Journal of Agricultural Education, 58(3), 19-36.
https://doi.org/10.5032/jae.2017.03019

Concerns of Female Preservice Teachers in Teaching and Supervising the Agricultural Mechanics Laboratory

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Abstract

Agricultural mechanics is a top career choice among secondary students enrolled in agricultural programs. Secondary agricultural mechanics teachers provide hands-on skill instruction with shielded metal arc welders, oxyfuel torches, and various hand tools in their agricultural mechanics laboratories. Preservice agriculture teachers have reported lack of preparation to adequately teach in this potentially dangerous environment. This qualitative case study explored the concerns of preservice teachers about teaching secondary students in the agricultural mechanics laboratory and how those concerns evolved over time. Researchers used a constructivist epistemology and open coding to identify and explore emergent themes. Three themes emerged from the data: 1) issues of trust and control in supervising laboratory students manifest themselves as a professional threat, 2) mechanics skill and supervisory skill development coincided with a change in focus toward student safety and learning, and 3) the agricultural mechanics laboratory provides unique instructional challenges and opportunities. Although each preservice teacher differed in their development, the authors identified persistent issues with agricultural mechanics skill knowledge and student trust.

Keywords: Agricultural mechanics, preservice teachers, welding, oxy-acetylene, trust, safety, shop, laboratory.

Introduction/Theoretical Framework

The first two lines of the National FFA Organization motto "Learning to do; Doing to Learn" underscore the importance of skill-based instruction as a cornerstone of secondary Agricultural Education programs. A majority of secondary agriculture teachers provide skill-based instruction in an agricultural mechanics laboratory (Burris, Robinson, & Terry, 2005). Specifically, agricultural mechanics instruction provides a place for teaching authentic career skills in a safe learning environment.

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Today, agricultural mechanics and technology is a popular career and course choice for students enrolled in secondary agricultural programs (Anderson, Velez, & Anderson, 2011; Burris et al., 2005; Busdiecker, 2015; Chumbley, Gill, & Chesher, 2013), but preparing students for these careers presents several unique challenges. Laboratory equipment is potentially dangerous (Johnson & Fletcher, 1990) and curriculum spans multiple skill areas. Agricultural mechanics teachers must have knowledge dealing with a wide array of curriculum (Saucier, McKim, & Tummons, 2012); they must also account for discrepancies in learners' ability, prior knowledge, needs, and experiences (Rayfield, Croom, Stair, & Murray, 2011). Although laboratory management skills are essential knowledge for all school-based agricultural mechanics teachers (Saucier, Terry Jr., & Schumacher, 2009), many preservice teachers report inadequate content knowledge in Agricultural Mechanics subject areas (Stripling, Thoron, & Estepp, 2014).

Agricultural mechanics knowledge issues are compounded by a lack of adequate training, professional development, and instructional materials in agricultural safety (Rudolphi & Retallick, 2015). Specifically, agricultural programs have reduced the amount of training received in courses specific to agricultural mechanics (Burris et al., 2005; Schumacher, Ess, Strickland, & King, 2002), and teachers across multiple geographic regions and teaching experience levels have reported a need for professional development related to agricultural mechanics (Blackburn, Robinson, & Field, 2015; Duncan, Ricketts, Peake, & Uesseler, 2006; Saucier & McKim, 2011; Stripling et al., 2014). Among the many professional development needs of agricultural mechanics teachers, safety instruction and supervision is a top concern while in the agricultural mechanics laboratory (Gliem & Miller, 1993; Johnson & Schumacher, 1988; Langley & Kitchel, 2013; Swan, 1992). Safety is not only identified as a top safety concern by teachers, rightfully so, teachers often times use safety of the students as a measurable goal of a class (Talbert, Camp, & Heath-Camp, 1994). Although educators have indicated safety as one of the most important aspects of the agricultural mechanics laboratory, some discrepancy still exists when determining the severity of a potentially dangerous situation, particularly among new teachers (Langley & Kitchel, 2013; Murphy, 2003). Safety evaluation and practice are ever changing within the agricultural mechanics laboratory; with the introduction of new tools, new teaching aids, and a changing demographic of students and teachers, agriculture mechanics instructors are asked to supervise an increasingly complex environment with reduced experience and training. These persistent knowledge and liability concerns may limit the scope of laboratory instruction within secondary agriculture programs (Dyer & Andreasen, 1999).

