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Assessing Youth Safety Knowledge through the Agriculture Experience Tracker (AET)

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Abstract

The purpose of this study was to assess high school agricultural education youth safety knowledge. The target population consisted of high school agricultural education youth, ages 14–19 years, who were enrolled in School Based Agricultural Education programs that utilized the AET agricultural safety exam feature between the dates of May 2019 and June 2020 (N=1478). The safety knowledge questions were randomly generated from the National Safe Tractor and Machinery Operation Program instructor curriculum resources. The exam consisted of 50 multiple-choice and true/false questions with one point being awarded for each correct answer and covered topics such as safety basics, agricultural hazards, tractors, connecting and using implements with tractors and materials handling. The majority of respondents were male (n = 865, 58.5%); and in eleventh grade, twelve grade, or beyond high school (33.8%, 34.3%, and 22.9% respectively). Most respondents indicated they were from a rural area (52.5%), and most had not received formal safety training (74.4%). Test scores for the 1478 respondents ranged from a minimum of 4 to a maximum of 98. Within each independent variable, test scores averaged in the low 60's with the exception of test scores from students in 8th, 9th, and 10th grade which averaged 78, 46, and 56 respectively. Research and continuous education are needed to influence the behaviors of young workers in agricultural settings.

Keywords

Assessment; Education; Safety; School-based Agriculture Education; Supervised Agricultural Experience; Youth

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Introduction/Background

According to the U.S. Bureau of Labor Statistics ([BLS], 2018), agriculture is one of the most dangerous industries within the U.S. and experiences a rate for fatal injuries at seven times greater magnitude. Fatalities of youth workers have exceeded all other industries combined (NIOSH, 2014). With more than 27 million youth living, working on or visiting farms (Hendricks, et al., 2012), this special population is certainly susceptible to agricultural machinery dangers (Hard and Myers, 2006). The high susceptibility of youth injuries has been attributed to agricultural labor regulation exemptions and provisions applying to youth. Even more concerning data are noted in the National Children's Center (2020) fact sheet, which reported 60% of household youth who were injured in agriculture were not actively engaged in work related tasks, thus reiterating the susceptibility to injury from exposure to a production agriculture environment.

With the proximity to safety hazards, agricultural youth need environment specific training. Students within school based agricultural education (SBAE) programs have the opportunity to participate in supervised agricultural experiences (SAE) (NCAE, 2015) where they are provided opportunities to develop their agricultural safety knowledge and awareness. Ultimately, SBAE allows students to apply classroom and laboratory concepts, such as agricultural safety, as they prepare for future career opportunities (FFA, 2020). Numerous studies have documented SAE benefits (Camp et al., 2000; Lewis et al. 2012; Moules 2013; Rubenstein and Thoron, 2014), and specifically applicable to safety, an SAE has been shown to provide a student the opportunity to explore multiple careers, develop skills, learn workplace behaviors, and apply occupational skills.

Due to their influential roles in SAEs, SBAE teachers are uniquely poised to help reduce agricultural related youth injuries by disseminating effective safety education curriculum. Yet, they continually express professional development needs in the area of safety education (McKim & Saucier, 2011; Lawver et al., 2016; Saucier et al., 2014; Shultz et al., 2014). Recent efforts to address these needs have been conducted via teacher trainings that focus on integrating hands-on activities into machinery safety curriculum (Pate et al., 2019). Additional research has focused on "train the trainer" approaches to increase safety knowledge and awareness of secondary teachers and subsequent students (Perry et al., 2020). Resulting efforts of this research culminated in recommendations that additional research should focus on the effects of youth background and safety measures within SAEs (Pate et al., 2019; Perry et al., 2020).

There is a significant need for research examining safety knowledge among agricultural youth, as the availability of data directly from this group is limited. In its Report, NIOSH (2002) notes that "[t]he effectiveness of tractor safety training programs has not been adequately evaluated nationwide" (p. 70). The few studies that have been completed continually demonstrate the need for a much closer and more thorough examination of the effectiveness of tractor safety training for children (Carraba et al., 2000; Jepsen, 2012; Wilkinson et al., 1993). One such study conducted in Indiana (Carraba et al., 2000) found that participants who engaged in a 4-H tractor safety program demonstrated a greater level of confidence in operating tractors, and that the program appeared to have a positive

influence on the safe operating procedures of participants. However, Carrabba et al. (2000) also found that despite the youths' feelings of confidence, they continued to engage in risky behaviors such as allowing extra riders. Even with the demonstrated challenges of improving youth safety behavior, NIOSH (2002) recognized a Wisconsin study (Wilkinson et al., 1993) that found youth who had completed a training program reported an increase in usage of tractors equipped with roll-over protection structures (p. 71).

