Immersive Learning for a Sustainable Future: The Role of Virtual Reality

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As virtual reality (VR) advances, its applications are expanding beyond gaming and entertainment to include social connection and education (Jo & Park, 2023). VR is a powerful medium that has been shown to impact human behavior and emotions (Skard et al., 2021). Its interactive features enhance user engagement, leading to higher levels of enjoyment (Chang & Suh, 2025) and a deeper and more meaningful understanding of the content (Ronaghi, 2023). Given that VR offers an engaging way to deliver information, this study investigated its role in improving awareness of sustainable practices in a virtual hotel setting.

This paper is a portion of a larger project, in which 120 participants took a survey before viewing the VR tour, and then they explored the tour on a laptop while wearing an eye tracker. After the tour, participants took a survey reassessing their awareness of the 17 practices and had an in-depth interview. SPSS Statistics was used to conduct a paired sample t-test of participants to compare before and after scores of the 17 sustainability practices. It provided insights into whether there was an increase or decrease in participant awareness after viewing the VR tour and the information provided. The interview transcripts were analyzed using thematic analysis.

Table 1. Before and After Means (n=116)

Sustainability Practice	Before		After		T-value
	Mean	SD	Mean	SD	
Electric Transportation	5.15	1.267	5.83	1.321	-5.298***
Green Wall	4.57	1.659	6.22	0.933	-11.503***
Paperless Front Desk	5.16	1.564	6.15	1.121	-7.809***
Solar Panel	6.35	0.935	6.62	0.765	-2.882***
Natural Daylight	6.16	1.157	6.51	0.928	-3.979***
Sustainable Food Choices	5.98	1.079	6.02	1.172	-0.377
Food Donation	4.73	1.701	5.89	1.297	-8.132***

ORCA Technology	5.27	1.392	6.01	1.226	-6.144***
Sustainable Uniforms	4.84	1.541	5.47	1.557	-4.932***
VSD AC Technology	5.33	1.297	5.91	1.325	-4.377***
Motion-Sensor Lights	5.55	1.488	6.27	1.137	-5.384***
Coffee Capsule Recycling	5.00	1.637	4.87	1.361	-6.559***
Waste Sorting	6.17	0.980	6.29	0.904	-1.203
Filtered Tap Water	6.48	0.918	6.55	0.762	-0.852
Reusable Amenity Pouch	4.96	1.612	5.59	1.319	-4.464***
Soap Cycling and Donation	4.83	1.680	5.93	1.178	-7.862***
Wall-Mounted Bathroom Amenities	4.88	1.785	6.14	1.250	-8.362***

Note: Significance level is represented by *$p < .05$. **$p < .01$. ***$p < .001$.

The results showed that VR tours could and did enhance awareness of sustainability practices. Fourteen of the seventeen sustainability practices had a significant difference at the level of 0.001 between the mean scores before and after the VR experience. Throughout the interviews, the sustainability practices that were most remembered by participants were the green wall (58 times), the soap donation and recycling program (39 times), and the uniforms made from sustainable materials (37 times). The green wall stood out the most for a couple of reasons, including its presence at the beginning of the tour, its novelty, and its beauty. Participant No. 35 explained that the soap and the green wall were things they had seen before, but were unaware of how these sustainability practices benefited the hotel's operations. The VR tour also enhanced participants' overall awareness and understanding of sustainability. As Participant No. 12 reflected, '*I learned just how significant small things are, because they can make a big difference.*' Participants also suggested improvements to the VR tour, including clearer navigation, additional interactive elements, and the inclusion of quizzes to enhance engagement.

Discussion and Conclusion

This research found that the interactive components of VR can not only encourage viewers to engage more attentively with sustainability messages but also enable them to retain

and recall the information. However, the observed increase in participants' overall awareness was less substantial than anticipated, suggesting that while VR tours are an effective communication tool, their impact may be more modest than expected. One caveat that should be taken into consideration is that there is an extra level of effort required by viewers when using VR, as they need to figure out how to navigate the VR environment and focus on the new information being given simultaneously. If the information is new to participants and of higher interest, the higher level of effort required does not prove to be a large obstacle.

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