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Educator Feedback on a Farm Tractor and Machinery Safety Training Program: Implications for Program Content and Success

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Abstract. This article provides results from a survey of instructors who have offered the National Safe Tractor and Machinery Operation Program (NSTMOP) to youth planning to work in agriculture. Youth younger than age 16 who wish to be employed on non-family farms are required to complete an approved safety training program to operate tractors and other powered machinery. A survey of educators who offered the NSTMOP program was conducted to learn more about their successes, challenges, and feedback related to the instructor training course and program materials. Results provide direction to the instructors' programmatic needs with respect to teaching safety-related topics.

INTRODUCTION

Youth of varying ages work in production agriculture across the country. From 2001 to 2015, 48% of all fatal injuries to young workers occurred in agricultural environments (National Children's Center for Rural and Agricultural Health and Safety [NCCRAHS], 2022). Farms, ranches, and agricultural worksites continue to pose dangers for young workers, with the leading cause of fatalities being tractors and other motorized farm equipment (NCCRAHS, 2022). The economic costs of injuries to youth are significant, with the total annual cost of childhood agricultural-related deaths estimated at $605 million (NCCRAHS, 2022).

Young workers in the 14–16 age bracket are often undergoing developmental changes (e.g., cognitively, physically) that can influence their understanding of hazards associated with agricultural work. These factors and others, such as physical immaturity, suggest a need to provide training to help youth identify, understand, and avoid hazards related to farm machinery. Hazard identification is commonly seen as the first step in risk reduction for employees (Brauer, 2016) and, therefore, should be a key component of programs to help youth work safely, with lowered risk for injury or fatality.

The U.S. Department of Labor (USDOL) attempts to reduce the risks to young workers by requiring anyone under age 16 who wants to be employed on nonfamily farms to complete an approved safety training program to operate tractors over 20 HP or other powered machinery (USDOL, 2016). Penn State Extension offers the National Safe Tractor Machinery Operators Program (NSTMOP) student manual to students nationwide. NSTMOP also provides materials for instructors to use when teaching students, and the instructor course provides instructors with information regarding certification and requirements. After the instructor successfully completes the online course, they receive access to materials to teach students the necessary content to receive a USDOL certificate under the Hazardous Occupations Order for Agriculture (HOOA) guidelines.

The purpose of this paper is to provide the results of a survey conducted with NSTMOP instructors that gathered information on the audiences reached with the NSTMOP materials, instructors' perceptions of additional information or resources needed to successfully teach the course, and the impacts the NSTMOP course has had on their students. Survey results will be used to make improvements to the online instructor course and to better equip instructors through additional resources and educational materials. Results can also help further explain how extension educators can provide safety-related training to youth and other audiences.

METHODS

A confidential online survey was developed to collect evaluation data on the NSTMOP instructor course. Qualtrics, an online survey software, was used for the survey design, survey distribution, and quantitative data analyses. The research

team used Qualtrics for data collection because it could accommodate all steps of the collection process, eliminating the need to use other data management tools (i.e., Excel). A mix of process and outcome evaluation questions was developed to measure the extent to which the NSTMOP instructor course was implemented as intended (i.e., percentage of instructors using various educational materials) and how effective the course was at meeting intended learning objectives (Centers for Disease Control and Prevention, n.d.).

The survey questions were developed by the research team, which consisted of content experts and an expert in survey research design. An additional content expert reviewed the survey draft to ensure that the questions had high face validity (Fitzner, 2007). The finalized survey consisted of 12 closed-ended (e.g., multiple-choice) questions and five open-ended (e.g., free-response) questions. To be eligible to participate in the survey, respondents had to report at the beginning that they were currently or previously an NSTMOP instructor. The Penn State institutional review board (IRB) deemed that the study did not meet the definition of human subjects research, and thus IRB review and approval were not required.

