



# AUGMENTED REALITY-BASED FIRE SAFETY FOR PUBLIC USAGE

FIRE SIMULATION AND SAFETY TRAINING  
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**SMART Objective: Self-acquisition of skills in active fire protection for the goods and people safety**

**Even if we hope for the best, we should plan for the worst !!!**

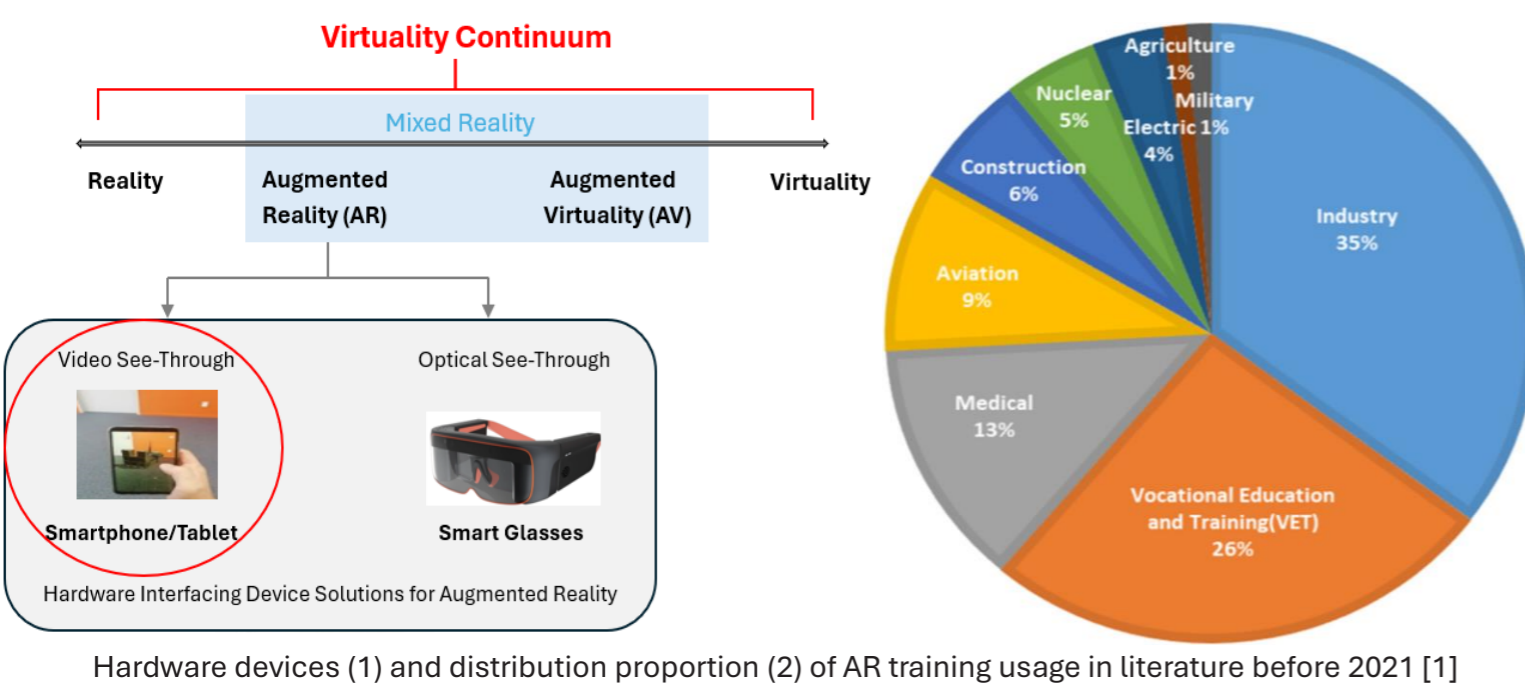
**What?** Improving the quality of fire safety training to foster well-preparedness

**Why?** Irreplaceable material and human damages caused by fire hazards lead to very huge costs

**How?** Regular monitoring of current technological developments for training, in conformity with International fire safety regulatory frameworks