These few studies demonstrate the need for a much closer and more thorough examination of the effectiveness of tractor safety training for children. However, a common challenge in evaluating the effectiveness of these safety trainings is access to a national agricultural youth population. Although admittedly not all encompassing, one such data source that targets this population and capitalizes on the learning potential of SAEs can be found in the Agricultural Experience Tracker (AET), an integrated online data management/record-keeping platform that allows educators and students to keep track of their SAEs (AET, 2020). Data about youth safety knowledge was collected and assessed for this project directly from high school agricultural education students who participated in a safety exam housed within the AET.

Purpose and Objectives

Recognizing the lack of adequate agricultural youth research, the purpose of this project was to assess high school agricultural education youth safety knowledge. Specific objectives included:

1. Describe selected demographics of high school agricultural education youth who completed the AET safety knowledge assessment.
2. Determine significant predictors of youth performance on the AET safety knowledge assessment, focusing on participant grade level, gender, race and residence.

Materials and Methods

The target population consisted of high school agricultural education youth, ages 14–19 years, who were enrolled in SBAE programs that utilized the AET agricultural safety exam feature between the dates of May 2019 and June 2020 (N=1478). The AET is an online data management system designed for agricultural education students and teachers to assist in managing time and financial resources associated with SAEs. The AET has assisted more than 2 million students and teachers nationwide in managing resources inside and outside of the classroom (AET, 2020). Within the AET, participants had the opportunity to complete an agricultural safety knowledge exam. To address objectives one and two, select demographic information was collected through self-reported data. Participants identified their age, grade level, gender, state of residence, race, and residence size. Residence size options were based off National Center for Education Statistics classifications for city (greater than 100,000 population and an urban setting), suburb (up to 100,000 population, but outside the city), town (10 to 35 miles from urban area), and rural (outside urban area and less than 5,000 population). Participants from 39 states completed the exam.

To address objective two, safety knowledge questions were randomly generated from the National Safe Tractor and Machinery Operation Program (NSTMOP) instructor curriculum resources. NSTMOP is a project of the United State Department of Agriculture Cooperative States Research, Education and Extension Service's Hazardous Occupations Safety Training for Agriculture (HOSTA) Program and was developed to respond to the need for resources to inform and support the USDA NIFA Youth Farm Safety Education and Certification Regulation. The agricultural safety exam consisted of 50 multiple-choice and true/false questions with one point being awarded for each correct answer and covered topics such as safety basics, agricultural hazards, tractors, connecting and using implements with tractors and materials handling. The instructional curriculum and exam items were evaluated by agricultural safety educators and determined to meet content validity standards (Garvey et al., 2008).

Results and Discussion

Researchers collected basic demographic data from all respondents. The majority of respondents were male (n = 865, 58.5%); and in eleventh grade, twelve grade, or beyond high school (33.8%, 34.3%, and 22.9% respectively). Most respondents indicated they were from a rural area (52.5%) and most had not received formal safety training (74.4%). Full demographic data is displayed in Table 1.

As shown in Table 2, the majority of respondents were White, Non-Hispanic (n = 1145, 77.5%). Therefore, researchers collapsed race data into two categories, White, Non-Hispanic and All Other Responses, for the remainder of the analysis.

Test scores for the 1478 respondents ranged from a minimum of 4 to a maximum of 98. The mean and the median scores were very close (63.32 and 64.00 respectively) and implied a roughly normal distribution. However, when graphed, as shown in Figure 1, the test scores showed a roughly bimodal distribution peaking at 62 and 80.

Within each independent variable, test scores averaged in the low 60's with the exception of test scores from students in 8^{th}, 9^{th}, and 10^{th} grade which averaged 78, 46, and 56 respectively. See Table 3 for full details.

Within each independent variable, mean test scores remained consistent as shown in Table 4. The largest variance was within the *Grade* variable, with 8^{th} graders (n = 2 scoring) the highest (78%), and 10^{th} graders (n = 109) scoring the lowest (55.63%).

Linear Regression Model

In order to determine significant predictors of youth performance on the AET safety knowledge assessment, researchers completed a linear regression model. Using grade level, race, residence, and gender as independent variables, the regression model predicted 2.6% of the variance in test scores (R^2 = .026). Within the model, *Grade Level* was a statically significant predictor of test scores. *Race, Gender*, and *Residence* were not statistically significant predictors of test scores. See Tables 5 and 6 for a complete summary of the regression model and associated coefficients.

