

# Immersive Training Solutions:

The Potential Role of Extended Reality for Safety and Skill Development in Offsite Construction



## Extended Reality (XR) may prove to be the solution for effective offsite construction training.

Extended reality (XR) offers risk-free environments for training, allowing workers to practice and prepare for hazardous situations. By examining parallel applications such as safety training and spatial awareness—as illustrated herein, with the summary of four key studies of XR-based educational interventions—the potential of XR for training in offsite construction becomes evident. These examples suggest that XR can effectively bridge the skills gap and provide comprehensive tutoring solutions for offsite construction. ■




References



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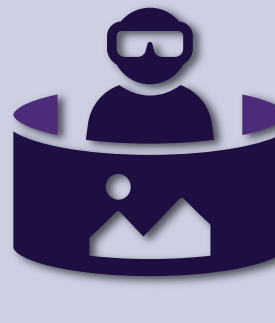


**Virtual Reality (VR)**

VR is a fully immersive digital environment that users can interact with as if it were real. Users typically wear headsets that block out the real world and create a sense of presence in a virtual space.<sup>[1]</sup>

### Evaluating Virtual Reality Simulations for Construction Safety Training:

The study demonstrates that VR simulations can lead to short-term learning effects concerning safety aspects, but the content of the simulation must match real-life experiences completely.<sup>[2]</sup>



**Mixed Reality (MR)**

MR blends both physical and digital worlds, allowing for interactions with both environments in real-time. It is more immersive than AR, as digital and real-world objects can coexist and interact seamlessly.<sup>[1]</sup>

### Construction Students' Experience with MR-Enhanced Learning in VR And AR:

Using mobile MR with BIM<sup>Ⓢ</sup> to enhance learning for construction students creates engaging environments but needs to manage cognitive load and motion sickness. Deeper integration in curricula is suggested to improve learning outcomes and engagement.<sup>[4]</sup>

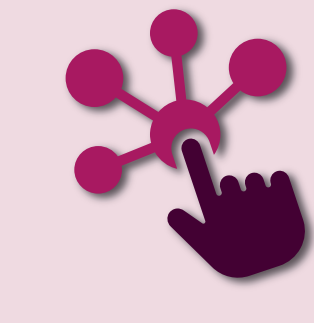


**Augmented Reality (AR)**

AR overlays digital information onto the real world. Unlike VR, users see and interact with their physical environment, with layers of digital content. This can be experienced through devices like smartphones, tablets, or AR glasses.<sup>[1]</sup>

### Using AR Video in Enhancing Comprehension for Construction Management Students:

The study shows AR, when combined with traditional lectures, improves students' ability to understand and identify construction processes and spatial-temporal constraints. It offers a more immersive learning experience.<sup>[3]</sup>



**Tangible User Interface (TUI)**

TUI involves the physical manipulation of digital information through physical objects. These interfaces involve physical objects that can be grasped and manipulated to control digital functions.<sup>[5]</sup>

### A Study of Carpenter Apprentices' Spatial Skills:

The study highlights the importance of spatial skills for carpenters, emphasizing visualization skills. It suggests that spatial skills training, especially using TUIs, can enhance learning and benefit other vocational and STEM<sup>Ⓢ</sup> fields.<sup>[6]</sup>

### Research Context:

Despite extensive research on workplace training and XR applications, a specific gap exists in offsite construction training.<sup>[7][8]</sup> While XR shows promise in other fields and construction safety training, its broader potential in offsite construction remains underexplored. ■

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### Innovative Training Solution:

Integrating XR technologies into offsite construction training can leverage its success in safety and spatial awareness applications. This approach addresses unique offsite construction skills with immersive, hands-on experiences in a risk-free environment. ■

Ⓢ BIM = building-information modeling

### Practical Implementation:

XR training in offsite construction can enhance safety, improve skill acquisition, and offer cost-effective solutions. Realistic simulations and comprehensive scenarios can bridge the skills gap, preparing a competent workforce for industrialized construction.<sup>[9]</sup> ■

Ⓢ STEM = science, technology, engineering, and math

### Future Research:

Continued exploration of XR training's long-term effectiveness and scalability, along with developing realistic VR scenarios for diverse tasks,<sup>[2]</sup> can revolutionize offsite construction education, equipping workers with essential skills for a safer, efficient future. ■