Agricultural mechanics is a field of expertise traditionally populated by male teachers and students. However, over the last 30 years, a demographic shift has emerged among agriculture teachers (Burris, McLaughlin, McCulloch, Brashears, & Fraze, 2010). Knight (1988) reported only about 5% of agriculture teachers were female, Camp (2001) reported almost 16% of agriculture teachers were female, and Shultz, Anderson, Shultz, and Paulsen (2014) indicated that as high as 33% of agriculture education teachers were female. Preservice preparation programs are also seeing an increase in female enrollment as well. Females comprise about half of recent student teaching populations (Burris et al., 2010; Saucier & McKim, 2011). Specific to agricultural mechanics preservice preparation, Blackburn et al. (2015) reported one-third of the students enrolled in a preservice agricultural mechanics course from 2006 to 2012 were female.

Based on teacher demographic data, many of today's young female agricultural mechanics teachers are hired to fulfill a role which was traditionally served by males. Although the professional development needs of agricultural mechanics teachers are well documented (Dyer & Andreasen, 1999; McKim & Saucier, 2011; Saucier et al., 2009; Saucier, Vincent, & Anderson, 2014; Shultz et al., 2014), young female agricultural mechanics teachers may face unique challenges and constitute a special population worth investigating. Burris et al. (2010) suggested researchers should compare mechanics teaching efficacy levels by gender. Further, Langley,

Kitchel, and Schumacher (2014) suggested an investigation of safety within the agricultural mechanics laboratory based on teachers' demographics such as age, gender, years of teaching, and skill level. This study sought to address the gap in literature regarding the unique experiences of female preservice agricultural mechanics teachers as they negotiate their role in becoming agricultural mechanics teachers.

Purpose

This study explored the concerns of female preservice teachers about teaching and supervising students in the agricultural mechanics laboratory and how those concerns changed over time. This study aligns with Priority Three of the National Research Agenda: Sufficient Scientific and Professional Workforce that Addresses the Challenges of the 21st Century, by contributing to the body of knowledge regarding the methods and practices in supporting agricultural educators in all stages of their career (Stripling & Ricketts, 2016). This study was guided by the following research questions:

1. What concerns did female preservice teachers hold about teaching secondary students in the agricultural mechanics shop?
2. As female preservice teachers progressed through preparatory course work, how did perceived concerns regarding agricultural mechanics instruction change over time?
3. What concerns held by female preservice agricultural mechanics teachers manifested themselves during the student teaching experience?

Methods/Data Collection and Analysis

The authors of this qualitative intrinsic case study operated under a constructivist epistemology. A constructivist epistemology focuses on preserving the unique and subjective realities of the subjects; researchers sought to preserve the complexity of views and maintain participant voice through open-ended questions and allowed the analysis to be guided by the data, not a predetermined theory (Creswell, 2012). This inquiry was guided by etic issues (Stake, 1995) regarding the complex and immediate hazards of teaching and managing students in the mechanics laboratory. The openness of the etic approach allowed for emic issues to emerge from the data, reflecting the continuous, interactive processes of qualitative research data collection and analysis (Miles & Huberman, 1994). After researchers completed initial data collection, coding, and analysis for emergent themes, researchers refined questions to reflect emic issues regarding how content credibility and behavioral management concerns unique to female preservice agriculture mechanics teachers shaped their teaching and management practices.

Researchers employed a single, bounded case methodology (Stake, 1995) where a cohort of female preservice agriculture teachers were followed from the beginning of their final academic semester through the end of their student teaching internship. Researchers established credibility by triangulating multiple sources of data, including multiple interviews, observations, document analysis, and extended field time with subjects (Lincoln & Guba, 1985). Initial coding was also confirmed through member checks (Lincoln & Guba, 1985). Researchers built trustworthiness by describing the case using thick, rich descriptions (Ary, Jacobs, Razavieh, & Sorensen, 2006). Data were analyzed using constant-comparative design, where data were analyzed using a multi-step process to transform raw data into relevant themes through multiple layers of abstraction (Glaser & Strauss, 1967). Dependability was facilitated by audio recording all interviews, independent researcher coding, and coding checks between all researchers after initial coding and at each level of abstraction (Lincoln & Guba, 1985). Confirmability (Lincoln & Guba, 1985) was facilitated by triangulation of data, an audit trail of raw data, data reduction, and data analysis products. Three

male researchers were former high school agricultural mechanics teachers with multiple years of experience; each had taught preservice teacher education courses in agricultural mechanics laboratory management. One female researcher was an undergraduate teacher certification student with little shop experience before her student teaching internship. Focus groups were conducted and transcribed by the female undergraduate researcher to facilitate participation. The three male teachers performed observations, document analysis, and extended field time, including on-site visits during the student teaching experience. Data were individually coded and analyzed by each researcher, and coding checks, data reduction, and abstraction were led by one male researcher.

