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Evaluating the Adoption of Virtual Reality Equine Selection and Judging Curricula: Instructional Responses to a COVID-19 Consequence

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Virtual reality is a technology that is on the leading edge of agricultural sciences dissemination. Virtual reality can be beneficial to improving global food security and better understanding climate impacts, due to its capabilities to reach mass media with critical information. Virtual reality, with the proper access, can connect users from all backgrounds to an immersive experience at their will. The impact of virtual reality as a dissemination tool in agriculture studies is relatively unknown in the literature. Therefore, the researchers chose to implement a mixed-methods research study to investigate the outcomes of student learning in a virtual reality course within the Texas A&M University Equine selection and judging team. Twelve students were purposively sampled within this study, with students taking the course in both 2020 and 2021. Findings from this study suggested that virtual reality could help students reach their desired learning outcomes. Students were also able to provide necessary information on improvements for the course, as it could possibly be a future barrier for student use if headsets are uncomfortable. Another finding of this research is that it further proved virtual reality technologies can be resourceful for disseminating agriculture education. Future studies should look to investigate virtual reality technologies and agriculture education on a wider array, as the results generated from this study are only applicable to the sample.

Keywords

educational technology, horse judging, assessment, diffusion, learning outcomes

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Virtual reality is a technology on the leading edge of agricultural sciences dissemination. Virtual reality can be beneficial to improving global food security and better understanding climate impacts, due to its capabilities to reach mass media with critical information. Virtual reality, with the proper access, can connect users from all backgrounds to an immersive experience at their will. The impact of virtual reality as a dissemination tool in agriculture studies is relatively unknown in the literature. Therefore, the researchers chose to implement a mixed-methods research study to investigate the outcomes of student learning in a virtual reality course within the Texas A&M University Equine selection and judging team. Twelve students were purposively sampled within this study, with students taking the course in both 2020 and 2021. Findings from this study suggested that virtual reality could help students reach their desired learning outcomes. Students were also able to provide necessary information on improvements for the course, as it could possibly be a future barrier for student use if headsets are uncomfortable. Another finding of this research is that it further proved virtual reality technologies can be resourceful for disseminating agriculture education. Future studies should look to investigate virtual reality technologies and agriculture education on a wider array, as the results generated from this study are only applicable to the sample.

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Introduction

Goal 4 of the United Nations Sustainable Development Goals calls for quality equitable and inclusive education for all global citizens (United Nations, n.d.). Global agricultural education researchers have been studying digital technology impact and reporting the respective technology's impact on student and stakeholder learning for years (Bellos et al., 2015; Irby & Strong, 2015; Klerkx et al., 2019; Narine et al., 2019; Shanthy et al., 2011). Developing assessment mechanisms for reporting student success from digital instruction are global necessities to increase education's impact on stakeholders regardless of social or economic status (Hromalik & Koszalka, 2018; Maina et al., 2020).

Agriculture has borne a brunt of COVID-19 consequences as agricultural institutions (Davis, 2020) and agricultural production supply chains (Mishra, 2021) have been negatively affected by the pandemic. The COVID-19 pandemic has disrupted agricultural education across the world as global universities teaching agricultural education have not been immune to the indirect consequences (Lindner et al., 2020). Instructional technologies have offered solutions to softening the effects of the pandemic on global post-secondary teaching efforts to assist in achieving student learning outcomes (Adedoyin, & Soykan, 2020).

Virtual reality is an integrated reality encompassing natural word elements and environments as three dimensional digital objects online (Abdullah et al., 2019). Chan et al. (2021) reported virtual technologies, such as virtual reality, were a global solution to help surviving COVID's educational challenges and consequences. Virtual reality technologies have been implemented to improve youth's learning in Extension programs (Davis et al., 2021). Virtual reality adoption within agricultural sciences curricula could be an effective instructional technology that aligns with student access attributes (Wells & Miller, 2020).

Modest empirical evidence denotes virtual reality's educational value even though the technology is expected to produce a paradigm swing in education and professional development (Makransky et al., 2021). Pellas et al. (2021) reported the lack of virtual reality outcome data to assist post-secondary instructors understand methods to incorporate virtual reality technologies to improve student learning. Due to the rate of technological changes, higher education institutions across the globe need to evaluate student learning outcomes based on instructor adoption of respective cutting-edge instructional technologies in courses (Strong et al., 2013). Global testing and learning the impact of virtual reality technologies as instructional technologies has had a slower rate of adoption than the actual adoption of the technology (Harris et al., 2021). Lindner et al. (2016) recommended the need for research to better understand new technologies, practices, and products that can help agricultural educators develop and implement now agricultural teaching practices to contribute to the development of sustainable agriculture.