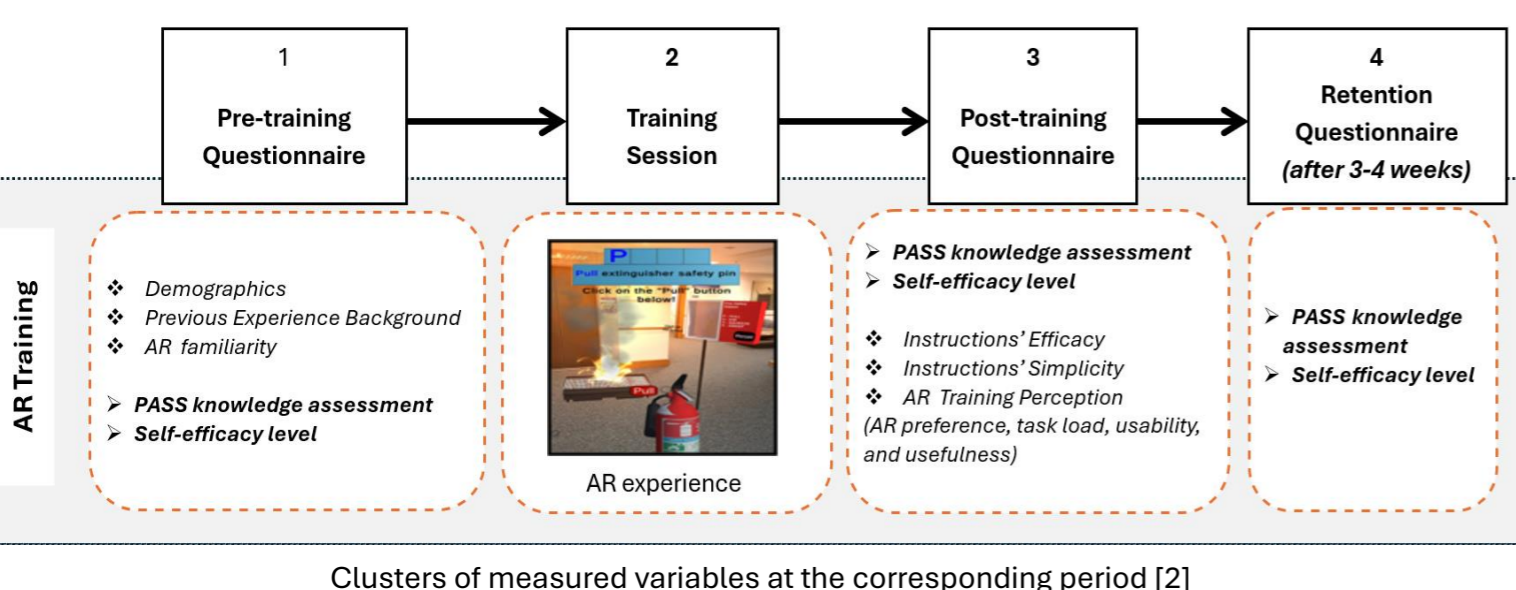
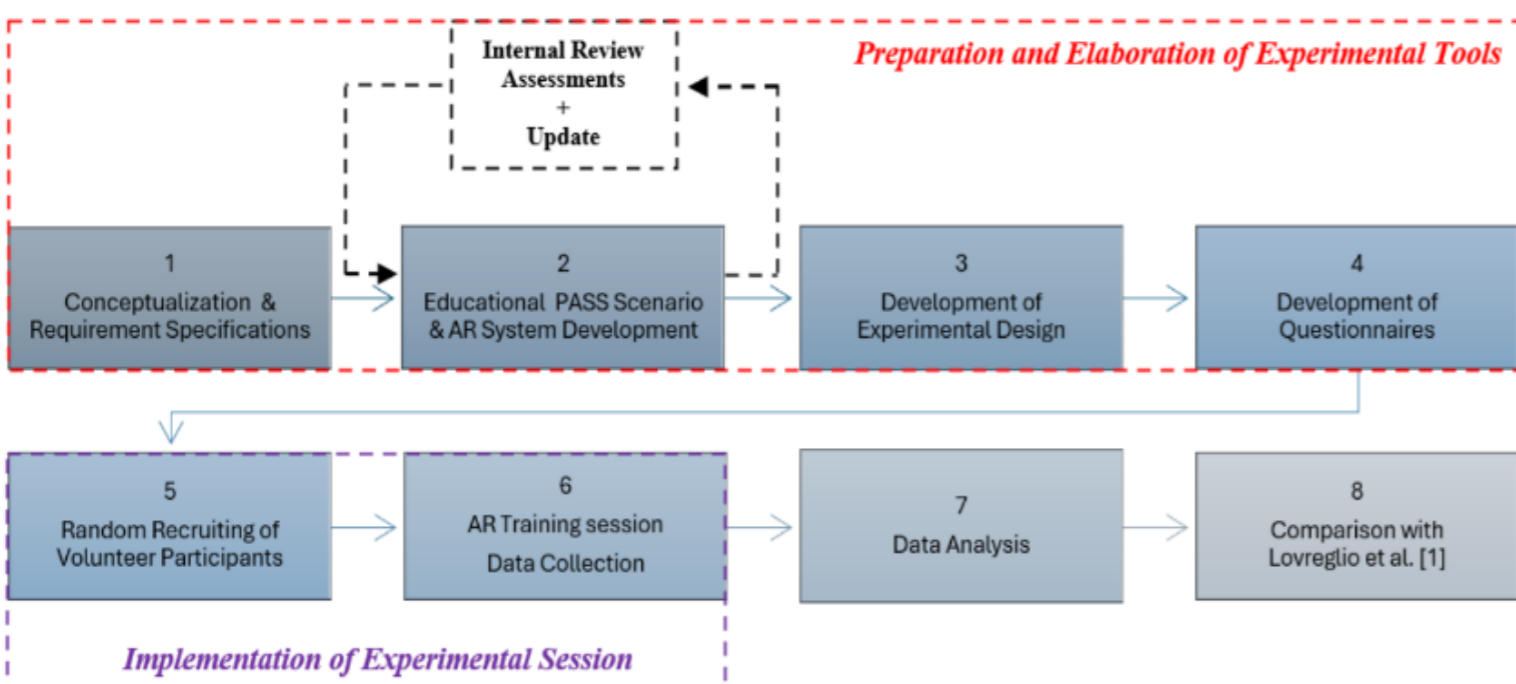
## RESEARCH CONTEXT