All current or past NSTMOP instructors who were trained by Penn State Extension, either online or in person (N = 1,072), were sent an email inviting them to participate in the online survey in November 2021. Two reminder emails to complete the survey were sent approximately 1 week and 2 weeks after the initial email invitation. As an incentive to complete the survey, respondents could opt into a random drawing to receive one of 20 $75 Visa gift cards. In total, 178 instructors (17%) responded to the survey, which is slightly higher than the average response rate for online surveys (~11%; Manfreda et al., 2008). Eighteen respondents reported on the survey that they were neither currently an NSTMOP instructor nor had been an instructor in the past and thus were ineligible to participate in the survey. Therefore, the final sample size consisted of 160 respondents, 145 of whom completed the survey in its entirety. The data collected for each quantitative survey question were analyzed by using descriptive statistics (e.g., mean, percentage). The qualitative survey question data were analyzed by using thematic analysis (Braun & Clarke, 2012).

RESULTS AND DISCUSSION

RESPONDENT PROFILE

The data collected for this study came from a nationwide sample of NSTMOP instructors. Approximately 70% of respondents were either Extension educators or agricultural education teachers. At the time of survey completion, 59% of respondents were actively offering the NSTMOP program. On average, respondents had been teaching the NSTMOP course for 5 years and trained 17 students per year. Respondents most commonly reported using the NSTMOP materials to train 14- and 15-year-olds for completion of the USDOL certifications (68%), but many also used it for training high school students 16 years old and older (58%). See Table 1 for the full list of results.

INSTRUCTOR NEEDS

The survey asked respondents what resources or teaching tools would better assist them in overcoming potential challenges when teaching the NSTMOP curriculum. More than 85% of respondents stated that they wanted access to short videos to show their students when teaching the NSTMOP curriculum. Updated PowerPoint slides (66%) and an online course (58%) were additional resources that instructors stated would be helpful for program delivery. Table 2 indicates the need for additional resources reported on the survey. Understandably, videos would be a preferred tool because discussing the material in class and having a visual of the same concept would aid in the retention of the material. Instructors could use updated PowerPoint presentations to guide their training schedule to address the core topic areas. An online course could assist instructors of students who have limited ability to travel, live in remote areas, or need an independent study option for various reasons.

One key fact that becomes clear from the results is that some Extension educators do not have experience with farm equipment and/or teaching safety material. As one participant stated in an open-ended question on the survey, "It seemed like the [NSTMOP] instructor course assumed that participants already had a lot of experience with equipment and teaching a safety class. I would like the class to provide information about farm equipment safety." This response indicates that basic introductory information added to the

Table 1. Main Target Audiences Respondents Trained by Using the NSTMOP Materials

Audience category	Percentage
14- and 15-year-olds for completion of the USDOL certifications	68%
High school students 16 years old and older	58%
13-year-olds	16%
New and beginning farmers	16%
College students	12%
Nonprofits	4%
Businesses	4%
Government agencies	1%

Note. Percentages do not add up to 100%, as respondents could select multiple audience categories on the survey.

Table 2. Additional Resources or Teaching Tools Respondents Desire to Have Available When Teaching the NSTMOP Curriculum

Resources/Teaching tools	Percentage
Short videos	85%
Updated PowerPoint decks	66%
Online course	58%
Pocket manuals	45%
Virtual reality	27%
Other resource/teaching tool	6%

Note. Percentages do not add up to 100%, as respondents could select multiple resources and teaching tools on the survey.

NSTMOP instructor course may assist in providing key background information to instructors who have limited experience with farm equipment. For this audience, providing this information may be crucial for instructors to fully understand more complex information covered in the course.

AUDIENCES IMPACTED

A surprising result from the survey was that 16% of the instructors use NSTMOP course materials for teaching new and beginning farmers. Newcomers to the agricultural industry may not be familiar with the basic operations of complex tractors or farm machinery, not to mention best practices for operating the equipment safely. Providing programming on agricultural safety and health issues for new farmers could be an important area for Extension educators to consider. By introducing safety and health concepts to producers at the beginning of their agricultural career, Extension professionals may help new farmers mitigate safety hazards and minimize their injury risk.

When asked about the impacts the NSTMOP course has had on their students, instructors most commonly reported that their students were able to successfully obtain employment as a result of completing the course (27% of responses). One participant explained how a student who obtained the NSTMOP certificate provided a "significant help to the farm who would have been short staffed and not able to get the crop in a timely manner." Students also benefited from employment obtained through the certificate, as "many students go on to career paths operating tractors and other equipment in farming, logging, and as heavy equipment mechanics and operators." Thus, the NSTMOP certificate provided students opportunities to gain experience with operating machinery to prepare them for future careers.

