

The Effect of Immersive Virtual Reality on Learning

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Introduction

Topic Statement: Over the last twenty years, there has been exponential advancement in instructional technology, including Immersive Virtual Reality (IVR). It may serve as a way to increase users' ability to learn specific topics.

Prior Literature

- IVR studies show increased user presence and enjoyment
- Mixed findings in relation to learning compared to controls

Purpose

- Assess whether learning in IVR compared to a laptop leads to increases in presence, science self-efficacy, enjoyment, and procedural knowledge retention.

Hypotheses

- **H1:** IVR will increase presence compared to laptop condition
- **H2:** IVR will increase enjoyment compared to laptop condition
- **H3:** IVR will increase science self-efficacy compared to laptop condition
- **H4:** IVR will increase procedural knowledge retention compared to laptop condition

Method

Participants

- $n = 127$ undergraduates
- $M = 18.95$, $SD = 1.84$
- Gender
 - 85 Female; Male 41

Design

- Between subjects
- Random assignment in either the IVR condition or laptop condition

Materials

- Assessment battery
 - The assessment battery included 4 tasks and was presented via a Qualtrics assessment

Technology

- IVR: Meta Quest 3s. See Figure 3
- Laptop: MacBook Pro (2023) M3

Learning Content

- Two 6-min long videos: The Crystal Reef and Coral Compass, which were developed by the Virtual Human Interaction Lab at Stanford University. See Figure 3

Procedure

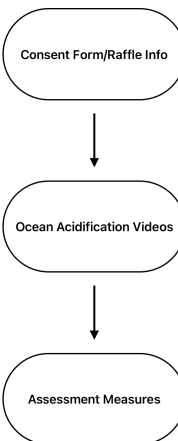


Figure 1. Order of Events



Figure 2. Meta Quest 3s



Figure 3. Coral Compass

Results

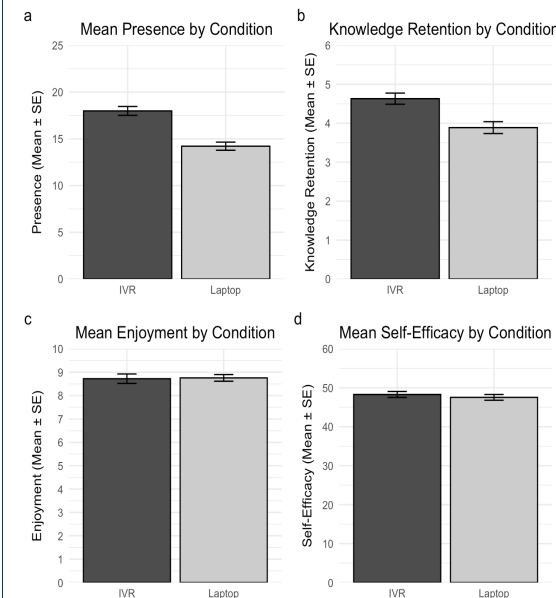


Figure 4. Mean Outcome Scores by Condition

- One-way ANOVAs examined the effect of immersion (IVR vs. laptop) on presence, enjoyment, science self-efficacy, and knowledge retention. Results supported H1 that the immersion would increase affected presence ($F(1, 125) = 34.02$, $p < .001$, $\eta^2 = .21$), and H4 that knowledge retention would increase in the IVR condition ($F(1, 125) = 12.65$, $p < .001$, $\eta^2 = .09$).
- No significant effects, however, were found for H2, enjoyment ($F(1, 125) = 0.02$, $p = .89$, $\eta^2 < .001$), or H3, science self-efficacy ($F(1, 125) = 0.49$, $p = .49$, $\eta^2 = .004$).

Discussion

Main Findings

- Effect of Immersion (IVR vs laptop) on Presence
 - Participants in IVR scored higher on presence compared to laptop
- Effect of Immersion (IVR vs Laptop) on Knowledge Retention
 - Participants in IVR scored higher on knowledge retention compared to laptop

Limitations

- Short duration; measures aren't as strong
- Lab Study; less realistic environment for learning

Future Research

- Whether difficulty of the topic or the design of the lesson moderates a learning effect

Conclusion

- This study adds to the growing evidence that immersive virtual reality may have the ability at increasing students' abilities to comprehend challenging content compared to traditional media.