

The CROPS Curriculum Experiment: Evaluating the Farm Safety Knowledge Gained Among Secondary Appalachia Youth

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Abstract

Rural youth in poverty stricken Appalachian communities are the highest at-risk population for tractor rollover accidents (Cole, 2007). The Apprenticeship of Observation theory (Lortie, 1975) concludes that the “apprentice” learns from watching those perceived to be the teacher and their work and so mimic their actions. Thus, farm youth who often overlook safety precautions believe farm accidents are simply a way of life. This project was partially funded through the Southeast Center for Agricultural Health and Injury Prevention. The funds assisted in the development of a Cost-effective Rollover Protective Structure (CROPS) curriculum. A total of 54 (N = 54) secondary agriculture mechanics students, served as the treatment group (n = 31) and control group (n = 23). The treatment group received farm safety instruction from their secondary agriculture teacher through the use of the CROPS curriculum while the control group received their farm safety instruction from their secondary agriculture teacher who taught, only, to reach the required state standards. Results from the quasi-experimental design study revealed a statistically significant gain in farm safety practices from the treatment group as compared to the control group. Recommendations to the participants, future participants, and research are also included.

Keywords: Appalachia, tractor, rollover protective structures, farm safety, youth, curriculum

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Introduction

Tractor rollovers continue to be the leading cause of death among farm related fatalities (Hoy, 2009). According to the *National Agricultural Tractor Safety Initiative*, tractor rollovers account for 130 deaths annually (Swenson, 2004). This is more than half of all tractor fatalities, which Rollover Protective Structures (ROPS) and seatbelts could prevent (Swenson, 2004). Only 51% of tractors are fitted with ROPS (Loring & Myers, 2008).

In 2007, the National Agricultural Tractor Safety Initiative (TSI) produced maps for their annual meeting which showed limited-resource farms to be in correlation with regions of high rates of tractor rollovers. Kentucky and Tennessee were both in the top six states to have the highest amount of tractor rollover fatalities (Cole, 2007), and the Appalachian region is at an even higher risk due to the poverty in the region combined with the topography of the land.

There exists a higher concentration of low-income farm operations in the Appalachian region (Colyer, 2001). The states with the highest number of tractor overturn fatalities are also the states with the largest number of small family farms, low incomes, and low-value farm machinery (Cole, 2007). Cole explains the tractors on the limited-resource farms are most likely older, not fitted with ROPS, and poorly maintained. It is also likely that the farm operators are unwilling or indifferent about putting ROPS on their tractors due to the financial barriers it may present to the limited-resource farm (Cole, 2007).

Need for the Study

According to Hoy (2009), when a tractor is fitted with a ROPS and a seatbelt, serious injuries rarely occur. Although aware of the dangers of operating tractors without seatbelts and ROPS, many farmers feel confident against having an accident (Ambe, Bruening, & Murphy, 1995). Farm youth are exposed early to dangers of farming and tractors if they are around the adults who operate the farm (McCallum, Conaway, & Reynolds, 2009). One approach, farm safety day camps, offer programming through various non-profit organizations, hospitals, and local advocacy groups across America (McCallum et al., 2009; McCallum, Reynolds, Kelley, Conaway, & Braune, 2006). Several studies have looked at the effectiveness of such programs, as well as considering how many youth share the information they learned with parents and family members (McCallum et al., 2009; McCallum et al., 2006; Reed, Claunch, & Rayens, 2008). Many of these programs are day long, with youth gaining general farm safety awareness (McCallum et al., 2009). Studies report children return home and share lessons learned to their parents and farming mentors, as well as families of these children making changes in farm safety behavior (McCallum et al., 2009; McCallum et al., 2006). According to McCallum et al. (2006) one-fifth of parents interviewed named one or more safety practices implemented following the child's participation in the farm safety day camp. The study concluded that the effectiveness of the camp is strengthened by the child sharing the newly learned information with his or her parents and the influence it has on changing the behavior (McCallum et al., 2006).