Five female undergraduate students and one female graduate student participated in four focus groups where researchers used structured questions, with impromptu probing questions, to elicit the concerns and challenges perceived to becoming an effective mechanics teacher. All participants were concurrently enrolled in the same agricultural mechanics teaching methods course. Each month, all participants participated in a focus group where they reflected on their current concerns and issues, guided by the same prompts designed and delivered by the female researcher. Male researchers observed participants as they served as "teacher for a day" in the metal fabrication and laboratory management course, noting critical incidents, supervision strategies, and students reflecting on their experience in managing the laboratory. Researchers also observed participants teaching essential mechanics skills (e.g., sharpening a drill bit) and power tool safety demonstrations to their classmates. Researchers analyzed power tool safety lesson plans, teaching reflections, and laboratory management plans to better understand the concerns of participants. In the spring, researchers coded the data and analyzed for common themes. This analysis revealed emic issues and additional interview questions were generated. After completing their student teaching, all six participants were invited to participate in a follow-up interview. We conducted three follow-up interviews in May, where researchers clarified and explored emic issues regarding their earlier concerns, current concerns, and to what extent their earlier concerns were realized through the student teaching internship. Data was again analyzed individually for themes and then refined into sub-themes. Researchers recorded a data trail for each level of abstraction (Lincoln & Guba, 1985). The findings of this study were written as thick, rich descriptions to facilitate transferability (Lincoln & Guba, 1985).

Case Description

All participants were enrolled in their final year of an agriculture teacher education program located in a College of Agriculture at a land-grant institution. The program serves approximately 90 undergraduate students, of which 82% are female. Students were required to complete six hours of instruction in agricultural mechanics before their student teaching internship. All students enroll in a three-hour introductory Agricultural Systems course and a three-hour metal fabrication and laboratory management course taught by Agricultural Education faculty taken just prior to the student teaching internship. Introductory course content included surveying, electricity, small engines, tractors and machinery, and grain handling. Metal fabrication and laboratory management competencies included shielded metal arc welding, metal inert gas welding, oxy-acetylene cutting, metalworking, general hand and stationary tool safety and operation, woodworking, project construction, context- and subject-specific pedagogy techniques, and laboratory management. Students complete a 16-week student teaching internship at one secondary school during the spring semester; interns are expected to teach a full course load for at least four weeks. Within the secondary agriculture programs of this state, four of the top six high school enrollment courses contain agricultural mechanics competencies, and a large majority of high school facilities include a mechanics laboratory. Seventy-six percent of the state's secondary agriculture instructors teach in a single-teacher department; it is likely a new teacher in this state will have some expectation for teaching agricultural mechanics.

Among the six participants, Anne, Betty, Carrie, and Elissa (all names were changed) were raised in rural areas. These four, and a fifth participant, Denise, were former members of the National FFA Organization. Two of the six participants, Anne and Betty, had enrolled in a one-year-long agricultural mechanics class in high school; both reported that they were the only female enrolled in the class. Anne had strongly negative experiences with her high school mechanics class; she reflected on an ineffective substitute teacher for much of the term and a lax safety policy, which led to a perceived dangerous work environment. A third participant, Carrie, had welded for one week as a high school freshman, and the final three participants, Denise, Elissa, and Faith, had never received any formal mechanics instruction. In August, researchers inquired about participants' previous experiences working with power tools. Betty had experience with power tools and saws from a summer roofing job, Faith "can work a power drill, that's about it," and Anne had worked at a butcher shop and had used a meat grinder and band saw. Carrie knew how to use an arc welder from her week of experience as a freshman in an introductory agriculture class; Denise and Elissa reported no experience using power tools. In the metal fabrication and laboratory management class, participants taught and tested their peers on the safe use of the arc welder, MIG welder, oxy-acetylene cutting torch, angle grinder, pedestal grinder, table saw, portable drill, drill press, radial arm saw, circular saw, jointer, planer, belt sander, reciprocating saw, jig saw, and various hand tools. All study participants safely used all listed tools in the fall class. All participants supervised and taught at least one class in the agricultural mechanics laboratory during their student teaching internship.

Results/Findings

The first objective sought to understand the concerns held by female preservice teachers about teaching secondary students in the agricultural mechanics shop. *Theme 1: Issues of trust and control in supervising laboratory students manifest themselves as a professional threat to preservice teachers.* Theme one emerged in the first focus group and persisted throughout the nine months of data collection. Preservice teachers expressed concern for their role as mechanics teachers and described in detail multiple scenarios where their credibility, safety, or employment as teachers could be jeopardized by students. Denise, Elissa, and Faith felt females faced unique professional challenges in agricultural careers, including agricultural mechanics instructors.

