 192). When examining behaviors and attitudes toward safety among agricultural mechanics teachers, it is important to examine their safety culture. Chumbley et al. (2019) assert that agricultural education teachers have a unique opportunity to set high expectations for workplace safety, thereby reducing workplace accidents. Hancock and McKibben (2024) found a strong culture of safety among the participating agricultural education programs.

Despite a common belief that safety is a priority, hearing safety is often overlooked in the field of health literacy among agricultural mechanics teachers. While most teachers focus on preventing immediate injuries like cuts, eye damage, or amputations, they may not fully recognize the long-term effects of noise-induced hearing loss (NIHL). Research by Lin et al. (2011a) shows a connection between hearing loss and a higher risk of developing dementia, emphasizing that lab safety awareness goes beyond just the classroom. Additionally, Lin et al. (2011b) discovered that hearing loss can independently impact memory and thinking skills, which are crucial for learning. Further supporting these concerns, Manohar et al. (2022) found that exposure to loud noises can harm the hippocampus, the part of the brain that handles memory, learning, and emotions, by reducing the growth of new neurons and increasing stress levels, especially in adults. This highlights how important it is to consider hearing safety not just for immediate protection but for long-term brain health too.

Despite the significant risks of noise exposure to brain health and function, there is still a lack of empirical evidence on how well agricultural mechanics teachers comprehend the long-term effects of NIHL. While teachers may show high self-efficacy within an agricultural mechanics laboratory setting, a disparity persists between their perceived safety culture and the actual implementation of hearing conservation practices. In the absence of a comprehensive understanding of the physiological consequences of noise exposure, the safety climate within the agricultural mechanics laboratory remains insufficient. It is essential to investigate how teachers' backgrounds and health literacy influence the utilization and availability of appropriate PPE, ensuring that the “steadfast commitment” to safety (Dyer & Andreasen, 1999) also encompasses the long-term cognitive health of future professionals in the agricultural sector.

Prospective and Conceptual Framework

The foundation of this research is rooted in the work of Dyer and Andreasen (1999), who identified systemic safety challenges within agricultural education that are still present today. Central to these challenges is the inconsistent use of Personal Protective Equipment by agricultural mechanics instructors, whose behavior varies between personal and professional contexts. Langley et al. (2018) observe that students demonstrate the lowest levels of PPE compliance and training related to hearing protection compared to other safety areas. As discussed by Hubert et al.

(2003), instructors who exhibit disregard for safety inadvertently perpetuate the cycle of unsafe practices, reinforcing the perception that neglecting PPE is an acceptable professional norm. However, the stakes of this neglect extend beyond immediate auditory damage. Lin et al. (2011a, 2011b) found hearing loss to be independently associated with incident dementia and accelerated cognitive decline in older adults, suggesting that hearing conservation may also be associated with long-term neurological health.

Ajzen's (1991) Theory of Planned Behavior provides the framework for this study, offering a lens for understanding how health literacy influences teacher behavior. The scientific evidence presented by Lin et al. (2011a, 2011b) should serve as a modifying factor in teachers' attitudes toward wearing hearing protection; the enforcement of hearing-related safety measures should be viewed as a peripheral safety risk to teachers' neurological health. The biological mechanisms identified in animal models by Manohar et al. (2022) lend biological plausibility to these long-term risks, strengthening the basis for an informed attitude toward hearing protection. When teachers understand the psychological reasons for hearing safety, they may demonstrate higher self-efficacy, leading to stronger behavioral intentions to create a safer environment for all.

Purpose and Objectives

The purpose of this study is to examine the overarching safety culture among secondary agricultural mechanics teachers. Specifically, this research investigates how a teacher's background expertise and awareness of long-term health risks, such as the link between noise-induced hearing loss (NIHL) and dementia, influence the resources and climate they establish in their laboratories. To achieve this purpose, the study is guided by the following objectives:

1. Evaluate the relationship between a teacher's self-efficacy related to laboratory safety and the established safety climate within secondary agricultural mechanics programs.
2. Determine and describe teachers' understanding of the long-term outcomes of hearing loss as related to cognitive decline, specifically dementia.