- Hands-on firefighting training requires fire permits and logistic constraints;
- Conventional/traditional training tools are sometimes pedagogically inefficient and time-consuming organization;
- Need to foster performance and engagement level during fire training and enhance fire suppression abilities through real-life scenarios;
- Ongoing innovative computer-generated training approaches to stimulate the perception degree (based on **eXtended Reality technology** such as **VR, AR**);
- Explore the effectiveness of VST AR tool in Fire Safety Training.



## METHODOLOGY

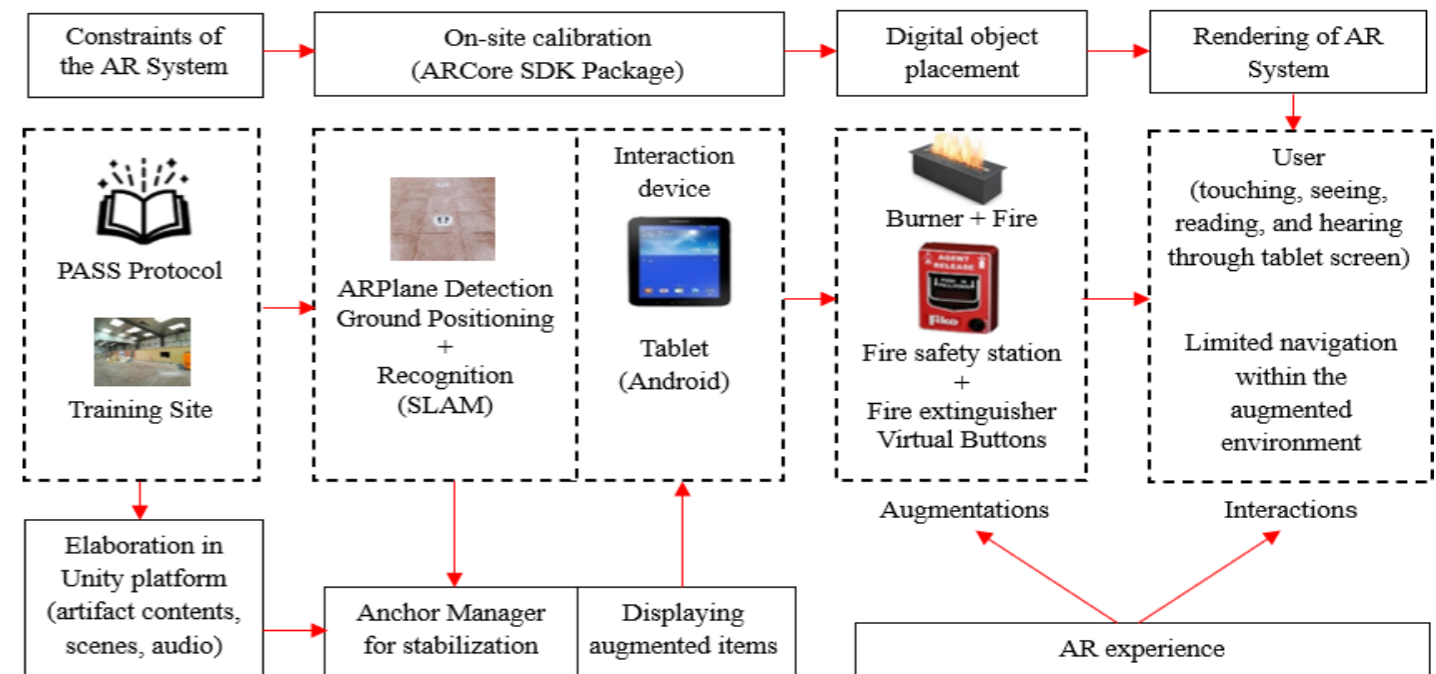
- Measure and analyze the beneficial impact, on people, of an AR-based fire extinguisher usage to put out a fire (PASS procedure);
- AR (*digital objects overlaid on real-world environment*), VR (*full immersion in virtual environment with artificial elements*), and Video harmless training compared through the same experimental process