While strengths of farm safety day camps are evident in the sense that the children will gain an understanding of farm safety and share what they learned at the camp with their parents, limitations still occur. The most prominent limitations are youth only continuing safety habits learned for up to one year and the camps only focus on short term or intermediate outcomes (McCallum et al., 2006). Although dated, Darragh, Stallones, Sample, and Sweitzer (1998) found an alarming theme with farm youth; they often overlooked safety precautions and felt that injuries from farm accidents were unavoidable. More recent, Murphy (2003) supports this phenomenon positing that since children begin working on farms at such a young age and they are exposed to so many hazards with no injuries occurring; they are led to believe that hazards and injury are part of farming. Reed et al. (2008) recognizes that learning safety rules and applying safety rules are two different things that may not develop into an action should a life or death situation present itself.

The Nova Scotia Agricultural College (NSAC) in Truro, Nova Scotia, Canada took action regarding the “culture of risk” (Sanderson, Dukeshire, Rangel, & Garbes, 2010, p. 243) by implementing a college level course for beginning farmers at the college. The purpose of the course was to not only provide safety information, but also to change and challenge safety beliefs, followed by attitudes, and then, behavior. Through the interviews, it was apparent that formal farm safety training was rarely provided to rural farm youth, but instead was learned through modeling of a family member, most often a male figure on the farm. NSAC believed what youth learn as children will likely shape how they work as adults along with the beliefs, attitudes, and values they will pass on to the next generation of farmers. It is not enough to only focus on the knowledge of health and safety on the farm, but instead, get to the root of farm safety attitudes and beliefs (Sanderson et al., 2010).

Apprenticeship of Observation Theory

Lortie (1975) coined the term “apprenticeship of observation” (p. 65), which resulted from his study with pre-service teachers. In his book, *Schoolteacher*, Lortie claimed that since pre-service teachers have received formalized education through the observation of the teachers that taught them throughout their schooling years, teacher education programs have little effect on pre-service teachers’ ideology regarding methods and practices (Mewborn & Tyminski, 2006).

Mewborn and Tyminski (2006) define a traditional apprenticeship as the master coaching the learner while the learner practices the skills of the trade. When applied in a farm safety context, the apprenticeship would look something like the following: The child observes the adult as he learns to operate the tractor. If there were direct teaching rather than mere observation, the adult would likely “teach the way they have been taught” (Heaton and Mickelson, 2002, p. 51; Mewborn & Tyminski, 2006). Oftentimes, parental or guardian figures are trusted adults in children’s lives, helping them grow and develop, while also motivating their behaviors, goals, and values (Wentzel, 2002; Zeldin, 2000). When considering how youth are learning farm safety practices from adults, the adults are often teaching the youth as either the adults were taught or they grew up experiencing (Mazur & Westneat, 2013). Many adults are aware of agricultural dangers, but due to time constraints, money, traditional views, or lack of initiative, they do not adopt safe behaviors (Lee, Jenkins, & Westaby, 1997), thus the young apprentice begins modeling the poor safety practices into their own work ethic (Baker, Esser, & Lee, 2001).

Teaching becomes imitation, which eventually becomes tradition that is passed down through generations (Lortie, 1975). Secondary agriculture teachers possess a unique role in which they can shape and reframe their students’ poorly acquired farm safety practices. When youth are interacting with their teachers, it is not a simple passive observation. Moreover, when a working relationship has been established between teacher and student, the student becomes more invested in the education (Lortie, 1975). Teacher-student relationships offer the chance to see one another as individuals, with growth in respect and trust (Frymier & Houser, 2000). Teachers have the potential to serve students in the capacity as a positive mentor (Bergin & Bergin, 2011) and students need mentors that provide emotional support and positive feedback through modeling (Grossman & Rhodes, 2002). Thus, when children become more knowledgeable about injury prevention, they are better equipped to share that knowledge with the trusted adult, namely, their parents (Reed et al., 2008).