Conclusions

The purpose of this project was to assess high school agricultural education youth safety knowledge by identifying selected demographics and determining significant predictors of youth performance, focusing on participant grade level, gender, race and residence. A limitation was the use of convenience sampling of participants who responded on AET. Generalizations based on study conclusions should be made with caution. Agricultural youth safety training is a continuous effort to ensure students have the basic understanding and knowledge to be safe in an agriculture setting. SBAE is a way to make contact with a variety of youth who are involved in agriculture. Specifically, students involved in SBAE come in contact with agriculture through their involvement in SAEs, which serves as an opportunity to apply learning occurred in the agricultural classroom.

Participant test scores ranged from 4 to 98, with the mean and median scores very close, implying a normal distribution. Test scores showed a bimodal distribution at two different points (62 and 80). Respondents had an overall mean of 63.32%, suggesting additional safety training needs to occur. However, the mode for respondents was 80% (SD – 17.87%), indicating a large swing in scores and the need for continued exploration. Within each independent variable, test scores averaged in the low 60's with the exception of test scores from students in 8^{th}, 9^{th}, and 10^{th} grade. Within each variable, mean test scores remained consistent with the largest variance in the *Grade* variable, which could indicate the time at which safety curriculum might be being taught to students in SBAE classrooms.

In order to determine significant predictors of youth performance on the AET safety knowledge assessment, researchers completed a linear regression model. Using grade level, race, residence, and gender as independent variables, the regression model predicted 2.6% of the variance in test scores (R^2 = .026). Within the model, *Grade Level* was the only statically significant predictor of test scores. It is important to note only 25.6% of respondents indicated having received formal training, indicating the impact of professional focal points. The residence (rural, town, suburb and city) classification did not see a difference in participant performance. The changing demographic might be a focus to consider with students regarding the experiences and training they have with agricultural equipment and practices.

Future research is needed to determine the impact of safety training and at what point students are receiving this instruction in agricultural education programs. This will be important to understand the youth safety knowledge and why the results fluctuate. This understanding will help identify specific areas of professional development for agricultural educators to reduce the work-related injuries of youth involved in SAEs. One such provision for teachers to consider integrating within their SAE programming is the National Children's Center Model Policy for youth in agriculture, which outlines guidelines for hired labor focusing on the youth employment, development, and the work environment (2020).

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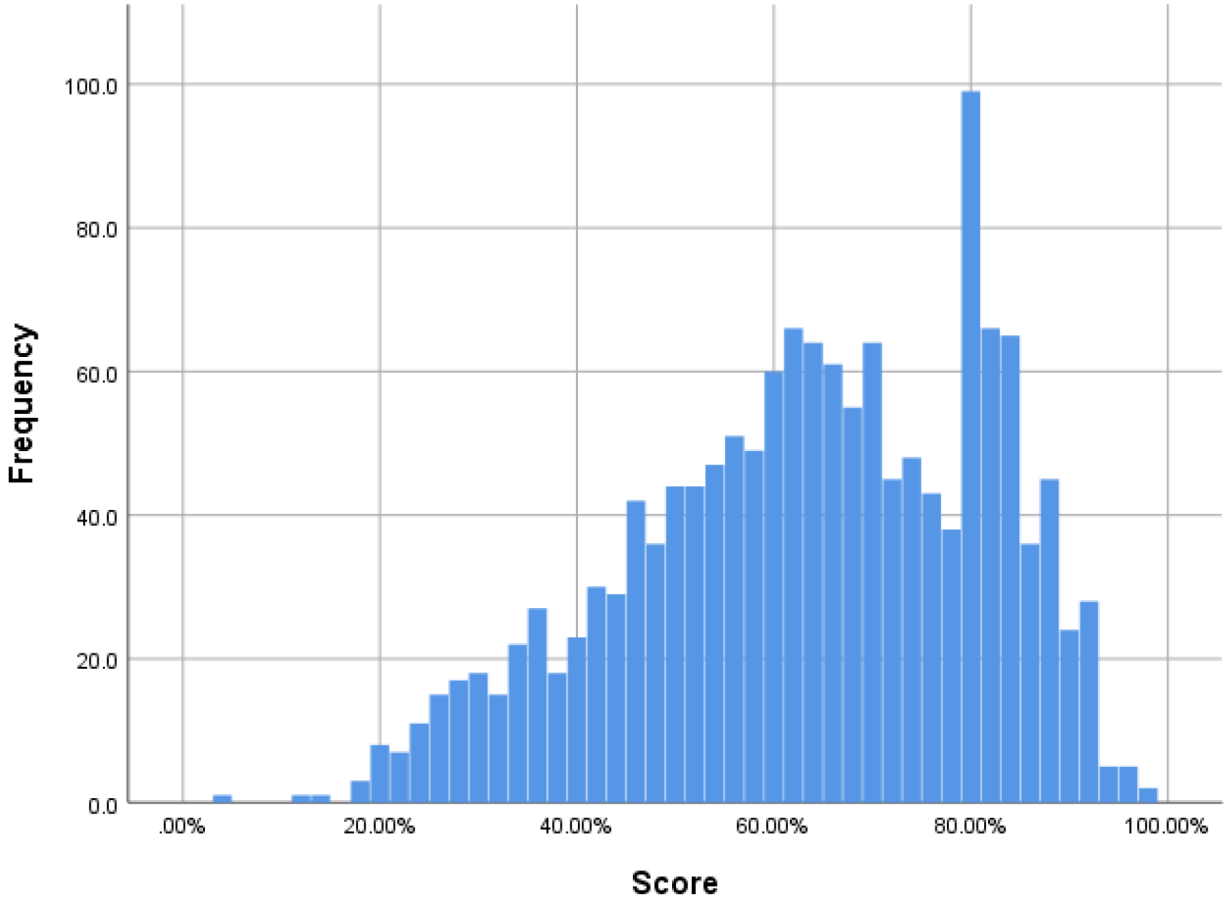

