It's all about absorption: Learning by teaching in immersive virtual reality

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Objectives

- Learning by teaching is an effective way to improve learning outcome [1, 2].
- The physical presence of another person is not mandatory because explaining learned material to fictitious students is effective [3, 4].
- By means of head-mounted displays immersive virtual reality (IVR) enables immersion in computer generated three-dimensional environments.
- We investigate whether learning by teaching in IVR improves learning.
- We compared the educational outcome of teaching an avatar in IVR with a less immersive desktop condition and a control condition (writing a summary).
- IVR has the potential to make its way into education.

Methods

- Sample: 68 participants (mean age: 22.34 ± 3.9 yrs)
- 1st appointment: Baseline, study-phase, intervention (IVR, desktop, control), test (16 MC and open questions), presence questionnaires
- 2nd appointment: Follow-up-test (16 MC and open questions), immersive tendency questionnaire
- Participants were instructed to explain a technical topic; randomly assigned to the conditions IVR, desktop or control.
- Besides the learning outcome, presence and immersive tendency (absorption and emotional involvement) were assessed.
- Bayesian Generalized Linear Mixed Models predicting the probability to answer the test-questions correctly.

Figure 1: Participant's 3D view in the IVR with avatar who listens to the explanation. The virtual environment was rendered using the *Worldviz Vizard* (version 5.0) and presented by means of a Oculus Rift Head-mounted display.

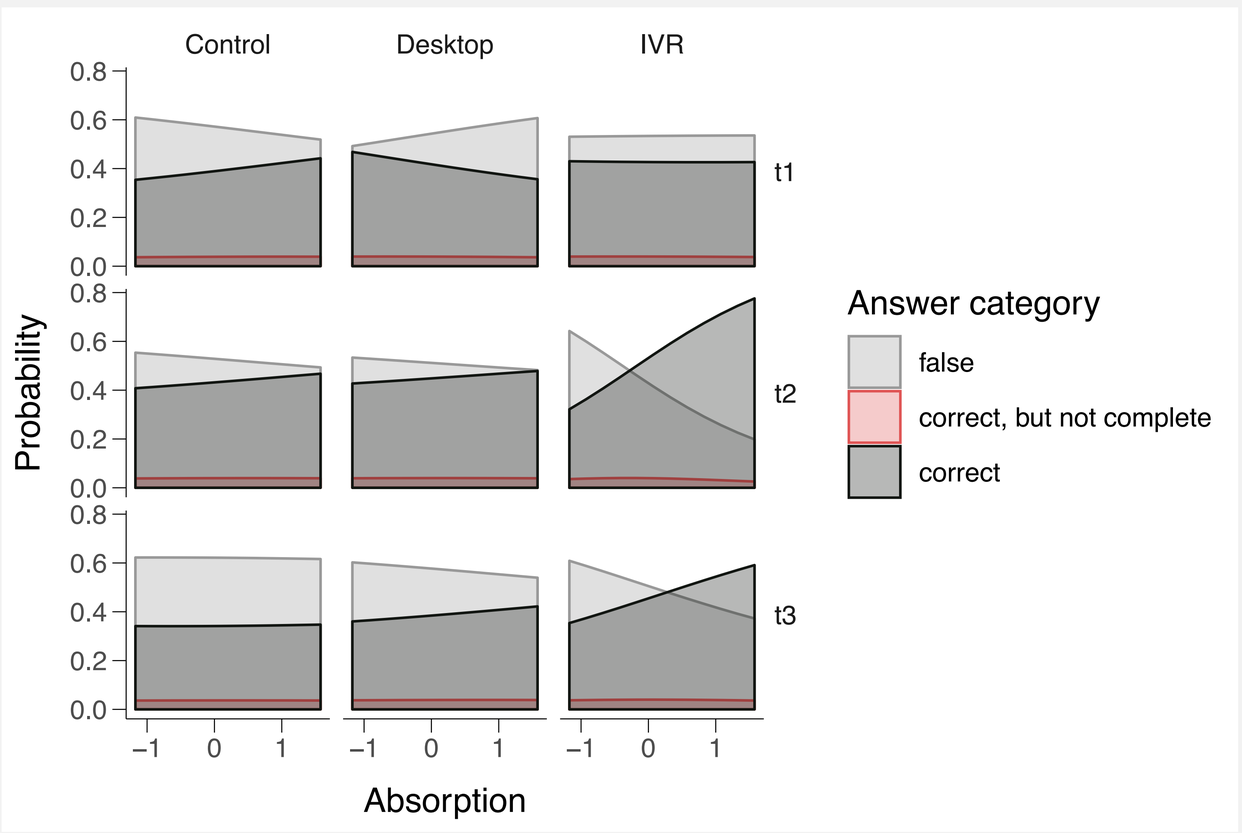

Figure 2: Probability to answer the test-questions with either a false answer, a correct, but not complete answer or with a correct answer as a function of the absorption score (centerd around the grand mean). The data are shown separately for time point t1 (= baseline), t2 (= just after the intervention) and t3 (one week after the intervention) for each of the three conditions (control, desktop, IVR).

Results

- **Learning Outcome:** There was no overall difference in the learning outcome in the IVR condition compared to the other conditions.
- **Absorption**: We found at time-point 2 an interaction between, condition and absorption. Higher absorption scores increased the probability to correctly answer the test questions in the IVR condition when compared to the control condition (β = 0.81, *SE* = 0.36, L-95% CI = 0.12, U-95% CI = 1.52) (see Figure 2).
- **Presence:** Participants in the IVR condition reported higher presence compared to the desktop condition (β = 1.20, *SE* = 0.05, L-95% CI = 1.11, U-95% CI = 1.30).
- Presence did not predict learning outcome.

Summary

- Learning by teaching in IVR improves learning, depending on individuals' tendency of absorption by media content.
- In contrast, absorption had no influence on learning outcome while teaching on a computer screen or writing a summary.
- Presence was higher in participants who were assigned to the IVR than in participants explaining in front of a computer. However, presence did not influence the learning outcome.
- The results highlight the importance of considering personality traits when applying IVR technologies and making use of their potential benefits.

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Acknowledgement: This study was funded by the Swiss Distance University

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