Two additional themes that were commonly reported by NSTMOP instructors as an impact occurring with youth included an increase in confidence (10% of responses) and knowledge (10%) after obtaining their certificate. As one instructor stated in the survey, "Most students do not know about the age restrictions for machine operation, or how dangerous it can be until it is broken down in the classroom." This response indicates how valuable the NSTMOP curriculum can be for compliance with the law and for preventing injury or fatality to youth operating farm machinery.

IMPLICATIONS

Safety-based training programs, such as NSTMOP, should be designed with the assumption that educators do not necessarily have preexisting knowledge related to farm machinery or safety content. Prior experience with tractor and machinery operation is preferred but not required. Therefore, the instructor course needs to outline the core modules needed for the USDOL certification and supplement its training methods with additional materials (e.g., videos, demonstrations) or include additional presenters who may have more experience with specific topic areas. The lack of firsthand experience with farm machinery also implies a greater need for extensive training videos, online resources, and even virtual-reality materials to assist instructors and students.

The NSTMOP materials were designed with a focus on tractors and other related farm machinery, based on the USDOL requirements for the HOOA (USDOL, 2016; see also Code of Federal Regulations Title 29, Part 570 - Child Labor Relations). Many respondents, however, stated that they would also like training materials to cover additional topics, such as all-terrain vehicles (ATVs), skid steers, or mowers. ATVs and utility terrain vehicles (UTVs), for example, are known hazards for youth around farm environments (NCCRAHS, 2022). The NSTMOP curriculum does address ATV/UTV and skid steer safety, but additional materials are requested and should be the focus of future revisions to the material.

LIMITATIONS

Although this study provided further insight into the needs of instructors in safety-related programs, such as the NSTMOP instructor course, it is not without limitations. The study only examined the needs of instructors who were trained by Penn State Extension. Additionally, respondents self-selected to be a part of the online study and self-reported their answers on the survey. Also, online surveys often yield lower response rates than do other data collection methods (i.e., mailed surveys), indicating a higher chance of participation bias present in the data (Manfreda et al., 2008). Considering these factors, the results of this study may not be representative of the perceived benefits and challenges of all safety-related programs hosted by various organizations (Brutus et al., 2013). Furthermore, the research team did not follow up with individuals regarding their survey responses by using

any additional data collection methods, such as interviews or focus groups. Without the collection of these forms of qualitative data, the experiences of instructors interacting with safety-related programs could not be fully captured in this study (Choy, 2014).

CONCLUSIONS

Agricultural safety practices may be an unfamiliar topic for some Extension educators, even though agriculture is one of the most hazardous environments and occupations in the country (e.g., Picciotto et al., 2022). Extension educators, as well as parents and employers, may not be aware of government regulations related to mandated safety training for youth seeking employment on a farm. Extension educators can sign the USDOL certification, but with numerous responsibilities vying for their time, it may be necessary for educators to partner with other agricultural professionals to assist with program delivery for tractor certification courses.

Extension educators have the potential to play an important role in educating youth about agricultural safety, health, and wellness topics. Additional instructors are needed who can educate youth about safe practices for operating tractors and machinery and who can provide the necessary instruction for the USDOL certification required to legally operate machinery while working on a nonfamily farm. This research indicates that employment gained by youth was one of the reported positive influences on NSTMOP students. Labor shortages are common in agriculture, and therefore a program that helps youth gain employment in agriculture is a win-win for the youth, producers, and agricultural community.

NSTMOP continues to expand nationally and internationally to provide required training to youth ages 14–15 for USDOL certification. However, NSTMOP resources are also used to provide training at agricultural training centers and to new and beginning farmers, women in agriculture, veteran farmers, and others on the basics of tractor and equipment safety. Learning safe tractor and machinery operation practices and implementing safe operating behaviors on the farm or ranch have the potential to reduce the risk of injury or fatality.

The current research highlights some of the areas where gaps may exist in educators' knowledge and the resources they need to train youth to work safely in farm environments. These results can help content providers design and produce materials that better meet the needs of instructors in safety-related programs. Such programs as NSTMOP depend on instructors who have the resources necessary to meet the educational objectives of the curricula, and with the results from this study implemented, such programs can be further strengthened.

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