Conceptual Framework

Kirkpatrick (1994) developed the four-level evaluation that includes reactions, learning, behavior, and results to assess the curricula impact and potential modifications to improve program impact. Reactions relate to the extent participants respond positively to the lesson. Learning, the second level, indicates the degree to which participants increased their knowledge from the curricula. Behavior seeks to understand the extent students can apply what they learned. Results relate to the achievement of target outcomes. Strong et al. (2021) identified evaluation as an essential assessment the outcomes or impacts of a program. The advantage of Kirkpatrick's (1994) evaluation model is the focus on students' feedback, measuring learning improvements, and impact of program outcomes (Chen et al., 2021).

Rogers (2003) identified diffusion as the process through which an innovation is communicated through channels within a social system over a specific period. Examples of innovations include but are not limited to technology, an educational program, an idea, or policy. The innovation adoption process is described as individuals gain knowledge of an innovation, are then persuaded by change agents, opinion leaders, and early adopters to use, a decision to use or not is made, implementation of the innovation occurs when the individual puts the innovation into practice, and then individuals confirm their resulting adoption or rejection of the respective innovation (Rogers, 2003). Upon diffusion, change agents should focus their efforts on the next innovation their organization is promoting (Ganpat et al., 2016) as increased credibility from opinion leaders and early adopters in the social system has been achieved and change momentum has occurred from the prior innovation adoption process within this respective social system (Rogers, 2003).

The four-level model (Kirkpatrick, 1994) is concerned with assessing learning and Rogers' (2003) focus is the innovation decision process respective to virtual reality technologies that, in our study, potentially improve student learning outcomes. Understanding the role and possible extent virtual reality adoption has on post-secondary student learning created the conceptual framework of our study given the robustness and validity of both theorist's work.

Purpose and Objectives

The global equine industry is a multi-billion dollar industry and students desiring to work in the industry should understand fundamental equine selection criteria (Masko et al., 2019). The purpose of this study was to understand the extent virtual reality technologies impacted student learning in an equine selection and judging course. The learning objective was to understand and apply the rules and guidelines for judging Halter and Western Pleasure classes. The title of the lesson was *Horse Judging - Stock type Halter and Western Pleasure Classes*. More specifically, this study's objectives were:

1. Describe student's reactions to learning with virtual reality.
2. Identify student's learning outcomes from virtual reality participation.
3. Understand student's identified benefits of using virtual technology in horse judging.
4. Discern student's suggestions for improving the virtual technology for horse judging.
5. Measure respondent's extent of cybersickness due to virtual technology participation.

Methods

Research Design

The researchers implemented an explanatory sequential mixed methods design to answer the study's objectives. A researcher first employs a quantitative method and then uses a qualitative method to follow-up and refine the quantitative results in an explanatory sequential mixed methods study (Creswell & Creswell, 2018). The two types of data are analyzed separately, but the findings of the qualitative analysis are used to build upon the results of the quantitative data. This mixed methods attribute is the meaning the approach is referred to as explanatory (Creswell & Creswell, 2018). Researchers believed the explanatory paradigm was most appropriate given the literature and this study's respective research objectives. The research team was comprised of scholars who teach graduate level courses in quantitative or qualitative research, and each felt efficacious in combining their respective credentials to develop and implement an explanatory sequential mixed methods design.

The quantitative data provides the researcher with the numerical and statistical data, and the qualitative data provides the researcher with the narratives. Mixed-method research is advantageous because the combination of those data sets allows for researchers to analyze and gather various kinds of data opposed to other types of data (Bryman, 2006). Researchers that chose to employ this method argue that the combination of qualitative and quantitative data provides a more complete data evaluation (Fraenkel et al. 2019). A mixed-method approach helps clarify what relationship exists between the variables associated with the data (Fraenkel et al. 2019). These studies can be costly and time consuming, or the researcher can be one-sided in their familiarity to the data collections (Creswell & Creswell, 2018).

Data Collection

A Qualtrics instrument including the Attitudes toward Virtual Reality Technology Scale (AVTRS) (Bunz et al., 2020) to assess attitudes toward virtual reality technology. Open-ended questions were also developed from the AVRTS with Kirkpatrick's (1994) four-level model constructs as the lens to develop the question and due to the small sample in the course. There were 18 post-secondary students in the equine selection and judging American institution course and 12 students chose to participate in this study. Students were not required to enroll in the course and did not have to be members of the Texas A&M University horse judging team to participate in the course and the virtual reality curricula. There were 10 females and two males in the sample.