Students Posed Safety Threats to Teachers, Themselves, and Other Students

Subtheme one highlights persistent physical safety concerns when teaching in the mechanics laboratory. The mechanics laboratory created unique opportunities for personal injury for teachers and students alike; early preservice teachers' concerns primarily revolved around students not knowing how to be safe and teacher inadequacy in creating a safe environment (see Figure 1). As preservice teachers gained technical and supervisory skills, their safety concerns began to shift from issues of ineffective instruction and supervision to issues of student trust and control. Participants' lesson plans and teaching reflections showed an evolving trust in the demonstration and safety documentation systems provided to prevent most accidents. However, student safety concerns persisted throughout the study, as some participants felt they supervised students who knew better but were still unsafe. Safety concerns during the student teaching internship appeared as student trust issues, in contrast to earlier issues of perceived incompetency.

Concern for personal safety	"The big difference [between classroom and shop] for me is they [students] can kill themselves in the shop and everybody else. They really can't kill anybody in the classroom." Betty, September
Skill inadequacy and liability	"I'm worried about it (oxyfuel rig) exploding, I'm worried about maybe not hearing the whistle. I'm worried about something going boom, and half of my kids being dead and that's on me… if I hurt myself that's on me, and my insurance will cover that and I'm liable for myself, but as far as students hurting themselves, that freaks me out. I'm worried about that; it's a constant stressor." Denise, September
Some injuries are not accidents	"We can talk about safety all we want, and yes, we know what is safe and there are safety tests that you keep on file, but at the same time, if a kid's going to electrocute himself, he is going to electrocute himself. I've watched dumb, ignorant kids stick tweezers in a light socket before. If they want to do something dumb, they are going to do it and it doesn't matter if they think it is safe or not. … And it only takes one incident for you to look like a complete idiot and probably your job or something, I think." Denise, November
Judging trust	"I don't know how you determine trust, it's just something you have to watch. The way I knew I didn't want to fully trust the kid who ended up getting in trouble at my student teaching spot was he wasn't really respectful to me, but he was not respectful when the other boys were respectful… it wasn't just me, it was with all the other teachers." Denise, May
Coping strategies for low-trust students	"I had some idiot students who you didn't want to take to the shop because I was afraid they were going to blow everyone up. So what I ended up doing was taking my students who excel very quickly and have them work with that student." Anne, May
Accepting the dangers of the environment	"I don't really have any safety concerns coming out. I know what proper safety looks like and feel like I can handle it. Most things [injuries] I know are just out of my control, I don't what to do, so send them to the nurse." Faith, May

Figure 1. Preservice teacher concerns of student safety and trust in the mechanics laboratory.

Students as Threats to Preservice Teacher Credibility

A second subtheme regarding trust and control emerged as teacher fear of high knowledge students exposing their ignorance, thus compromising their professional credibility. Some preservice teachers feared students who had strong mechanical knowledge would seek to humiliate and discredit teachers in front of their peers. Preservice teachers were concerned their lost credibility would prevent them from successfully pursuing a career as a mechanics teacher.
"And so I guess that [ignorance] is my big thing and I know the 'fake it till you make it', but I don't know how to fake it. What happens when the boys ask me a question to trip me up because they know they can…? I don't have very much [credibility] to start off with and I'm afraid that they are going to try to trip me up because they know I don't know anything and I will lose what little credibility that I have." Elissa, August

Students as Threats to Effective Instruction

Subtheme three centered on how attitudes and dispositions of certain students may interfere with the preservice teachers' professional goals. Some preservice teachers recounted personal horror stories from their days as students while others expressed concerns about student motivation and off-task behaviors (see Figure 2). For some teachers, student teaching renewed trust concerns regarding instruction and supervision. Preservice teachers struggled with assessing student readiness and task persistence in the laboratory. January focus group discussion revolved around specific students perceived as threats and how teachers each day must assess trust level for their students. Trust evaluation methods varied among teachers.