Methods

The first objective of this research is to evaluate the correlation between teachers' perceptions of safety within laboratory environments and a safety climate score. To establish the safety climate score, mean responses were calculated from the following inquiries: 1) Do you wear hearing protection when working at home when exposed to loud sounds? 2) Do you wear hearing protection while working in the school's agriculture mechanics shop at school when exposed to loud sounds? 3) Do you make your students wear eye protection in the shop? 4) Do you make your students wear hearing protection in the shop? 5) Do you provide eye protection for your students? 6) Do you provide hearing protection for your students? The overall safety climate score was derived by averaging the mean responses to these six questions. Because all six items measure observable behaviors: personal and professional PPE use, student enforcement, and PPE provisions, this composite is best understood as an index of safety practices rather than a direct measure of internalized safety culture.

Furthermore, this study aimed to assess participants' comprehension of the long-term consequences of hearing impairment in relation to dementia.

The study population consists of secondary education teachers in Georgia who instructed at least one agricultural mechanics class during the fiscal year 2025 (N = 125). This group is well recognized by the research team. To ascertain whether these behaviors mirror a broader national trend, an additional cohort was included, comprising instructors participating in the National Agricultural Technologies and Mechanical Systems Career Development Event held at the 98th National FFA Convention and Expo in Indianapolis, Indiana (N = 46). This national cohort provides a comprehensive pool of teachers representing various geographical regions across the United States.

Instrumentation

The instrument employed several different Likert scales. Questions one and two pertain to the teachers' use of hearing protection in a home or personal work setting, as well as their utilization of hearing protection in a professional environment, such as a school agricultural mechanics laboratory. Question three inquires whether teachers require their students to wear eye protection while in a shop, whereas question four requests information regarding the enforcement of wearing hearing protection in a laboratory setting. These four questions utilized a 5-point Likert scale with the following response options: 1 = Always, without exception; 2 = When students perform an activity that could pose an eye or hearing hazard; 3 = Most of the time, as students work in the workshop, with occasional exceptions for low-risk activities; 4 = Sometimes, depending on the specific activity and my risk assessment; 5 = Never.

Questions five and six addressed the provision of hearing and eye protection. A 6-point Likert scale was employed to evaluate the availability of eye and hearing protection within the laboratory: 1 = I provide each their own; 2 = I have enough for each student in the shop; 3 = I have enough for most students; 4 = I have enough for some students; 5 = I have enough for one or two students; 6 = I do not provide any.

Finally, participants were asked whether hearing loss is associated with dementia. Using a 5-point Likert scale, they indicated their level of agreement: 1 = Strongly Agree; 2 = Somewhat Agree; 3 = Neither Agree Nor Disagree; 4 = Somewhat Disagree; 5 = Strongly Disagree.

The dates and locations for administration were selected to ensure access to two distinct cohorts. The initial administration took place at the Georgia Vocational Teachers Conference in Athens, Georgia, in July 2025. The research team distributed paper copies of the instrument to teachers identified as having taught agricultural mechanics during the 2024-2025 school year. Paper-based administration was chosen over digital distribution to maximize the response rate during face-to-face interactions. To maintain anonymity, instruments were collected in person or left at unmonitored drop-off locations, ensuring responses could not be linked to individuals. Of the identified potential participants (N = 125), 97 completed the instrument (n = 97), resulting in a response rate of 78%.

The second administration was conducted in October 2025 at the National ATMS CDE in Indianapolis, Indiana. During the second day of the event, paper instruments were provided to the 46 participating advisors during their students' competition flights. The research team personally distributed and collected these instruments from the instructors. This administration yielded 32 usable responses, for a response rate of 69%. Collectively, these two cohorts supplied the data necessary to analyze the correlation between teachers' self-modeling behaviors and their subsequent enforcement of PPE compliance among their students.

