

EGS-VR

Skalierbare VR-Ausbildung im Katastrophenschutz
vom Piloten zur nationalen Implementierung

AVRiL, Potsdam am 15th September 2026, Leon Pietschmann & Fritz Pickhardt





Focus of this Talk

1. Motivation, Aims and Objectives
2. Study Design, XR Development and Co-Creation
3. XR-Application and Process of Implementation
4. Evaluation and Findings
5. Discussion and Contributions
6. Conclusion and Reflection

Applied perspective: Focus on rationale, outcomes, and lessons learned



Intro



- Leon Pietschmann, XR Lead at THW
- Research focus on HCI in XR, visual guidance and spatial intelligence (AI + XR)
- Prev. XR Advisor & Researcher at Boston Consulting Group, Harvard, Cambridge



- Federal Agency for Technical Relief (THW) is Germany's national emergency organization
- Approx. 90.000 members (98% volunteers)
- 670+ sites across Germany and beyond

Motivation

Challenges

- Decentralized training setup
- Complexity, logistics and risks of training
- Realism, safety, consistence of training

May VR improve training in the context of emergency service (ES) training?

- Prior studies show promising results
- Scalable, asynchronous, low-risk supplement to hands-on practice
- Limited knowledge about challenges and ROI at scale

Project Initiation

- Multi-year research project with THW
- Aim: create immersive training system that fits into existing structures
- Key question: can asynchronous VR preparation improve ES readiness at scale

Investigate:

- National deployment and maintenance
- Course pass rates (enabling ROI estimate)
- User and trainer feedback

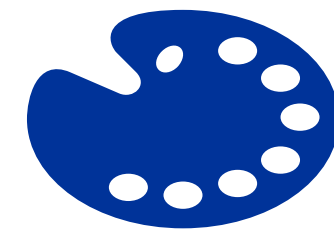


Study and System Design



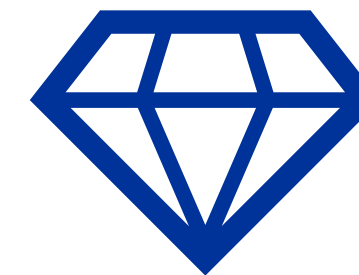
Selection

- Scaffolding (EGS) certification course
- Low pass rates
- Improve training readiness
- Spatial component
- Asset availability



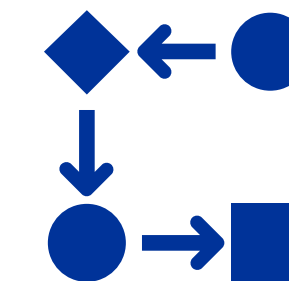
Co-Design

- Early integration of domain experts
- Targeted application design + acceptance
- Viewer mode and assembly practice
- Adaptive difficulty



Comparison

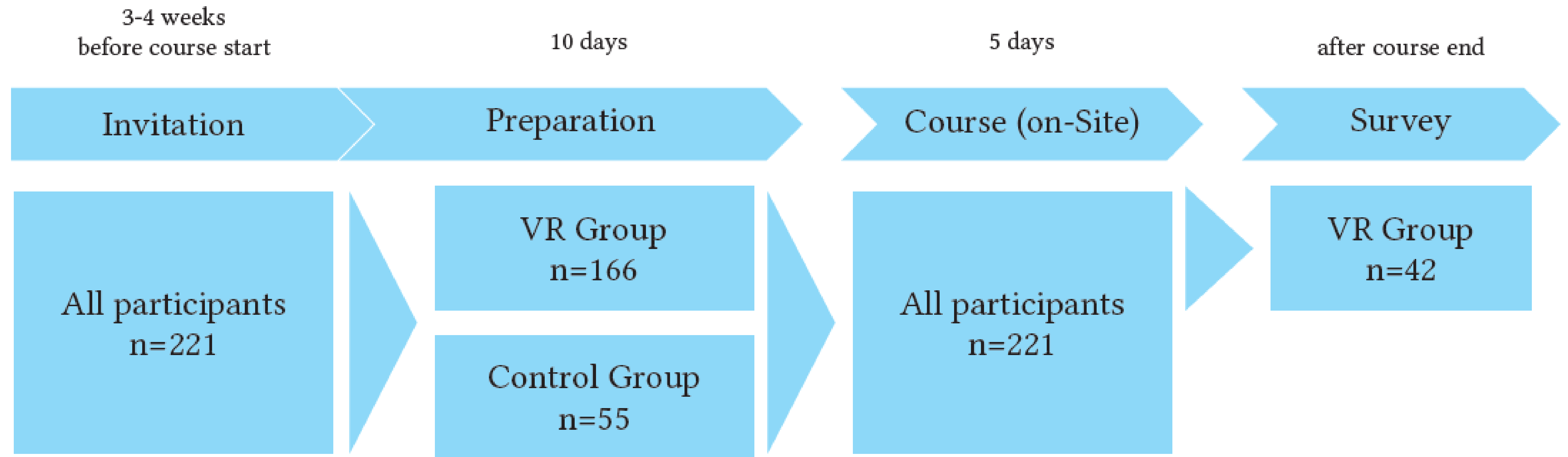
- Between subjects design: VR vs non-VR
- 13 cohorts across two years (n=221)
- Data sources: course pass rates, surveys, observations



