Research Poster

A One-Year Evaluation of Knowledge Retention from a Virtual Reality Professional Development

Anuradha Choudhary
University of Nebraska – Lincoln
P.O. Box 830947
Lincoln, NE 68583-0947
(402) 472-2807
achoudhary3@unl.edu

Tyler Granberry
University of Tennessee, Knoxville
2640 Morgan Circle Dr.
Knoxville, TN 37996
(865) 974-8256
tgranber@utk.edu

Nathan W. Conner
University of Nebraska – Lincoln
P.O. Box 830947
Lincoln, NE 68583-0947
(402) 472-3938
nconner2@unl.edu

Taylor K. Ruth
University of Tennessee, Knoxville
2431 Joe Johnson Dr.
Knoxville, TN 37996
(865) 974-3522
truth3@utk.edu

Jamie A. Greig
University of Tennessee, Knoxville
2431 Joe Johnson Dr.
Knoxville, TN 37996
(865) 974-8553
jgreig@utk.edu

A One-Year Evaluation of Knowledge Retention from a Virtual Reality Professional Development

Introduction

The use of virtual reality (VR) has increased in educational settings to provide learning opportunities for subjects where access to real-world contexts may be limited by cost, time, and safety concerns (Craig & Kay, 2023; Samala et al., 2025; Stracke et al., 2025). Research has suggested that VR enhances learner engagement, improves learning transfer, and deepens understanding through visual experience (Pellas et al., 2021). Specifically, Makransky and Mayer (2022) found that VR activities improved learning compared with regular video content.

Within school-based agricultural education (SBAE), VR has been applied in welding instruction, virtual field trips, and equipment safety and operation to provide opportunities for skill practice and safely increase access to activities that are difficult to plan and execute (Greig et al., 2024; Heibel et al., 2024; Pulley et al., 2025a). Studies in SBAE have reported positive user experiences and high levels of student interest, but also highlight adoption challenges that complicate performance outcomes, as SBAE teachers frequently mentioned barriers related to equipment access, technical reliability, and limited professional skills for effective instructional use (Pulley et al., 2025b; Wells & Miller, 2020).

In response to these needs, the Agriscience Metaverse Academy (AMA) was designed as an intensive professional development experience to strengthen SBAE teachers' foundational knowledge of VR and their capacity to implement and evaluate effectively in classroom instructions (Greig et al., 2024; Pulley et al., 2025b). Prior work on this project has documented perceptions, attitudes, and intentions to use VR immediately following the professional development experience (Ruth et al., 2025). However, this study sought to evaluate the impact of the professional development on participants' sustained knowledge over time. Therefore, the purpose of this study was to examine changes in SBAE teachers' VR knowledge from preworkshop to postworkshop and approximately one year after the AMA professional development, providing longitudinal evidence on whether a multiday, hands-on professional development produces lasting results that can support future classroom integration.

Conceptual Framework

This study is supported by Desimone's (2009) professional development framework, which highlights that professional development is most effective when it is content-focused, includes active learning, coherent, involves collective participation, and sustained over time. In this study, the AMA was designed to align with core features of this farmwork by emphasizing VR-specific content, hands-on and experiential learning, and collaboration among SBAE teachers. Desimone's framework is used to assess whether the structured, technology-focused professional development experience resulted in meaningful and sustained knowledge.

Methodology

We collected data for this study using a Qualtrics survey sent to SBAE teachers who participated in the AMA professional development program. Surveys were conducted at three

points: (a) prior to the professional development workshop, (b) immediately after participation, and (c) approximately one year later. All participating teachers (n = 28) completed all survey instruments. The knowledge instrument included a 10-item VR knowledge assessment developed to measure teachers' understanding of VR concepts and instructional use. Data were analyzed using SPSS v.29. First, descriptive statistics were calculated for each time point. Because assumptions of normality were not met, Friedman's test was used to examine changes in VR knowledge across time, followed by Wilcoxon signed-rank tests for post hoc comparisons.

Results

The findings of this study indicate that teachers' participation in the AMA professional development workshop increased their knowledge of virtual reality (VR). Mean VR knowledge scores show an increasing trend from the pretest (M = 4.32, SD = 2.50) to the posttest (M = 7.71, SD = 0.81). At the one-year mark, mean knowledge scores did not decrease (M = 7.86, SD = 1.08). In addition to higher mean knowledge scores, variability decreased following teachers' participation in professional development, indicating improved consistency of VR knowledge after the workshop. Results of the Friedman test indicated a statistically significant difference in VR knowledge across time, χ^2 (2) = 38.63 ($p < .001$). Wilcoxon signed-rank tests indicated a significant increase in VR knowledge from pretest to posttest ($p < .001$) and from pretest to the one-year follow-up ($p < .001$). However, no statistically significant difference was observed between the posttest and one-year follow-up scores (p = .381), suggesting that gains in VR knowledge were sustained over time.