## CONCLUSION

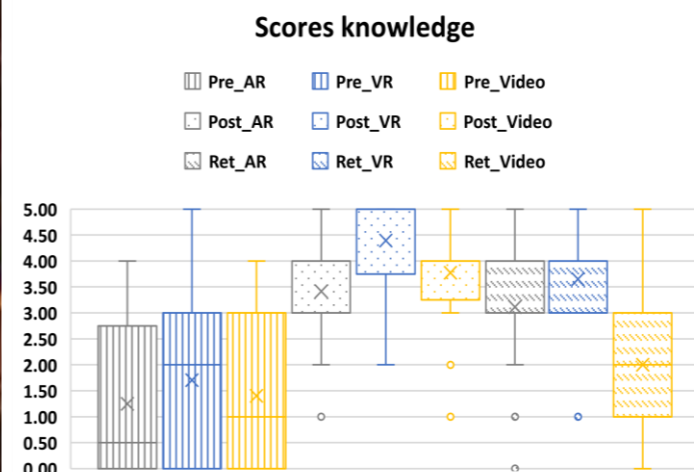
- Correct and timely actions are critical factors in reducing fire outbreak's impact
- The proposed AR approach demonstrates the ability to self-train users more realistic, active, retentive over time, and quite practically, without any risk exposure to real hazards;
- AR training outperformed traditional video training regarding knowledge acquisition and retention, but was not as effective as the VR experience;
- Further work will investigate the use of a real fire extinguisher in an augmented environment for a practical and eco-responsible training with other senses involved.

## DIGITAL ECOSYSTEM

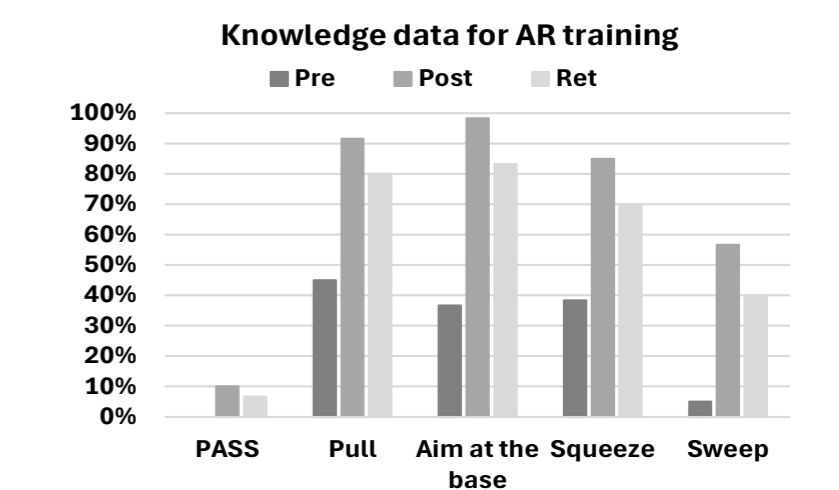


## RESULTS

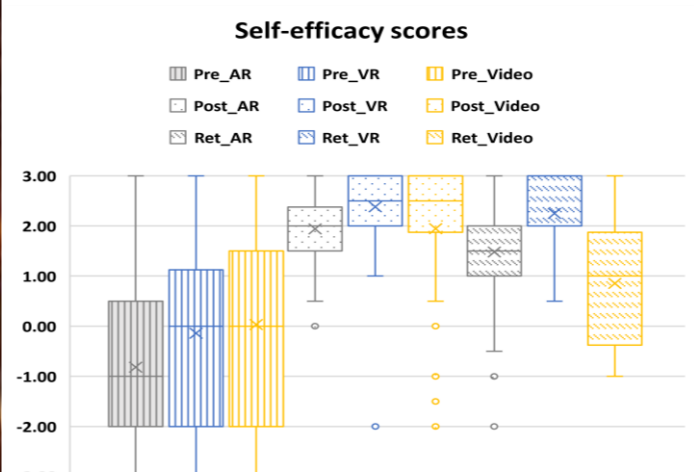
- Kolmogorov-Smirnov & Shapiro-Wilk tests showed that across all measured variables only SUS data was normally distributed ;
- Within group pairwise comparison in the AR sample: Wilcoxon signed-rank test;
- Between group pairwise comparison across the 3 samples: Mann-Whitney u test;
- A significance level of 0,05 was assumed to derive the p-value ;