The term “farm apprentice” (Sanderson et al., 2010) can be used to describe the role that a farm youth may have, where they feel like part of the team and are providing valuable help to the operation of the farm. Here, they help with running the farm while at the same time are learning skills to carry on to their own farming career. Children are often taught farm work by observing and mimicking the adults that takes place in dangerous settings (McCalum et al., 2006; Reed et al., 2008). When working on the farm, children are often put at risk where they operate machinery that is old and damaged (Sanderson et al., 2010). While the adults on the farm have exposed the children to perform jobs and tasks that put the youth at a high risk of injury, the emphasis is on task mastery rather than safety training. While mastering the task,

the farm youth learn skills, but are often exposed to agricultural hazards through the play, work, and passive observation of the modeling adults (McCalum et al., 2006).

Purpose and Research Objectives

As farm youth continue to be exposed to the dangers of operating a tractor without a ROPS in place, the importance of an effective educational model continues to grow. The purpose of this quasi-experimental design study was to examine the behavioral changes in secondary agricultural mechanics students regarding their attitudes towards farm safety practices. A quasi-experimental design was used due to selecting purposive, rather than random classrooms (Creswell, 2014). The research objectives and hypotheses are as follows:

1. Describe the characteristics that make up the total student population in regards to their grade, gender, number of tractors utilized with ROPS, previous farm work experience, overturn tractor experience, previous tractor operation without ROPS, knowledge and experience building ROPS, and limiting resources for safety equipment.
2. Describe the treatment and control groups' level of understanding on the pre- and post-assessment, which were administered during the course of the curriculum.

Lortie's (1975) Apprenticeship of Observation theory believed that behavior is established based upon children's surrounding and upbringing. Therefore, it would be difficult to identify change in a student's behavior toward farm safety practices based upon the entrance of classroom instruction. Thus:

H_{O1}: There is no statistical significant difference between pre- and post-assessment scores from the students receiving farm safety curriculum meeting the state's approved standard ($H_{O1}: \mu_{1Pre-assessment} = \mu_{2Post-assessment}$).

H_{O2}: There is no statistical significant difference between pre- and post-assessment scores from the students receiving the CROPS curriculum ($H_{O1}: \mu_{1Pre-assessment} = \mu_{2Post-assessment}$).

However, if a difference does exist, it does not provide an applicable scope for direct inference to classrooms that receive the CROPS curriculum. Previous studies conducted did not study the use of an experiential curriculum as a change agent for farm safety awareness (Sanderson et al., 2010). Therefore:

H_{O3}: In the population there is no significant difference in knowledge gained from pre- to post-assessments between students receiving agricultural mechanics instruction verses those engaged in the CROPS curriculum ($H_{O2}: \mu_{Control} = \mu_{Treatment}$).

Research of the past have investigated Lortie's Apprenticeship of Observation in various context, but not with the influence of a mentor providing the educational material. This study provided an outlet to further explore if the methods, in this case study, support the findings of Lortie (1975). Thus,

H_{O4}: There is a statistical difference between pre- and post- assessment scores among the students with live/work experience on a farm, following the implementation of the CROPS curriculum. ($H_{O4}: \mu_{1Do\ not\ live/work} \neq \mu_{2Do\ live/work}$).

Methods

Process-Outcome Evaluation Design

This preliminary feasibility study used a utilization-focused evaluation process. Utilization-Focused Evaluation (UFE) is an approach with a premise that an evaluation should be judged on its usefulness to its intended users (Patton, 2001). When describing UFE, Patton (2004) posited that a well-planned and efficiently conducted evaluation that enhances the likely utilization of both the findings, and of the process itself, would inform decisions and improve performance.

UFE has two essential elements. First, the primary intended users of the evaluation must be clearly identified and personally engaged at the beginning of the evaluation process to ensure that their primary intended uses can be identified. Second evaluators must ensure that these intended uses of the evaluation by the primary intended users guide all other decisions that are made about the evaluation process (Patton & Horton, 2009). Outcomes that were expected in this study were changes in attitudes, opinions, awareness, and beliefs regarding farm safety, more specifically tractor rollover.