The Tailored Design Method (Dillman et al., 2014) is the foremost strategy to collect electronic survey data. The Tailored Design Method was implemented using a Qualtrics developed link distributed to students at the conclusion of the equine selection and judging course. The first step researchers provided the electronic prenotice to students and the second step included emailing students the link to the Qualtrics housed instrument. The third, fourth, and fifth steps included thank you/reminder notices based on Dillman et al.'s (2014) recommended approaches for collecting electronic survey data. Dillman et al.'s (2014) approach connects to the theoretical framework and methodology due to the unobtrusive nature of electronic survey data collection, the research objectives, the study's sample size, and the distribution specifically of the AVRTS to measure student learning from virtual reality technologies in the equine selection and judging course.

Data Analysis

Quantitative responses were measured using nonparametric statistics were used to examine the quantitative data (Fraenkel et al., 2019). Qualitative responses were assessed for trustworthiness and credibility with the inclusion of an audit trail and member checking as recommended by Natow (2019). The researchers implemented the Tailored Design Method to collect data and thematic analysis as outlined by Braun and Clarke (2008) to identify and analyze themes from the qualitative data.

Findings/Results

Twelve students responded to the instrument. The goal of objective one was to describe student's reactions to learning with virtual reality. Most students believed "Using virtual reality technology to learn horse judging was easy" (n = 9; 75%). Nine respondents or 75% also agreed "Virtual horse judging was an effective use of my time". Ten of 12 (83%) students "enjoyed using virtual reality to learn about horse judging." Eight of ten respondents would recommend virtual horse judging to others.

Objective two sought to identify student's learning outcomes from virtual reality participation. Most respondents (*n* = 9, 75%) somewhat to strongly agreed virtual reality horse judging technology addressed their learning needs. Eight of 12 (67%) respondents at least somewhat agreed VR taught them to effectively apply standards to judge each class. Also, eight of 12 (67%) respondents agreed virtual reality technology taught them how to better apply horse industry rules. Nine of 12 (75%) respondents agreed with "Virtual reality technology allowed me to apply the standards for judging each class." "Virtual reality technology taught me how to utilize time management to judge each class" found agreement with eight of 12 (67%) students. Ten of 12 (83%) students indicated they could "apply what I learned from the virtual technology in a horse judging contest." Eleven of 12 (92%) respondents agreed they could apply what I learned from the virtual technology in real life evaluations. Six respondents (50%) at least somewhat agreed with "In the future, I will be more successful at visually evaluating horses due to the virtual reality technology experiences." Most students neither agreed nor disagreed with "After applying my previous knowledge of horse judging, I feel like I am a better judge after completing these modules".

The purpose of objective three was to understand student's identified benefits of using virtual technology in horse judging. Participants reported diverse attributes of virtual technology's role in horse judging. R7 included "A benefit would be that you have the horses right in front of you whereas in real life they are somewhat farther away." R11 shared, "You could see horses in 3D instead of just 2D and it was easier to see and compare their size and volume differences." R6 conveyed the virtual reality technology "Provides a more realistic experience compared to watching a recording." and R1 shared "It was nice to be able to view the horses in real time and look back and forth between different horses as needed. It was definitely a better experience than just looking at pictures." "It gave you a more realistic look at the horses while teaching you how to keep scanning the class in rail events to simulate a contest scenario." indicated R6.

The benefit of convenience and not traveling was indicated by participants, R4 added, "Even when you can't physically go see the horses this allows the judge to get close and have a greater grading." R10 identified "access to classes" as a benefit of virtual reality adoption. R2 went further, "For those who cannot or do not have opportunities to go in person to horse judging shows." "Being able to learn how to apply horse judging on classes of horses if there aren't live horses readily available that could be used in practice." said R12.

> R1 explained VR benefits further "Using virtual technology allows you to feel more like you are judging horses live. You are able to practice watching all the horses moving at once, like you have to do in a judging contest. It also allows you to practice time management while you look at the horses."

The aim of objective four was to comprehend student's suggestions for improving the virtual technology for horse judging. R4 reported, "The head piece itself was sorta heavy on my face which was not the most comfortable. But the virtual part was pretty good, only if the quality was a little better." R9 indicated, "Make it so we can move around and judge the horses and it isn't just a stationary place" and R1 suggested, "I think distance from the camera is important. I felt more nauseous the closer the horses were moving toward the camera."

> R6 responded with "I would suggest for the halter classes, the horses should be further away from the camera, so that you can get a better idea of how you would

> like to place the class. They should also be set in a line like they are in a judging contest so that you have to walk down the line of horses to evaluate them. For the Western Pleasure class, maybe the footage could be filmed in a bigger space as well, instead of a round pen."