Figure 1.
Distribution of Student Test Scores

Table 1

Demographic Data for Survey Respondents

	Frequency	%	N
Gender			1478
Male	865	58.5	
Female	613	41.5	
Grade			
8	2	.1	1478
9	22	1.5	
10	109	7.4	
11	499	33.8	
12	507	34.3	
Beyond HS	339	22.9	
Residence			1478
Rural	776	52.5	
Town	434	29.4	
Suburb	169	11.4	
City	99	6.7	
Formal Safety Training			459*
Yes	122	26.6	
No	337	73.4	

Note:

*Formal training data not collected on all state instruments

Table 2

Race Data for Survey Respondents (N= 1476)

Race	Frequency	%
White, Non-Hispanic	1145	77.5
Asian	11	.7
Hispanic	180	12.2
American Indian	18	1.2
Two or more	58	3.9
Black, Non-Hispanic	37	2.5
No Answer/Non-disclosed	24	1.6
Pacific Islander	2	.1
Native Hawaiian	1	.1

Table 3

Descriptive Statistics for Dependent Variable, Test Score (N = 1478)

	Mean	Median	Mode	SD	Minimum	Maximum
Score	63.32%	64.00%	80.00%	17.87%	4.00%	98.00%

Table 4

Test Scores of Students within Each Independent Variable

	Mean	SD	Median
Grade			
8 (n = 2)	78.00	14.14	78.00
9 (n = 22)	46.18	17.17	45.00
10 (n = 109)	55.63	18.86	56.00
11 (n = 499)	61.84	18.37	62.00
12 (n = 507)	66.32	17.09	68.00
Beyond HS (n = 339)	64.49	16.49	66.00
Race			
White	63.60	16.91	66.00
All Other Responses	62.44	20.88	62.00
Gender			
Female (n = 613)	63.33	18.49	64.00
Male (n = 865)	63.30	17.44	66.00
Residence			
Rural (n = 776)	62.85	17.48	64.00
Town (n = 434)	64.10	18.09	65.00
Suburb (n = 169	64.21	18.41	64.00
City (n = 99)	61.96	19.09	62.00

Table 5

Summary of the Regression Model to Predict Test Scores (N = 1476)

R	R^2	Adjusted R^2	F	p
.162	.026	.022	6.589	.000

Note: Predictors: (Constant), Residence, Gender, Grade, Race (White, All Other)

Table 6

Regression Coefficients within the Model

						95% CI	
	B	**SE**	**Beta**	**t**	**Sig.**	**LL**	**UP**
(Constant)	29.221	5.925		3. 4.931	.000	17.598	40.844
Grade	2.848	.480	.153	3.245	.000	1.907	3.789
Race *	−1.660	1.149	−.039	−1.445	.149	−3.913	.593
Gender	−.285	.944	−.008	−.302	.762	−2.136	1.566
Residence							
Rural	.657	1.920	.018	.342	.732	−3.110	4.424
Town	2.288	1.972	.058	1.160	.246	−1.580	6.157
Suburb	2.519	2.241	.045	1.124	.261	−1.877	6.915

Note.

* Race coded as White or Non-White.