Treatment Participants

Five sites were selected in the state of Kentucky. The schools were located in a region identified with low socio-economics and mountainous terrain, which are high risk for tractor rollovers. Selected secondary schools, in the qualified demographic areas, were identified by state agricultural education staff and teacher educators as being proficient in agricultural mechanics. Teachers received training along with an established and field tested Farm Safety curriculum (Cole et al., 2000) to assist the delivery of their lesson. The CROPS curriculum capstone project entailed the students constructing CROPS for 2-6 local farmers in their communities. Consent was received from each school's administrator and teacher. Each participating agricultural education program sought CROPS recipients within their community. An approved grant from the Southeast Center for Agricultural Safety and Injury Prevention provided the necessary funds for each secondary agricultural program to purchase all materials and equipment to construct the capstone project.

From the five selected high schools agriculture programs, students ($N = 118$) enrolled in an agricultural mechanics course served as the overall population. Following the receipt of consents and the use of random selection, the sample size was reduced to ($n = 31$). Each student in the class received either a consent form, or an assent form with a parent consent form. After learning about the project and pre- and post-test process, students had choice to continue on and fill our consent forms or not participate in the project. Each student received the examination as a pre-test prior to receiving any instruction or engagement in the capstone project. Once all CROPS were constructed and installed, the students completed the assessment again, which served as a post-assessment.

Control Participants

One high school in the same demographic area was selected to serve as the control group in this study. The students ($n = 23$) were provided instruction on farm safety from their secondary agricultural education teacher as it related to the already established state standards. Students completed the examination prior to instruction, as a form of pre-assessment, and then again following the unit, in the form of a post-assessment.

Research Design

A 33-item examination was provided to the treatment and control students before the farm safety unit began. The exam was designed to evaluate students' knowledge regarding farm safety and CROPS assembly. A panel of experts ($n = 3$) evaluated the questionnaire for face and content validity. One member of the committee has a devout career in curriculum, instruction, and assessment; another completing a PhD in curriculum and instruction; and the final member was a former secondary agriculture mechanics teacher and now post-secondary agricultural educator.

Reliability errors are concerned with determining the degree of inconsistency in scores due to random error. No classroom test is perfectly reliable because random errors operate to cause scores to vary or be inconsistent from time to time and situation to situation (Jacobs & Clinton, 1992). The goal is to try to minimize these inevitable errors of measurement and thus increase reliability. One method of improving

the reliability was to increase the number of questions from 25 to 33. Herman and Winters (1992) believed that 30 – 40 questions were appropriate in maintaining a reliable instrument yet, minimizes fatigue. In addition to improving the reliability, the academic school year prior to this study, a different secondary agriculture mechanics classroom, with similar student demographics, served as a pilot group ($n = 16$) for the assessment. A Kuder-Richardson (K-R 20) test was utilized to determine the consistency of the participants' responses. The K-R 20 measures consistency of responses to all the items within the test and reflects two error sources: item sampling and heterogeneity of the content domain sampled (Kuder & Richardson, 1937). The results from the pilot study (K-R 20 = 0.73) were considered highly reliable (Jacobs & Clinton, 1992).

Procedures

Pre-test. After obtaining approval from the University of Kentucky IRB board, the pre-test process could begin. Before research data could be collected and construction of the CROPS could take place, a research team visited each school and explained the program to the students. At this time consent and assent forms were distributed, as well as parental consent forms. A demographic assessment was completed, and then the pre-assessment was administered prior to the beginning of the farm safety unit of instruction. At each school site, the research team read an instructional guide verbatim, prior to the taking of the exam. This assisted in inter- and intra- delivery reliability.

Curriculum. Following the pre-assessment, teachers began teaching the CROPS curriculum with the capstone CROPS project. Curriculum was designed and distributed to teachers so quality, consistent instruction was delivered to all of the students. The curriculum included lessons regarding tractor safety, welding, and a blueprint type guide for the actual construction of the CROPS. The curriculum is also to assist in student ownership and understanding so they are aware of the “why” behind the reason of CROPS. This provides students with a sound awareness of the impact and importance that they will leave on their community by taking action now to prevent potentially fatal accidents from happening to classmates, family, friends or members of their community. Plans for the tractors that were used were accessed from the National Institute for Occupational Safety and Health (NIOSH) website (Centers for Disease Control, 2014). Teachers and students had access to this website before and during construction to use as a reference. An on call member of the research team was available to answer any questions that a teacher may have during the lesson delivery.