High school students can't be trusted	"You know high school boys? If they aren't busy, they are going to get into trouble." Betty, August "I know what my friends did in high school shop. They pooped in the vacuum, the shop vac…. They could smoke, dip, skip class, and just hang out back there." Faith, August
Fear of job loss	"I have this huge fear of liability and I know how easy it is for someone to come back and sue me. If I do one thing wrong, it's my fault. I've managed it [concern] by thinking and knowing that I'm not going to be the best teacher when I graduate." Anne, September
Lack of effort	"I expect them [students] to do the very least amount of work to get through. Not a lot of kids are going to go up and over the bar." Anne, November
Trust in following procedures	"I'm worried about them [students] taking safety seriously. After talking with other student teachers in the area, they have told me stories about students not taking PPE seriously and it is something I know I will need to take seriously with them. And then, having them take it seriously and then you break the rule, then all shop order goes away." Anne, January
Violating trust	"I feel like I spend most of the time trying to find kids…kids are always disappearing to places in the shop so they don't have to work and can play poker on their phones. It's frustrating." Elissa, January
External factors affecting trust	"And they [students] are just talking about taking their own prescriptions. Unless you can prove a kids is on drugs or you feel like they are a liability in the shop, then I feel like it is ok to turn a head if it doesn't meet those criteria." Faith, January
Peers and trust	"It's more like trust and maturity level mixed together, and mixed with the other people in the class. If there's one kid who is always goofing off, and he has five friends in the classroom and he makes those five friends goof off, then you have over half of the classroom goofing off. Um, so I think, I don't know how you determine trust." Denise, May
Trust and accountability	"If they get hurt, they know it's their own fault, but at the same point, the people who didn't want to be there were just goofing around in the shop when they really shouldn't have been in there. If you're not dressed for it, then you can go sit in the classroom. If you want to be out there, be out there; if not, find a different class to be in." Faith, May

Figure 2. Preservice teacher instructional concerns regarding students in the laboratory.

Preservice teachers placed great importance on shop procedures, including safety training and demonstrations, as the foundational component of safe laboratory work. As time progressed, most participants reported less concern for safety and more concern for learning outcomes.

Objective two sought to describe how student teacher concerns changed over time. Researchers used semi-structured interviews for all focus groups and interviews to capture preservice teachers' immediate concerns through the fall and spring. Early focus groups arrived at consensus regarding issues of inadequacy and reputation; later concerns became more complex and divergent among teachers. *Theme two: skill and supervisory skill development coincided with a change in focus toward student safety and learning.*

Early Concerns of Inadequacy

Early in the semester, Anne, Betty, Denise, Elissa, and Faith shared external concerns of credibility, inadequacy, and incompetence. These preservice teachers discussed their issue as a young female teacher in terms of reputation with her students, community members, co-teachers, and other agriculture teachers. Specifically, a lack of agricultural mechanics skills contributed to their feelings of inadequacy (see Figure 3). Researchers observed credibility concerns manifested in participants' planning and delivery of power tool safety and operation demonstrations for their peers, as demonstrating a power tool for which they had no practical knowledge brought unique challenges and fears. Additionally, participants shared concerns regarding their ability to provide adequate supervision and accurate evaluation and feedback while serving as teacher for a day.

Gender issues	"You can tell the difference between the guys that actually took shop that are in our class and the girls that have no knowledge of it….they have more knowledge than we have and I think that plays a lot into the fear of the preservice teacher." Denise, August
Coworkers	"I think the idea of a co-teacher is fantastic, but we are all envisioning the perfect co-teacher, but what if we got the old man that thinks we are incompetent? So I think that at that point, instead of not being highly looked upon by a co-teacher, I would much rather suffer and doggy-paddle through on my own." Faith, August
Lack of skills	"I don't know how to work a machine, I don't know what is safe and what's not safe, and when that student gets hurt because I didn't know what I was doing, then I'm going to lose my job because I have no knowledge of it." Denise, August
Threats to credibility	"How am I going to grade a student on their welding quality when mine is not very good, to say the least?" Carrie, August
	"My concern is…high schoolers taking you seriously. We are closer in age to them than most other teachers. It is hard to enforce that I am an adult when they know it is your first teaching job and they know they can probably play you like a fiddle if they want to, because it is our first year of teaching and you have no idea what to do if a student does something like that." Elissa, September

Figure 3. Initial preservice teacher concerns regarding mechanics laboratory instruction.

Awareness of Student Safety Responsibilities

As preservice teachers gained experience in specific technical and supervisory skills, concerns shifted from reputation toward issues of student safety in the shop. Reputation concerns persisted, but preservice teachers came to terms with their limitations regarding skill performance, some showed willingness to seek help from external sources. Technical skill concerns become more diverse and preservice teachers begin to reflect on project planning and preparing to teach (see Figure 4).

Skill competence and safety concern	"I'm excited to MIG weld again and see how my skills are, and oxyacetylene still worries me. It's just the fact that I am in charge of so many kids; they are around a very dangerous and potential explosive [material]…How do I get students to realize that technically my job is in their hands?" Anne, September
Reputation and safety	"Like building a trailer, obviously, I'm not going to tackle that my first year, but I need to make sure it's safe and if it's my first time going through it, it makes me a little bit nervous having them take it home and essentially putting my name on it and signing off on it." Faith, September
Acceptance of skill level and resources	"I feel like I can correctly teach a student how to scratch, tap, and how to make a decent bead even if I may not be the best welder in the world… I'm going to teach the students how to grade themselves and how they are going to recognize a quality weld. I've got my free teaching materials which I will use to the best extent." Anne, September
Project management	"I could teach them the essentials, but as a problem solver, I don't have the right answers for them. I'm not equipped with that knowledge yet. I feel like I am on the same level as them, I feel like I can help them sort their [problems] out… it will take up more class time than necessary." Faith, September
Seeking help and reputation	I'm just going to have to rely heavily on community members, obviously there is going to be someone in the community that knows something…I'm not the best at everything, no one is the best at everything and everyone needs help. People tend to not like you if you think you're the best at everything." Denise, November

Figure 4. Second stage of preservice teacher concerns regarding mechanics instruction.