Findings

To assess teachers' self-efficacy, defined as a teacher's perceived confidence in the safe utilization and instruction of agricultural mechanics equipment, descriptive statistics were computed for the Georgia cohort. The participants' self-efficacy scores (M = 2.08, SD = .66), based on (n = 97) responses, were documented. These scores were contrasted with the composite safety climate score, which was derived from the mean responses to inquiries about the provision and accessibility of laboratory PPE, the instructor's personal and professional PPE use habits, and the frequency of student PPE enforcement in a school agricultural mechanics laboratory. The resulting safety climate score for the Georgia cohort was (M = 2.73, SD = .69), based on (n = 94) responses. It should be noted that the self-efficacy measure (the teacher's perceived confidence in safely teaching), and the safety climate score (an index of PPE use, enforcement, and provision) were derived from distinct item sets, and the correlation reported below reflects the relationship between perceived and reported safety practices rather than an artifact overlap.

A Pearson Correlation was conducted to evaluate the relationship between teachers' self-efficacy scores and the established safety climate scores within their agricultural mechanics programs. A statistically significant positive correlation was identified ($r(92) = .36$, $p < .01$). This noteworthy correlation suggests that teachers in Georgia perceived self-efficacy increases, and there is a corresponding and significant increase in the quality of safety climate they established for their students.

The identical analytical procedure was employed on the responses of the national cohort to ascertain the self-efficacy and safety climate scores. National respondents reported a self-efficacy score ($M = 1.78$, $SD = .66$) based on ($n = 32$). The safety climate score for the national cohort was ($M = 2.5$, $SD = .58$), with ($n = 32$) responses. Although the sample size of the national cohort was smaller than that of the Georgia cohort, these descriptive statistics exhibit a similar distribution, thereby offering a comparative benchmark for the broader population of agricultural mechanics instructors.

To further investigate this relationship, a Pearson Correlation analysis was performed to assess the relationship between the national cohort's self-efficacy scores and the safety climate of their agricultural mechanics programs. A strong, statistically significant positive correlation was identified ($r(30)=.63$, $p < .01$). These findings align with those observed in Georgia, suggesting a consistent relationship between these variables across the broader population of agricultural mechanics teachers. This result further reinforces the implication that as self-efficacy levels increase, teachers are significantly more likely to foster a safer learning environment for their students.

Secondly, this study sought to determine and describe teachers' understanding of long-term outcomes of hearing loss related to a specific cognitive decline, dementia. Participants in both cohorts, Georgia and National, were asked to indicate their level of agreement with a link between NIHL and the increased risk of incident dementia.

Table 4.1
Responses to question: Is hearing loss linked to dementia?

	Georgia Cohort				National Cohort			
	f	%	*M*	*SD*	*f*	%	*M*	*SD*
			2.66	.76			2.9	.91
Strongly Agree	6	6.4			-	-		
Somewhat Agree	28	29.8			11	35.5		
Neither Agree Nor Disagree	54	57.4			15	48.4		
Somewhat Disagree	4	4.3			2	6.3		
Strongly Disagree	2	2.1			3	9.7		

Note: Missing Responses for Georgia Cohort of (n = 3), which is 3.1% of the total respondents. Missing Responses for National Cohort of (n = 1), which is 3.1% of the total respondents. Values receiving no response are indicated by a dash.

As shown in Table 4.1, the Georgia Cohort (n = 94) indicated a neutral stance related to the health link between hearing and cognitive decline, with 57.4% selecting "neither agreeing nor disagreeing". A small contingent, 36.2% of teachers, expressed some level of agreement with the link, and only a small minority 6.4% strongly agreed with the link between NIHL and cognitive decline.

Nationally (n = 31), similar trends were observed. Nearly half of the national respondents 48.4% identified as neutral, selecting "neither agree nor disagree". One item of note, the national cohort lacked any respondents in the "strongly agree" category. In contrast to the Georgia cohort, the National cohort showed a much higher rate of disagreement 16% compared to 6.4% in Georgia.