Post-test. The timeframe for the project is one academic school year. The teachers were free to begin the unit delivery after the pre-assessments were administered as their schedule allowed. The post-assessment data collection was completed near the end of the school year. Similar to the pre-assessment, the research team visited each classroom, read an instructional guide verbatim, distributed the assessment, and collected responses for analysis.

Limitations. Limitations occurred as a result of this study. Due to inclement weather out of the researcher's and research site's control, delays occurred during the research time-frame resulting in school cancellations. The many weeks (in some cases) of school cancellations delayed the rate at which some of the schools were able to complete the project. Some post-assessments were not received until after the school year so incomplete data sets existed. Thus, the sample size was drastically decreased. In addition, timely, sequential delivery of curriculum was sometimes compromised due to the school cancellations.

Data Analysis

Frequency counts and percentages were used to describe the characteristics of the treatment and control groups. In order to describe the level of understandings, measures of central tendency was utilized.

In order to test H_{01} and H_{02} , a paired, 2-tailed t -test was calculated to compare the pre- and post-assessment scores of the control and treatment groups. Calculations of effect size were conducted with Cohen's d utilized from the t -tests results (Thalheimer & Cook, 2002). When solving for H_{03} , a repeated measures ANOVA was utilized due to the two time points of pre- and post-assessment. An *a-priori* of .05 was set to determine significance for all hypotheses.

Results

To determine homogeneity, student demographic information was compared. Research question one was to determine the student characteristics that make up the population of the group in regards to their demographics such as their grade, gender, number of tractors utilized with ROPS, previous farm work experience, tractor overturn experience, operation of ROPS tractors, knowledge and experience building ROPS, and limiting resources for safety equipment.

The treatment group reported there were 28 (90.32%) males and three (9.68%) females. Six (19.35%) students reported being freshmen, 14 (45.16%) were sophomores, eight (25.81%) were juniors and there were three (9.68%) seniors. The group reported that 22 (70.97%) students had experience working on a farm and nine (29.03%) students did not. Seventeen (70.38%) students reported that they have operated a tractor without ROPS while seven (29.17%) have operated a ROPS equipped tractor. Most had experience with tractors, with only seven (29.71%) students reporting they had not operated a tractor before. Twelve (38.71%) students reported themselves, a family member, or friend having experience with overturning tractors while 19 (61.29%) have not. Only one (3.23%) has experience building a ROPS, while 29 (93.55%) have no experience.

The control group reported having no freshmen ($f = 0$; 0.00%), two (9.52%) sophomores, 10 (47.62%) juniors, and nine (42.86%) seniors. There were 16 (69.57%) males and seven (30.43%) females in the control group. Eleven (52.38%) students reported having work experience on farms, while 12 (52.17%) reported no previous farm related work experiences. There were six (26.09%) students in the control group who have operated a tractor without ROPS before, while eight (57.14%) have operated a ROPS equipped tractor, and nine (39.13%) have not operated a tractor before. Seven (30.43%) students reported themselves, a family member, or friend having experience with overturning a tractor before, while 16 (69.57%) students have no experience. There were no students who reported having previous knowledge and experience in regards to ROPS construction.

Table 1 assists in interpreting the results for research objective 2 as well as hypotheses 01 and 02. Measures of central tendencies were used to describe the pre- and post-assessment scores for the control and treatment groups. Two-tailed, paired, t -tests were calculated to test hypotheses 01 and 02. Each hypothesis sought to determine if significant differences existed over the time span of the farm safety curriculum being taught. As noted in the control group, the post assessment scores received a mean score of 51.91 ($SD = 8.63$), which is not significantly ($p > .05$) higher than pre-assessment scores ($M = 48.75$; $SD = 11.45$). Therefore, equal variance was assumed with a t -value of 0.78 resulting in a fail to reject null hypothesis 01.

Significant difference was found in the paired t -test results from the treatment group. In the treatment group, the post assessment scores received a mean score of 63.64 ($SD = 13.62$) while the pre-assessment received a mean score of 54.84 ($SD = 11.85$) with a large effect size ($d = 0.83$). Null hypotheses two was rejected in favor of the alternative hypotheses, which states a difference does exist over the time of the CROPS curriculum being taught. Equal variance was not assumed with a significant t -value of 4.93.