Comfort With Safety Supervisory Role and Concerns Student Learning

Participants' concerns continued to evolve through their student teaching experience; later concerns revolved around student learning, project management, and reactions to instructional strategies used by their cooperating teachers. Preservice teachers reflected their initial fears were realized to some extent but reported they had developed sufficient professional skills to deal with these fears. Anne, Denise, and Faith independently spoke of a singular moment where they earned credibility with students by demonstrating their competence at a specific technical skill (see Figure 5).

Freedom and supervision	"As a student teacher, it was really a lot easier than I had made it out to be…. Yeah I still have the same fears; I don't want a student to get hurt….At the same time, I'm more focused on students learning now, instead of being the most cautious person in the word, like a protective mom, standing over them…Just give them more range to do what they want to do and what they want to try and really that's how I let them learn" Denise, May
Finding a teaching style	"Whenever we sent the ag power boys out to the shop and started working on small engines, Mr. Z. told them that he… expected me not to answer any questions, which in turn made them actually go through and find the answer in the book. It showed me I didn't have to know everything but I still need to know a lot about the material." Anne, May
Responsibility	[Students] "have to learn their own responsibility, and they have to plan their own [projects], although it's really you planning most of it, but you have to make them think they are planning it and make them run it by you, essentially. That part creates a lot of responsibility in them and it's ownership for their project." Faith, May

Figure 5. Teacher laboratory concerns at the conclusion of their student teaching internship.

Objective three sought to describe to what extent early concerns of preservice teacher were realized. *Theme 3: The agricultural mechanics laboratory provides unique instructional challenges and opportunities.* In the fall, preservice teachers described how they envisioned teaching in the laboratory different than teaching in the classroom (see Figure 6).

Complexity of planning and supervision	Learning in the laboratory holds students more accountable, it's harder to plan, though. You just have to let go and let the students in the class guide you whereas in a classroom you are more structured on a time frame. You won't have a set schedule. In this class you are doing this and this but in shop you are really just "here's a learning experience, let's learn from it." Faith, October
Difficulty of skill acquisition	"[production agricultural content] you can learn very quickly. The night before you are teaching a lesson on swine diseases you are going to learn about it….the other content areas you can kind of doggy paddle through but you can't just go out and be good at MIG welding." Elissa, August "My kids think I'm a creep because sometimes I just stand there and watch them so I can learn." Denise, January
Inability to predict problems	"In the classroom, I feel like most days to be a teacher it's preventative measures, whereas the shop is more reactive measures." Faith, September

Figure 6. Unique challenges in providing instruction in the laboratory.

Agricultural Mechanics Teachers Must Simultaneously Perform Many Unique Tasks

The complexity of project planning, construction, and supervision in addition to teaching duties was overwhelming to study participants. Over time, preservice teachers found comfort in

procedures and successfully supervised small project construction. All participants felt pressure to build large projects and apprehension regarding their abilities to successfully supervise (see Figure 7).

Planning projects	"I'm stressed out about student projects…knowing exactly what they are going to need, what cuts to make, the bill of materials, the cut list. I'm a little nervous that… I will not be able to figure that out for the project they want to make as well as keeping enough supplies to last us so that we don't run out." Faith, September
Dealing with supply issues	"It is going to suck when you mis-order wood or something or a kid chops an extra piece and then you have a kid that doesn't have enough. It happens, and that's the thing, but it's like 'what do I do now?'" Denise, November
Pacing	"But then, how much time is too much time? Because for me, I don't know how long it would take a high schooler to make [a project], so they could have dragged it out to a month and a half." Elissa, November
	"Is this [project] going to last me five years or five days? I'm a little uneasy with that." Faith, August
Keeping students on task	"They [students] have shop projects to be working on, but you have to be on them all the time to make sure that they are working on them because they will just sit in there in a corner and they don't pull out their homework, they just sit there and do nothing. You are working with one student and trying to get some one-on-one attention and it is hard to manage." Carrie, January

Figure 7. Concerns regarding the many tasks of teaching and supervising in the laboratory.