Conclusions

Overall, our findings suggest that the structured, content-focused AMA professional development experience significantly increased teachers' VR knowledge and supported long-term retention, rather than short-term learning alone. These results provide strong evidence for the effectiveness of a structured, hands-on professional development experience focused on emerging technologies as a meaningful way for teachers to increase their knowledge, which aligns with Desimone's (2009) framework. By documenting changes in SBAE teachers' VR knowledge over time, our study contributes to research on the longitudinal outcomes of VR-focused professional development workshops in agricultural education, aligning with the research recommendations of Pulley et al. (2025b).

Implications and Future Research

The results provide evidence that professional development programs that emphasize content-focused, active learning are successful in building teachers' foundational knowledge of emerging instructional technologies such as VR. Agricultural education stakeholders and teacher educators may consider adopting similar professional development models when introducing new technologies into SBAE programs. Future research should examine how gains in teachers' VR knowledge translate into instructional practice and if these practices ultimately improve student learning outcomes in SBAE. Additionally, the implementation of VR in SBAE would benefit from further research identifying factors that support or hinder teachers' continued use of VR.

References

Abich, J., Parker, J., Murphy, J. S., & Eudy, M. (2021). A review of the evidence for training effectiveness with virtual reality technology. *Virtual Reality, 25*(4), 919–933. https://doi.org/10.1007/s10055-020-00498-8

Craig, C. D., & Kay, R. (2023). A systematic overview of reviews of the use of immersive virtual reality in higher education. *Higher Learning Research Communications, 13*(2), 42–60. https://doi.org/10.18870/hlrc.v13i2.1430

Desimone, L. M. (2009). Improving impact studies of teachers' professional development: Toward better conceptualizations and measures. *Educational Researcher, 38*(3), 181–199. https://doi.org/10.3102/0013189X08331140

Greig, J. A., Colclasure, B., Rampold, S., Ruth, T. K., & Granberry, T. (2024). Enhancing agricultural education through virtual reality: Facilitation, application, reflection, and measurement in the classroom. *Advancements in Agricultural Development, 5*(2), 64–80. https://doi.org/10.37433/aad.v5i2.353

Heibel, B., Anderson, R., Swafford, M., & Borges, B. (2024). Integrating virtual reality technology into beginning welder training sequences. *Journal of Agricultural Education, 65*(1), 210–225. https://doi.org/10.5032/jae.v65i1.2468

Makransky, G., & Mayer, R. E. (2022). Benefits of taking a virtual field trip in immersive virtual reality: Evidence for the immersion principle in multimedia learning. *Educational Psychology Review, 34*(3), 1771–1798. https://doi.org/10.1007/s10648-022-09675-4

Pellas, N., Mystakidis, S., & Kazanidis, I. (2021). Immersive virtual reality in K–12 and higher education: A systematic review of the last decade. *Virtual Reality, 25*, 835–861. https://doi.org/10.1007/s10055-020-00489-9

Pulley, J., Claflin, K., & Thompson, A. (2025a). An evaluation of Ohio agricultural education students' performance and user experience in a virtual reality machinery safety experience. *Journal of Agricultural Education, 66*(1), Article 12. https://doi.org/10.5032/jae.v66i1.2856

Pulley, J., Claflin, K., & Thompson, A. (2025b). A review of virtual reality applications in agricultural education and recommendations for future research. *Journal of Agricultural Education, 66*(3), Article 15. https://doi.org/10.5032/jae.v66i3.3195

Ruth, T., Young, S., Granberry, T., Conner, N., & Greig, J. (2025, May 19–22). *Into the metaverse: Exploring how teacher processional development influences intent to use virtual reality in the classroom* [Paper Presentation]. 2025 American Association for Agricultural Education National Research Conference, Lubbock, TX, United States.

Samala, A. D., Rawas, S., Rahmadika, S., et al. (2025). Virtual reality in education: Global trends, challenges, and impacts—Game changer or passing trend? *Discover Education, 4*, Article 229. https://doi.org/10.1007/s44217-025-00650-z

Stracke, C. M., Bothe, P., Adler, S., et al. (2025). Immersive virtual reality in higher education: A systematic review of the scientific literature. *Virtual Reality, 29*, Article 64. https://doi.org/10.1007/s10055-025-01136-x

Wells, T., & Miller, G. (2020). Teachers' opinions about virtual reality technology in school-based agricultural education. *Journal of Agricultural Education, 61*(1), 92–109. https://doi.org/10.5032/jae.2020.01092