

# Taking Tractor Safety to the Virtual Limit: A Pilot Study

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## Introduction & Literature Review

During 2019, the agriculture, forestry, fishing, and hunting industry reported 573 fatal injuries and 167 fatalities resulted from contact with an object or equipment (U.S. DoL, 2020). During this same year, 84 youth ages 19 and below suffered fatal injuries while working in the United States. Statistics like these supports the need for farm safety and is an aspect of a large industry, like agriculture, that impacts everyone involved. Programs of multiple types have been developed to help train and educate students in safe tractor operation from traditional methods to more creative methods (Vincent et al., 2019, Koc et al., 2012).

Given the hazardous situations that can occur on machinery while working and during training, educators believe that Virtual Reality (VR) can be used as an alternative training tool (Kizil et al., 2001). VR can be an efficient tool for K-12, colleges, and universities to provide their students' knowledge and skill of complex mechanisms and theories (Lee, 2012). As VR proves to be a more effective method of training students than fully traditional methods (Stredney et al., 2008). The need for more realistic simulations creates the opportunity for us to incorporate VR as an alternate means of training students and workers. Currently VR is used as a training method in the Army, Air Force, surgical training, industrial safety training, and pedestrian safety training (Aggarwal et al., 2006).

## Objectives

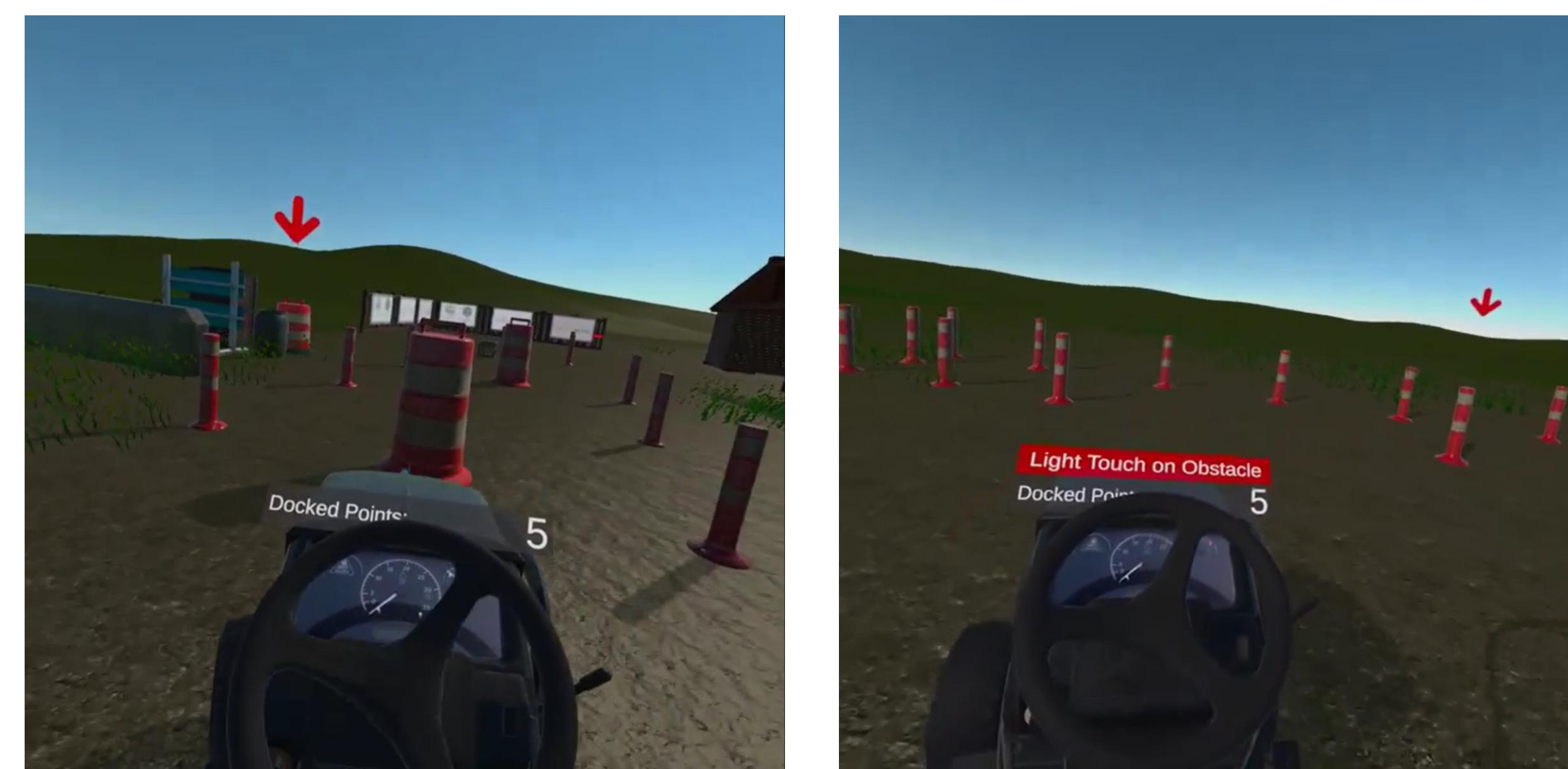
The objective of this pilot study was to:

1. Describe the user experience (UX) of the students.

## How It Works

The virtual reality program utilized for this study is a product of an objective from a Safety in Agriculture for Youth (SAY) grant funded by USDA NIFA. The program was developed from the National Safe Tractor and Machinery Operation Program (NSTMOP) driving and skill course. In the virtual environment, participants are required to complete pre-op checks on a tractor and drive the tractor through a course modeled after the NSTMOP certification course. The program was developed as a supplemental resource for the live offering of the course so that students can practice while someone else is on the machine, while at home or at a distance, accommodate social distancing and COVID requirements. The program operates on the Oculus Quest/Quest 2 VR headsets.

The VR experience consists of three different areas, the first area consists of a stationary tractor that allows students to move around it and interact with different points of interest related to safety. The second area is a driving course where students must answer questions related to preoperational checks related to machinery operation. They can then mount and drive the tractor through an obstacle course that resembles the course they will drive during certification, once completed they get a scorecard detailing their progress. The last area is the skills test, this allows students to interact with hitching an implement, attaching a PTO and hydraulic connections. The student's data can be saved within the headset to be accessed on the teacher's computer for grading.



## Methods/Results

The population that was used for the pilot study was comprised of students that were enrolled in an Ag Safety and Health and Machinery Maintenance course at The Ohio State University. Students were solicited from those classes to participate in the pilot study (Creswell et al., 2018). The sample size of students was  $n = 11$ , due to COVID restrictions and the end of classes turnout was low. The students could only participate in the survey once they had completed virtual reality program. Survey questions asked students about their user experience and were on a 10-point scale.

The results found that students had a moderately positive user experience ( $M = 6.2$ ) from the VR program. The results of this pilot study did identify a bug that prevented students from driving the tractor very far, so students completed as much as they could inside the program before completing the survey. The bug was rectified, and the experience was tested with a group of 11 new students again with no issues.

## Future Plans

This was a pilot study, to determine base of usability of this experience and to determine if there were any problems with students using the experience. A large-scale pilot study, to evaluate students' performance and user experience, is being planned for 2021-22. The future for this experience will include adding different types of equipment and more skill related activities to machinery operation.

## Costs/Resources

Currently the VR experience is going through the approval process through university branding and marketing departments. The program will then be available for download through the SideQuest online store or through the developer's website. The only thing needed for the experience is a Quest or Quest 2 VR headset, which run from \$299-\$400 depending on the store space purchased.

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