

Exploring Digital Twins in Virtual Reality through 360-Degree Images

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Theoretical Background

Learning with VR environments (Merchant et al., 2014)

- Well-researched conduciveness to learning
- Increasing availability in educational settings
- VR learning requires more cognitive processing than conventional learning (Parong & Mayer, 2021)

Cognitive Load Theory & Cognitive Theory of Multimedia Learning

- Limited processing capacity can be supported by the presentation of the learning object (Sweller et al., 1998)
- Segmenting (Mayer & Pilegard, 2014) and signaling (van Gog, 2014) are beneficial design principles to enhance learning outcomes

The Cognitive Affective Model of Immersive Learning (Makransky & Petersen, 2021)

- Interest, motivation, and cognitive load impact learning outcomes
- Presence as a precedent factor for immersive learning

Research Questions

RQ1: To what extent do the principles of segmenting and signaling affect situational interest and motivation?

- H1a: Segmenting has a positive impact on situational interest and motivation.
- H1b: Signaling has a positive impact on situational interest and motivation.

RQ2: To what extent do the principles of segmenting and signaling affect factual and transfer knowledge?

- H2a: Segmenting has a positive impact on factual and transfer knowledge.
- H2b: Signaling has a positive impact on factual and transfer knowledge.

Methodology

Study design

- 2x2 between-subject design
- post-hoc (pre- posttest) and online (electrodermal activity) measures

Measures

- Subjective self-reports
- Self-designed factual & transfer knowledge tests
- Elaborated questionnaires on interest, motivation, cognitive load, and presence

Objective online measure

- Physiological measure for information processing (electrodermal activity)

Procedure



Figure 1. Design elements of the learning units

Learning Environment

Structure

- Six learning units consisting of 360-degree images of the Isenbrücke in Schwindegg
- Simultaneous auditory and visual presentation of learning objects (see Figure 1)

Design (see Figure 1)

- Highlighting elements to focus the attention to relevant information (signaling)
- Division of learning content into concise segments to support information processing (segmenting)

Learning Objects

- Introduction, history of the Isenbrücke and learning goals
- Definition and applications of Digital Twins
- Sensors used in bridge construction & installation site at the Isenbrücke
- Overview of the measuring points on the Isenbrücke
- Data management and challenges of Digital Twins
- Take-Home-Message and summary

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Finanziert von der Europäischen Union
NextGenerationEU