Discussion and Conclusions

The findings of this study indicate that as teachers' perceived self-efficacy increases, their confidence in effectively navigating and instructing within the laboratory increases, and there is a significant and corresponding increase in the quality of the safety climate established within their agricultural mechanics programs. The statistical evidence corroborates the theoretical framework of this research, suggesting that teachers who perceive themselves as competent and secure in the laboratory environment are more likely to implement required safety measures, provide appropriate PPE, and consistently enforce safety regulations to reinforce that perception. Essentially, self-efficacy functions as a fundamental catalyst in fostering a stable, secure, and efficacious learning environment. This finding must be read alongside the second result of this study. The same teachers who report high self-efficacy and who build comparatively strong safety climates are largely unaware of the link between noise-induced hearing loss and cognitive decline. Taken together, the two findings suggest that confidence and safety practices can develop in the absence of complete health literacy. Teachers are building climates oriented toward visible, immediate hazards while remaining uninformed of long-term neurological stakes. Self-efficacy thus appears to drive compliance and enforcement, but is insufficient on its own to produce a deeper safety conviction that would support an understanding of the permanent neurological risk.

However, when these behaviors are examined through the framework of Ajzen's (1991) Theory of Planned Behavior, the predominant response in the "Neutral" category across both cohorts indicates that teachers are not necessarily rejecting the science of cognitive decline. A neutral response is open to multiple interpretations. It may reflect genuine uncertainty, an unwillingness to commit to the unknown or simple inattention, but the most likely outcome, given that this link is largely absent from agricultural mechanics safety education, is that many teachers have not been exposed to the relevant information. While teachers express confidence in the current safety practices and climate in their laboratories, they may lack the specific health literacy needed to understand the long-term neurological implications. The complete absence of “Strongly Agree” responses in the national cohort underscores the systemic nature of the health literacy gap, suggesting that even among the most proactive teachers, this health-related connection remains unrecognized.

Given that most members of both cohorts remain either neutral or unaware of the connection between NIHL and cognitive decline, the health risk remains unaddressed in professional discussions among agricultural mechanics teachers. Without a foundational understanding of these neurological implications, teachers are unable to establish a subjective norm that emphasizes the importance of audiological health. This perpetuates a cycle of silence, whereby the deficiency in individual knowledge hinders the development of a collective professional priority, thereby highlighting the necessity for external intervention through the formulation of safety curricula and professional development initiatives.

This deficiency in health literacy highlights a crucial issue. This conclusion should be qualified by the way the construct was measured. Teachers' awareness was assessed with an agreement item related to the link between hearing loss and dementia, instead of a multi-item health literacy scale. The finding is best characterized as a lack of awareness of the specific link rather than a comprehensive deficit in health literacy, and future work employing a multi-item measure would clarify the gap. Future safety training and professional development initiatives should extend beyond conventional safety education in agricultural mechanics, mechanical safety, and the use of personal protective equipment (PPE). Such training must encompass the repercussions of exposure to elevated noise levels. It is anticipated that this approach will foster a change in teachers' perceptions of hearing safety, shifting from mere compliance to advocating for long-term health protection.

Future Research Questions and Application

Based on the findings of this study, several areas of future research and partnership are proposed. First, research should focus on a demographic analysis to investigate the relationship between a teacher's age or level of experience and their level of health literacy. Seeking to find if a generational gap exists relating to the understanding of the link between NIHL and cognitive decline. This research should be used to develop age and experience-level-specific safety interventions. Another vein of research should be conducted to determine whether targeted professional development sessions on the neurological aspects of hearing loss result in a measurable shift in teachers' attitudes, knowledge, or laboratory enforcement behaviors.

Moving beyond research, the profession as a whole should seek to develop our strategic partnerships between State and National agricultural education professional organizations and audiological safety organizations such as NIOSH. These collaborations could provide teachers with access to low or no-cost hearing screenings, evidence-based educational materials, and possible hearing protection samples during professional conferences. Finally, research should be conducted to determine the direct association between a teacher's health literacy related to long-term outcomes and actual provision and enforcement of hearing-related PPE use in their laboratories.

Chapter: Five

Summary, Implications, Recommendations, and Final Thoughts

Summary

Chapter five of this dissertation provides a synthesis of three distinct articles concerning hearing safety within secondary agricultural mechanics laboratories. Prior research has extensively documented the hazardous noise levels prevalent in agricultural mechanics shops and laboratories; however, a gap persists in understanding the cognitive and behavioral factors that influence teachers' safety practices. This body of work examines teachers' technical knowledge related to sound levels (Article One), the consistency of their safety behaviors across personal and professional environments (Article Two), and the influence of health literacy regarding long-term neurological outcomes on the safety climate within agricultural mechanics (Article Three).