Adjusting Teaching and Supervision Expectations

Teachers reflected on time and space issues during shop supervision. Large groups of students spread over a wide area working on different tasks caused angst for preservice teachers. Faith and Denise reflected on the internal dialogue on when, how, and to what extent they should offer students help (see Figure 8).

Differentiated instruction and supervision	"Everything is [at] different skill levels. One girl who is in the class is really just basic and the rest of them are working on big projects, so you have that one student who needs your special attention, but the other five should be good to go if they were on target." Carrie, January
Managing instruction with limited equipment	"It is me trying to figure out where I need to be at what times and then we are going to be doing half torch, half arc welding because we don't have enough set ups and it would be chaos trying to have that many kids out in the shop waiting." Denise, January
Supervisory skills built on technical skills	"Probably the most impactful…was getting in and grasping the basics, learning how to do it myself; it really helped because you can't teach something you don't know how to do. And watching him [cooperating teacher] looking at 'what's wrong with this picture? What do you see that kid doing? What are you looking for in this picture?' Helping me recognize hazards that not everyone is aware of, and, as a teacher, you should be aware of." Denise, May
Letting students learn from failure	"They [students] want to make this project, I kind of know how it's going to go and how long it's going to take, but let them figure out their problems on their own. I knew that problem was going to come up…, you have to learn how to fix them. You have one piece of sheet metal to make this dust pan out of, and it you cut it too small, you will have to fix it." Faith, May

Figure 8. Reflections on monitoring students and instruction in a busy mechanics laboratory.

Discussion

This study was conducted within a small subset of preservice Agricultural Education majors; therefore, findings should be inferred with caution. Further, researchers recognize potential gender and power differentials may have influenced data collected from participants. With research question one, investigators sought to describe concerns held by female preservice teachers about teaching secondary students in the agricultural mechanics shop. We concluded preservice teachers in this study held multiple and varying concerns regarding their personal safety, the safety of their students, and the impact dangerous student behaviors, accidental or intentional, may have on their professional teaching careers. At the beginning of the fall, many participants were so consumed by thoughts of danger and injury they could not conceptualize student learning happening in the laboratory. Teachers feared student behavior would interfere with their goal of educating the students within the mechanics laboratory; issues with trust manifested themselves as professional and personal threats. Some beginning teachers feared a student confrontation or accident would expose their ignorance to other students, administration, or fellow agriculture teachers. Skill development through practice reduced fears and allowed preservice teachers to begin to focus on learning outcomes. One preservice teacher requested additional pedagogical training in mechanics laboratory management, supporting the assertion preservice teachers would prefer to have additional mechanics training (Burris et al., 2005), and reflects reduced agricultural mechanics courses at the university level (Schumacher et al., 2002).

For research question one, researchers recommend preservice teacher programs facilitate a working knowledge of safety and liability with preservice teachers and to what extent they are liable for student injuries. Since skill development precedes conceptualization of laboratory learning, preservice programs should prioritize agricultural mechanics skill development early in

the curriculum. Further research includes a phenomenological investigation regarding the essence of trust between high school agriculture teachers and their students. Researchers should also describe quantity and type of agricultural mechanics field experiences required for preservice teachers and to what extent beliefs are shaped by those experiences.

Researchers sought to describe how preservice teacher concerns evolved over time in research question two. Investigators note that not every preservice teacher progressed along the same timeline or through the exact same concerns, but a general pattern of concerns emerged. Early in the fall of their last semester of preservice courses, preservice teachers felt strong concerns about themselves, their adequacy, credibility, and reputation with co-teachers, peers, students, and community members. This finding supports Wigenbach, White, Degenhart, Pannkik, and Kujawski's (2007) assertions regarding the importance of adequate knowledge and comfort while teaching agricultural mechanics skills and safety practices. During the fall semester, the focus of concerns moved from a self-centered paradigm to a student safety-centered paradigm. "Teacher for a day" fall observations confirmed preservice teachers were often more concerned about themselves and safety of their classmates, machines, and facilities than facilitation of learning. However, observers witnessed isolated cases of reflective questioning and student-centered laboratory instruction toward the end of the semester. A lack of skills may cultivate feelings of personal and professional unaccomplishment, which can lead to burnout among beginning teachers (Friedman, 1996). The student teaching experience brought a relapse of self-concern for some teachers as they attempted to negotiate the relationship with their cooperating teacher.