Table 1

Two-Tailed Independent Sample t-test on Assessment Scores Gained by Each Group (N = 54)

Characteristic	<i>n</i>	<i>M</i>	<i>SD</i>	Range	<i>t</i>	<i>p</i>	Cohen's <i>d</i>
Control Group – Curriculum Meeting State Standards							
Pre-Assessment Percent Correct	23	48.75	11.45	30.30-69.70	0.78	.43	
Post-Assessment Percent Correct	23	51.91	8.63	33.33-66.67			
Treatment Group – CROPS Curriculum							
Pre-Assessment Percent Correct	31	54.84	11.85	27.24-72.73	4.93	.01*	0.83 Large
Post-Assessment Percent Correct	31	63.64	13.62	33.33-93.94			

p ≤ .05

Hypothesis 03 is best described in Table 2, which includes the repeated measure ANOVA findings between the treatment group and the control group over the time span of the farm safety curriculum being taught. The overall model was found to be significant ($p < .05$). The test of significance lead to rejecting null hypothesis 02 in favor of the alternative hypothesis suggesting there is a difference in the knowledge gained from pre- to post-assessments between students receiving farm safety instruction, which meets the state approved standards, verses those engaged in the CROPS curriculum ($H_{O2}: \mu_{Control} \neq \mu_{Treatment}$).

Table 2

Repeated Measure ANOVA Between Treatment and Control Groups Over Time

Effect	<i>F</i>	<i>df</i>	<i>p</i> -value
Between-Groups	5.64	52	.02*

* *p* ≤ .05

Table 3 illustrates the results of Hypothesis 04. A significant difference was not discovered in the in the paired *t*-test results between the students who live/work on a farm and the students who do not live/work on a farm. We failed to reject Null hypotheses four, which states a difference exists between pre- and post- assessment scores among the students with live/work experience on a farm, following the implementation of the CROPS curriculum.

Table 3

Two-Tailed t-test Results on Live/Work Farm Experience with CROPS Curriculum Implementation (n = 31)

Characteristic	<i>n</i>	<i>M diff</i>	<i>SD</i>	Range	<i>t</i>	<i>p</i>	Cohen's <i>d</i>
Do not Live/Work on Farm	6	0.33	5.85	-8.00 - 8.00	1.35	.19	
Live/Work on Farm	25	3.52	5.03	-4.00 – 18.00			

Conclusions, Implications, and Recommendations

The overall purpose of this study was to seek a method for decreasing youth farm injury and fatalities due to tractor rollovers, especially in resource depleted communities. From the demographic information gleaned from the control and treatment groups, it was evident the research team worked with similar groups in both cases. Nearly half of the students in both groups have experiences working on farms and operating tractors not equipped with ROPS. Nearly one third of the agriculture students from both groups had experiences with tractor overturn incidents.

Even with the serious implementation issues consequent to severe weather and numerous school closings, the CROPS curriculum was effective. The students from the treatment group scored higher on the post-assessment than the control group. In fact, a large effect size was determined and significance was revealed. From the findings, it implies that students' belief of 'apprenticeship' toward farm safety practices were removed in order to gain a new perspective. Although the experiment revealed short-term reverses on the Apprenticeship of Observation theory (Lortie, 1975), the philosophies could return to poor practices. Baker et al. (2001) believe that continued acknowledgement regarding a better practice was the only way to overcome Apprenticeship of Observation. Therefore, it is recommended that the teachers that represented the treatment group continue to instruct, acknowledge, and implement farm safety practices and awareness throughout a student's entire secondary agricultural education curriculum.