Summary of Article One: The Sound of Silence: Evaluating Technical Knowledge of Noise-Induced Hearing Loss Risks and NIOSH Standards Among Secondary Agricultural Mechanics Teachers.

Article One establishes the foundational context for this dissertation. The subjects of this study consist of agricultural mechanics teachers from Georgia and a National cohort of agricultural mechanics teachers whose teams participated in the National FFA Agricultural Mechanics and Technology Systems Career Development Event (CDE). These teachers were chosen because they represent the second-largest pathway in Georgia and, in the case of the national cohort, were selected because these teachers are notably accomplished in the field of agricultural mechanics. Having completed a rigorous competitive process, they have successfully qualified for national-level competition.

Teachers were solicited to evaluate their perceived self-efficacy regarding safety in the domain of agricultural mechanics, as well as their actual technical expertise regarding sound levels in the field, with particular emphasis on the sound intensity of commonly used agricultural mechanics tools. The research revealed a notable discrepancy between teachers' perceived self-efficacy and their actual technical competencies related to tool sound levels. Teachers in both cohorts frequently underestimated the decibel output of tools while simultaneously overestimating safe exposure durations as defined by NIOSH standards. This tendency poses a substantial risk: even teachers who feel confident in their safety protocols may inadvertently expose themselves and their students to hazardous noise levels.

Summary of Article Two: Bridging the Personal and Professional: A Comparative Study of Hearing Protection Behaviors Among Secondary Agricultural Mechanics Teachers.

Article two expands upon the technical findings of Article one by examining the behavioral consistency of agricultural mechanic teachers. These teachers are responsible for the physical maintenance of the learning environment, including facilities and equipment, and for modeling industry-standard safety protocols. This study sought to reveal discrepancies between teachers' personal safety values and their professional safety behaviors by comparing their PPE usage in professional school laboratory settings versus personal settings such as home or farm shops.

Findings indicated a significant distinction between the safety behaviors teachers reported modeling for their students and the hearing protection they reported themselves. While teachers reported high levels of safety modeling and rigorous enforcement of PPE requirements for students within the school environment, their self-reported utilization of hearing protection in markedly lower in both personal and professional settings, with no significant difference between the two. This discrepancy suggests that teachers often perceive PPE usage, particularly audiological protection, as a professional obligation rather than a personal health priority. As a result, hearing protection is primarily worn and enforced during school hours, rather than being regarded as a personal value or vital health practice. The data imply that PPE was generally accessible and enforced in the educational setting; yet low personal use, combined with risk assessment-based decisions, reveals a deficiency in personal risk assessments. This disconnect is particularly significant because safety modeling constitutes the most observable form of instruction for students. If a teacher's commitment to safety is not wholehearted, it may jeopardize the development of an authentic safety culture among students. We observe that Article Two finds that agricultural mechanics instructors have achieved compliance with safety regulations rather than establishing a safety conviction.

Summary of Article Three: Cultivating a Culture of Safety: The Impact of Teacher Proficiency and Long-Term Health Literacy on Hearing PPE Provision.

Article Three examines the cognitive motivations behind laboratory safety, investigating why the disparity between technical knowledge and behavioral practices identified in prior research persists. This study analyzed the relationship between teachers' self-efficacy, their confidence in safely operating and instructing within an agricultural mechanics laboratory, and the quality of the safety climate they have established. The methodology for determining the safety climate score involved utilizing all safety-related questions concerning types and quantities of PPE, as well as enforcement practices and teachers' use of hearing protection in both personal and professional contexts. Most importantly, it evaluated the level of “health literacy” among teachers pertaining to the permanent neurological consequences of noise exposure, specifically the established link between NIHL and cognitive decline or dementia.

Findings indicated a strong positive correlation between teachers' self-efficacy and the safety climate within their agricultural mechanics programs. This statistical evidence suggests that instructors who perceive themselves as competent teachers are more likely to implement necessary safety measures and enforce safety regulations consistently. However, a critical knowledge gap was identified that impedes further safety advocacy.