Researchers further conclude participants reframed their conceptualization of what technical skills were required to teach agricultural mechanics during the study. This reframing was facilitated by both an increase in skill and supervision experience and accepting skill limitations (Friedman, 2000). It is worth noting the tempering of skill expectation coincided with a willingness to seek outside help. Do mechanics teachers need to know what they do not know before they seek assistance? Our findings for research question two support the teacher concerns model as proposed by Fuller (1969). Fuller's pre-teaching concern for self and adequacy were evident in issues of personal knowledge and safety. Later teacher concerns for students, then learning emerged clearly from the data, after teachers developed knowledge and/or support mechanisms to aid in instruction. This study potentially adds depth to the Fuller model by suggesting concern for students could be a two-stage concern model in this context, whereas stage one is a concern for student safety and stage two is concern for student learning. Further research should examine how teachers move from teacher concern to student safety concern and the validity of the proposed two-stage student concern model.

We recommend teacher preparation programs align agricultural mechanics equipment and curriculum to those found in high schools to facilitate skill transfer. Future research should identify to what extent cooperating teachers provide opportunities for skill demonstration to promote preservice teacher confidence. Future research should also investigate the readiness level for college of agriculture graduates to supervise subordinates in dangerous environments. What circumstances facilitate the opportunity for student teachers to prove their technical competence?

In research question three, investigators sought to describe to what extent early concerns were realized through the student teaching experience. Researchers conclude that many of the initial concerns raised by preservice teachers regarding student (mis)behavior were realized. In contrast, other teachers were surprised by the help they received by high knowledge students. Initially, preservice teachers raised concerns that students would not find them as credible mechanics teachers. Beginning teachers discussed lowering their skill performance standards during fall interviews; beginning teachers often adjust expectations in order to shield themselves

from the negative difference between their personal performance standards and their performance (Hoy & Spero, 2005). However, three students independently reported their personal credibility concerns were put to rest by a critical incident where they skillfully demonstrated specific task knowledge for their students. Based on our findings, we question what factors can predict the ability of a preservice teacher to use skill demonstration to promote teacher efficacy as well as what is the role of cooperating teachers in creating opportunities for skill demonstration to promote confidence?

Agricultural mechanics skill development was important for preservice teachers both for fostering feelings of self-efficacy and for instructional success. With an increase in expertise, student teachers came to a richer understanding of the teacher-student trust paradigm and issues of control with teaching and mechanics experience. However, issues of student trust and control persisted throughout and beyond the student teaching experience, and some participants looked for nebulous and potentially incorrect trust factors (e.g., the type of clothes a student wears as a measure of trust).

For supervisors, safety-specific trust mediates leadership behaviors in creating a climate of safety (Conchie & Donald, 2008). Supervisor trust and distrust are not opposites, but rather unique constructs which are both needed to minimize risk (Burns, Mearns, & McGeorge, 2006; Pidgeon, Walls, Weyman, & Horlick-Jones, 2003). Student mistrust manifested itself as intentional and unintentional harm to themselves, other students, and the teacher. In order to build trust in the workplace, supervisors must develop functional supervisory trust behaviors, which include monitoring/checking subordinates, high level of maintenance/safe equipment, open communication climates, and reduced risk perception (Pidgeon et al., 2003). Agriculture student teachers reported their greatest professional development needs in the areas of lab and equipment maintenance and laboratory safety (Saucier & McKim, 2011), suggesting a lack of experience in determining the safety of a piece of equipment may limit student teachers' ability to display functional supervisory trust behaviors to build a culture of trust. We recommend teacher preparation programs prioritize teaching functional supervisory trust behaviors, particularly equipment maintenance, within the preservice curriculum, to help student teachers build a climate of trust. We also recommend future research to measure the functional supervisory trust behaviors of novice and expert agricultural mechanics teachers and their relationship to a positive safety climate.

Preservice teachers reported issues of trust and control through the length of the study, as they sought to build capacity within their students as both teacher and supervisor. In agricultural laboratory classes, teachers build capacity by empowering students through skill development and shared decision-making (Bird, Tummons, Martin, & Henry, 2013; Watson, Mazur, & Vincent, 2015). Within the classroom, teachers enable youth-adult partnerships by fostering trust and respect, creating meaningful (not equal) roles, and building capacity for both parties to fulfill those meaningful roles (Mitra, 2009). However, we theorize teaching and supervising students in the laboratory creates unique opportunities and problems in supervision through evolving roles of instructor, safety supervisor, consultant, and contractor. We recommend future research on to what extent agricultural mechanics teachers utilize positive youth-adult partnerships to facilitate student success in project construction. We also recommend future research to examine how teachers foster trust and respect among students while fulfilling their multiple roles. Does the power differential between teachers and students necessary to maintain a safe lab environment obstruct the development of collaborative student relationships necessary for positive youth-adult partnerships? Lastly, as this study has focused on perceptions of teacher roles and responsibilities, the agricultural education profession could benefit from an in depth investigation into student roles, responsibilities, and transfer of knowledge gained by engaging in laboratory based instruction.

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