Embedded

- Augmenting existing training course
- Designed for ecological validity
- Hardware sent 2-4 weeks before course

Study and System Design



Use Case EGS

- **EinsatzGerüstSystem** (EGS) = Emergency scaffolding
- Versatile tool for rescue and stabilization
- Quick setup and nationwide availability
- High training effort and complexity



Vehicle decontamination



Structural support



Rescue from heights and depths 7

Deckenabstützung

00 : 01

Willkommen zum Training!

Wir führen dich in den nächsten Minuten durch den Aufbau der Deckenabstützung 2m.

Weiter





Evaluation and Findings

Improved course pass rates

- 21% improvement in pass rates (n=221)
- Statistically significant (Linear regression, $p < 0.01$)

High user acceptance

- Reported improvements in confidence and familiarity
- Users valued hazard-free, repeatable, flexible training

Identified challenges

- Scepticism about replacing practical training
- Logistical overhead + minor cases of cybersickness





Outcomes

Discussion

- Strong pass rate improvement likely linked to XR preparation ($p < 0.01$)
- Positive user evaluations with some concerns
- XR seen as a supplement, not a replacement for drills
- Flexibility and adjustable support valued by responders
- Early instructor involvement critical for acceptance
- Survey responses yielded further use cases

Contributions

- Embedding: real-world setting, workflows, and training data (ecological validity)
- Scale: evaluation based on more than two hundred participants across 13 cohorts
- Evidence: strong empiric evidence for sustainable XR benefits in ES context
- UX: Design implications based on lessons learned and user feedback
- Blueprint: Practical lessons for scaling immersive systems in large organizations

Conclusion



Positive evaluation

- Measurable improvement
- Strong acceptance from users/trainers
- Live integration



Success factors

- Early co-creation with practitioners
- Matching XR's USPs with training needs
- Robust evaluation



Contributions

- Ecologically valid empiric evidence
- Blueprint for future XR deployments at scale

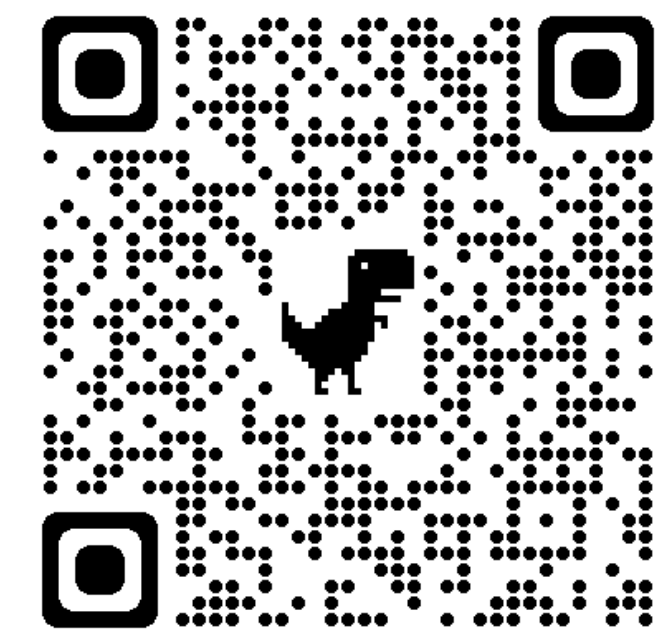
THANK YOU!

Stay in touch!

Leon Pietschmann



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