In both the Georgia and national cohorts, many responses were classified as “Neutral” regarding the association between hearing loss and cognitive decline. Notably, the national cohort, composed of highly accomplished agricultural mechanics teachers, recorded no responses of “Strongly Agree” concerning this neurological connection. This may imply that most agricultural mechanics teachers are not necessarily rejecting the scientific evidence but may have never been exposed to it. This deficiency in health literacy fosters a “cycle of silence” within the agricultural mechanics community. Without an understanding of the long-term neurological risks, teachers are unable to shift the professional culture from merely complying with PPE requirements to actively advocating for lifelong health.

Implications

When the findings from both Georgia and National Cohorts are examined across three articles, three major themes start to emerge that give us an insight into the current state of hearing safety within agricultural mechanics

The initial significant finding identifies a notable "calibration error” among teachers specializing in agricultural mechanics. While teachers report high levels of self-efficacy regarding laboratory safety, Article One indicates that this confidence is often not supported by technical accuracy. Teachers often underestimate the decibel (dBA) output of common agricultural mechanics tools while concurrently overestimating the safety duration associated with exposure to those sounds. This creates a “false sense of security,” leading instructors to believe they are creating a safe learning environment; however, in reality, they are unknowingly operating at hazardous sound levels as defined by the National Institute for Occupational Safety and Health (NIOSH). Technical proficiency underpins safety, and currently a gap exists between teachers' perceived knowledge and the actual sound-level requirements.

Our second theme identifies a modeling error related to safety behaviors. Article Two emphasizes that agricultural mechanics teachers perceive safety as a professional obligation rather than a personal habit. There is a significant discrepancy between PPE use in professional settings, where it is mandated and exemplified, and in personal environments, such as at home or in farm workshops, where it is often overlooked. This indicates that, for many teachers, safety is regarded as important only when observed by others, rather than an ingrained personal value. This disconnection is of considerable concern; the apparent lack of regard for personal safety suggests that the profession has achieved compliance in the workplace without cultivating a comprehensive and genuine safety identity.

Lastly, the most critical theme pertains to the deficiency in health literacy concerning the long-term neurological repercussions of noise exposure. Article three reveals that a “Culture of Silence” within the field of agricultural mechanics is facilitated by a lack of awareness, specifically regarding the fact that hearing loss constitutes a significant risk factor for cognitive decline and dementia. The complete absence of a “Strongly Agree” response from the national cohort emphasizes that even the most accomplished teachers in agricultural mechanics are not sufficiently informed on this matter. Without a comprehensive understanding of these neurological risks, teachers lack the motivation to reevaluate their perception of hearing protection, failing to recognize it as an essential safeguard for their long-term well-being.

Recommendations

The findings of this dissertation provide a foundational understanding of the cognitive and behavioral barriers to hearing safety within agricultural education. To advance the profession toward a more comprehensive safety culture, the following research areas are recommended.

While Article Three identified a lack of awareness regarding the connection between NIHL and dementia, it did not delineate findings based on age or years of experience. A potential avenue for future research is to conduct a quantitative analysis to determine whether the identified gap is generational. Specifically, it would be pertinent to investigate whether veteran teachers have greater awareness than pre-service teachers. Such data would facilitate the development of tailored professional development programs for teachers, tailored to age and experience. Experience-based differences in agricultural educators' perceptions regarding technology adoption. Early-career and experienced educators reported varied degrees of awareness, perceived benefits, competence, and potential barriers (Lindner et al., 2026). Such targeted professional development could emphasize strategies for preventing NIHL among pre-service teachers, and for senior teachers who may already be experiencing NIHL, it could provide strategies for mitigating existing damage.

Given the deficiency in technical expertise and knowledge of health outcomes, as established by Articles One and Three, it is advisable to conduct a longitudinal study in which teachers are divided into distinct groups. Across SBAE contexts, targeted professional development remains an important aspect for improving classroom instructional pedagogy; Teachers experience specialized instructional demands, for which general experience may prove insufficient without external support instruction (Miller et al., 2025). One group would receive conventional PPE training, whereas the experimental group would undergo training emphasizing neurological outcomes. Several safety climate assessments should be conducted after these training sessions are completed. This approach could determine whether health literacy contributes to more enduring behavioral changes than traditional safety training.