Knowledge scores before, directly after, and 3-4 weeks after the training for the AR, VR, and video groups



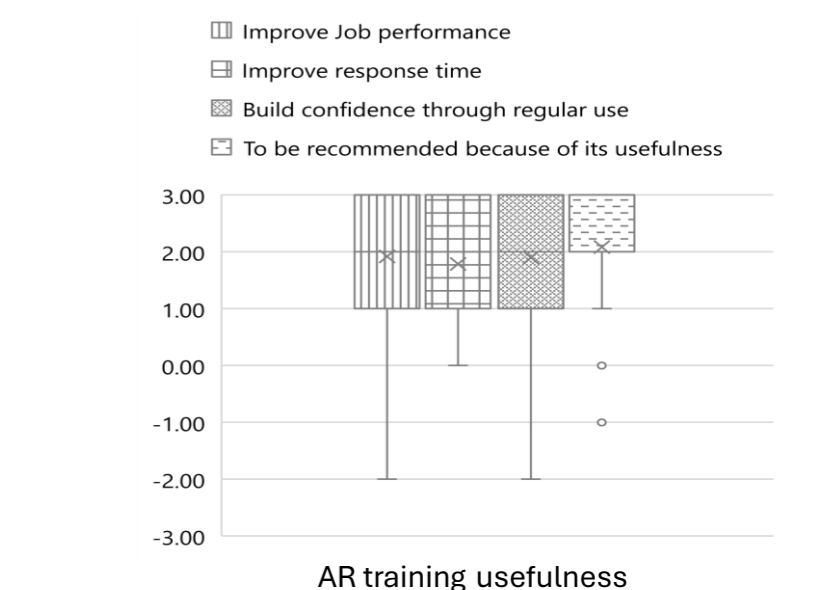
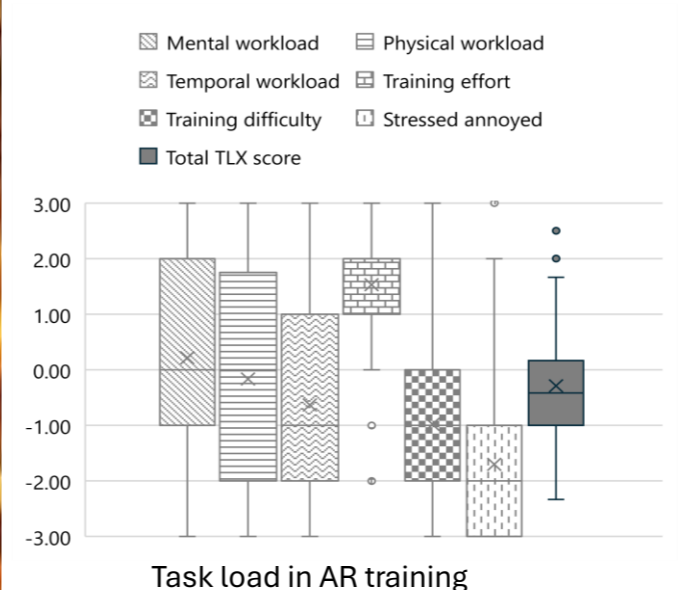
Segregated knowledge data for each evaluated item in the AR group



Self-efficacy scores before, directly after, and 3-4 weeks after the training for the AR, VR, and video groups



Qualitative words cloud from participants' experience report



## REFERENCES

- [1] F.-K. Chiang, X. Shang, and L. Qiao, 'Augmented reality in vocational training: A systematic review of research and applications', *Comput. Hum. Behav.*, vol. 129, p. 107125, Apr. 2022, doi:10.1016/j.chb.2021.107125.
  - [2] Lorraine Domgoue & al., *Video See-Through Augmented Reality Fire Safety Training: A Comparison with Virtual Reality and Video Training*, *Safety Science*, 2024, DOI: 10.2139/ssrn.4914272.
- To better understand AR :** Peizhen Gong & al., *Applications and effectiveness of augmented reality in safety training: A systematic literature review and meta-analysis*, *Safety Science*, Vol 178, 2024, DOI: 10.1016/j.ssci.2024.106624.