There were challenges reported using the virtual reality technology to learn rules and guidelines of horse judging. R9 included, "Sometimes the video quality seemed weird, but I think that had more to do with me not knowing how to properly adjust the VR headset and not the video itself." R2 added, "Do it in the dark room. After taking the headset off the lights were bright and hurt my eyes." and R8 said further "My video was blurry the whole time".

> R11 suggested improvements included "I like the whole idea, the only thing would be for the quality in the head piece to be better. And the head piece itself was also a little heavy on my face which was not that comfortable. I tried adjusting it but it was either too loose or too tight."

R10 described improvements further "Labeling the way we look at the halter horses more clearly, so we know when the views change and when the first horse starts tracking."

The fifth objective was to measure respondent's extent of cybersickness due to virtual technology participation. Seven of the 12 (58%) respondents indicated they eventually developed headaches from the virtual technology use to learn the rules and guidelines of horse judging. Six of the 12 (50%) respondents became dizzy after VR use in the class. None of the participants reported being nauseous or but two reported motion sickness from the virtual reality experience in the horse judging lesson.

Conclusions/ Implications/ Recommendations

The limitation of this study was the small sample and one course focused on equine selection and judging virtual reality curricula at one American post-secondary institution. Instructors perceived virtual reality as having a relative advantage (Rogers, 2003) over traditional approaches to teach equine selection and judging as they implemented VR curricula to disseminate the learning objective. Participants were positive in their reactions (Kirkpatrick, 1994) to virtual reality technologies use in the course. All participants (100%) reported virtual reality equine selection and judging curricula was easy to use (Kirkpatrick, 1994).

The international applications for international agricultural educators are due to the students' positive reactions to learning with the virtual technologies, the researchers feel as though this could have a positive impact on global education in the future. Future because the usage of these technologies in education are very limited. International agricultural education and extension researchers should look to explore different virtual reality headsets as dissemination tools, as the headset used in this piece was deemed heavy by the students. Having a headset that doesn't cause uncomfortable circumstances for students will be crucial in improving the learning experience. Having a much larger global study across multiple divisions of agriculture would be something researchers should consider, because different industries and disciplines are accountable for different results.

International researchers should seek to answer the extent cybersickness occurs when using different technologies, as those would be critical to know. If one virtual reality headset has minimal cybersickness and another one causes the usage of the technology to be somewhat harmful, the facilitators of instruction will then know what dissemination tool they should employ. Within cybersickness, researchers should answer what things are outcomes of cybersickness. Headaches may be a common theme. Eye strain may occur in only students that use contact lenses. Dizziness may result due to a full immersion versus a 180-degree image. Answering these inquiries will be important for determining what practical educational use virtual reality technologies would have holistically in international agricultural education.

Larger samples from around the world are needed to generalize results not solely to a course but fields of study. Experimental designs are needed to predict variables that enhance student outcomes due to virtual reality technology adoption in agricultural education or sciences coursework. Courses with duplicate sections during a semester can utilize a treatment, virtual reality disseminated curricula in one section, and a control group learning the content traditionally. Findings between the two sections could inform international instructors' variables to target when implementing virtual reality technology to meet learning outcomes (Lindner et al., 2016) and better prepare students with virtual technologies experiences for careers preparation post-graduation.

Virtual reality adoption and impact studies within international agricultural extension are also needed. Agents or officers could participate in virtual reality trainings and knowledge, behavior, and results of program content and implementation could be measured. The competencies needed for extension staff to use virtual reality instructional tools is warranted. International agricultural extension program dissemination to farmers via virtual reality could be implemented due to farmer’s improved convenience, allocated time, and respective location. Regardless of commodity or farm size, farmer’s, knowledge, behavior, and the impact of results from the virtual dissemination should be assessed. International agricultural extension challenges require quick and often innovative solutions. Digital instructional technologies such as virtual reality, augmented reality, and artificial intelligence should not be immune to implementation and use for international agricultural extension programs, staff, or farmers. Diffusing the digital instructional technology innovations may assist international agricultural and extension educators meet the fourth Sustainable Development Goal (United Nations, n.d.).

Given the rate of instructional technology innovation (Maina et al., 2020) and depth of the global equine industry (Masko et al., 2019), future global studies are needed to determine the extent equine selection and judging instructors are innovators or early adopters (Rogers, 2003) juxtaposed to other agricultural education instructors. In this institutional study, equine selection and judging annually implements virtual reality technologies to disseminate the content and address student learning outcomes. The paradigm is the equine instructor’s innovation and potentially, culture at Texas A&M University. The extent or existence of similar international agricultural sciences’ instructor virtual reality implementation warrants investigation not solely for discovery but to advance our literature on innovativeness characteristics (Rogers, 2003) respective to global post-secondary agricultural education instructors.

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