Article Two identified a modeling dilemma, where teachers neglect personal safety when not in the professional spotlight. Future research should investigate the use of wearable noise dosimeters or real-time sound level apps that provide immediate visual or auditory alerts. This real-time data would make the invisible visible, potentially prompting changes in teachers' personal or professional behavior. A study comparing self-reported PPE use with measured sound levels would provide a more objective assessment of the compliance-versus-conviction gap identified in this dissertation.

Finally, it has been 30 years since Woodford et al. (1996), a foundational study for this dissertation, quantified hearing loss among agricultural teachers. A large-scale clinical study should be conducted to correlate years of teaching experience with clinical audiograms. By comparing teachers' technical misunderstandings identified in Article One against their medically determined hearing deficits, we can transition from a perceived risk to a clinically documented reality. Such evidence would provide the necessary means to facilitate systemic policy changes and prioritize hearing health and safety as a core value within the agricultural education profession.

Final Thoughts

Throughout this dissertation, the ultimate objective has been to protect the hearing of agricultural mechanics teachers. This research has revealed a critical paradox: While teachers diligently uphold and model safety standards for their students, they often neglect their own hearing safety in both personal and professional settings. This suggests that for many, safety remains a workplace requirement rather than an internalized personal value. However, the data also shows that this neglect is often born of a lack of awareness rather than intentional defiance.

The impact of this research is already becoming evident through informal professional discussions. Over the past year, multiple teachers have approached me, noting that the research instrument prompted them to reevaluate safety protocols in their own laboratories. These interactions have revealed a notable shift; teachers are now enforcing PPE usage more rigorously and increasing the availability of hearing protection in areas where it was previously absent. They are beginning to ask critical questions: What types of protection are most effective for specific equipment? How can I ensure student compliance? Are electronic protectors sufficient for high-decibel environments? Is there truly a link between hearing loss and dementia?

Each of these questions represents a spark, a desire to improve the learning environment for the sake of the students. It is my hope that this body of work serves as a catalyst for a broader cultural shift within agricultural education, especially among agricultural mechanics teachers. We must move toward a future where teachers prioritize their own long-term well-being with the same effort they put into their students' safety. Protecting the “Sound of Silence” is not merely a laboratory rule; it is a vital investment in a long, healthy, and cognitively vibrant life.

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APPENDICES

AUBURN UNIVERSITY
Institutional Review Board

EXEMPT DETERMINATION

July 10, 2025

Jason McKibben
345 W Samford Ave. Suite 2406
Auburn Univ, AL 36849
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Dear Jason McKibben:

On 7/10/2025, the IRB reviewed the following submission:

Protocol Information	Submission Details
Type of Review:	Initial Study
Title:	Sounds in Agriculture, perceptions and understanding
Investigator:	Jason McKibben
IRB ID:	STUDY00000624
Funding:	None
Grant Title:	N/A
Grant ID:	None
IND, IDE or HDE:	None
Documents Reviewed:	• email from GVATA Executive Secretary Allowing Data Collection, Category: Letter of Support; • hearing for ag mech coaches instrument.pdf, Category: Survey/Questionnaire; • HRP-503a - TEMPLATE - Exempt Protocol Sound CDE Coaches B. Elrick.pdf, Category: IRB Protocol; • HRP-581 - TEMPLATE - Information Letter coaches sound and hearing study B..pdf, Category: Consent Form;

The IRB determined that this protocol meets the criteria for exemption from IRB review. This determination is valid through 7/10/2028. The IRB has implemented a three-year determination period for Exempt submissions to better manage the active research portfolio.

In conducting this protocol you are required to follow the requirements listed in HRP-103 - INVESTIGATOR MANUAL.

This determination applies only to the activities described in the IRB submission and does not apply should any changes be made. If changes are made and there are questions about whether these activities impact the exempt determination, please submit a modification in the Endeavor system.

Sincerely,
IRB Administration