The data reveals the impact the agricultural mechanics teachers, with the support and training of the research team, can have on the students' knowledge of safety practices framed in the CROPS curriculum and CROPS capstone project – that explicitly demonstrates through a collaborative work experience – how important it is to equip and use a CROPS on an unprotected, dangerous tractor. Thus implying that working with agricultural mechanics teachers to explicitly train them on the effects of observational apprenticeships and the strategic opportunity the teachers have to not only counter students' previous experiential apprenticeship cycle with their students through a real-world safety project. Creating such experiences needs to be part of the pedagogy of agricultural mechanics instruction. Therefore, it is recommended that secondary teacher educators seek methods in their teacher preparation curriculum in aiding pre-service teachers in addressing observational apprenticeships. In addition, the research team in this study is working to design a summer clinic to work with practicing teachers in targeted regions on utilizing the CROPS curriculum to reverse the apprenticeship mindset.

Limitations do exist in this exploratory study, but the findings suggest that further investigation is necessary on a larger scale. A study that encompasses a larger volume of participants involved in the CROPS curriculum and experiential experience activity in order to determine if a change in Apprenticeship of Observation mindsets are occurring. In addition, a variable should be explored regarding the effects the teacher/student relationship has on the Apprenticeship of Observation. In a qualitative study conducted by Watson, Mazur, and Vincent (2015) it was concluded that a Youth and Adult Partnership exist among the student and teacher participants in a pilot study of the CROPS curriculum. A follow-up of this existing study is recommended to further assist in the occurring phenomena.

When implementing the CROPS curriculum in its entirety, the cost can be challenging, which in turn could result in the instruction diminishing. In order to maintain sustainability for the CROPS program and to continue the growth and spread of the program, it is recommended for secondary agricultural education teachers apply for grants and encourage community support in order to fund the supplies and materials necessary for building CROPS each year. Other methods of maintaining sustainability for the curriculum implementation is to design a crowdfunding website through a variety of social media sources. To assist the participating teachers in this study, a crowdfunding portfolio was created to encourage the funding for the construction of two CROPS capstone projects per year.

Teachers who have participated in CROPS previously could provide workshops at their respective state agricultural education teacher's conference or National Association for Agricultural Educators (NAAE) convention. These opportunities serve as a platform to showcase the curriculum, discuss the gained experiences, and explain best practices for overcoming the Apprenticeship of Observation (Lortie, 1975). In addition, the research team should conduct a clinic for the teachers to reflect on the areas that work and the barriers while teaching the CROPS curriculum.

Lortie (1975) believed that changing the Apprenticeship of Observation mindset was a difficult challenge. Although the results are limited to the 31 participants in this study, preliminary results conclude that a mindset shift occurred. A difference, and improvement, in the score occurred among the students who live/work on a farm; however the findings were limited due to the number of participants who do not live/work on a farm. The improved difference in mean scores among the live/work on farm students could be the result of a Youth Adult Partnership (Mitra, 2008) between the student and the teacher implementing the CROPS curriculum. Mitra (2008) described Youth Adult Partnership as "collaborative learning environments where [young people and adults] come together in groups, with the willingness to share authority, accept responsibility, and highlight individual members' abilities and contributions" (p. 8).

Recommendations for Future Research

The need for replication of the CROPS study should expand throughout Appalachia. Appalachia continues to remain a dangerous area for farmers and the rates of tractor rollovers are high (Cole, 2007). This study provides a glimpse of evidence that the curriculum, in the beginning, plays a role in youth mindsets. To expand this in other high-risk areas would allow research to see if the study works in other areas of the region.

The pre- and post-assessment instrument was determined to be a reliable measure. In the future, demographic items need to be crafted to explicitly ask about how participants 'learned' tractor operations on their own farms and/or tractor-use experiences.

A larger population of participants would allow researchers to determine additional characteristics that play a role in the knowledge gained or not gained. This study did not expand on the students who have experienced a tractor rollover, but a focus group that explores this dimension could work. Additional characteristics to explore are with students who have previous exposure to tractors versus students who have not. This causal-comparative study would highlight a deeper understanding in the theory of Apprenticeship of Observation.

A longitudinal study should be conducted with the participants on their continued farm safety awareness and use after participating in the CROPS curriculum. The opportunity to capture the impact of the curriculum played in limiting, stopping, or reversing the apprenticeship of observation theory. Research should also be conducted on the recipients of CROPS capstone project. Follow-up interviews would assist in understanding a different viewpoint and attitude towards farm safety and youth involvement.

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