



Developing a Design-Based Research Methodology that Utilises Mixed-Reality (MR) Technologies to Enhance learning for Authentic High-Risk (or Extreme) Situations

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Abstract:

Even experienced mountain climbers underestimate key dangers and make poor decisions in stressful, high-risk situations when climbing, leading to injury and death. Effective education can play a key role in managing these risks and improving experienced climber's decision making. Current educational approaches for climbers, however, are generally limited to textbooks and 'on the mountain' learning. It is vital, therefore, that new approaches and methods are developed to improve learning.

Emergent case studies indicate that VR (Virtual Reality) and MR (Mixed Reality), have affordances (possibilities offered by the technology) to underpin new forms of learning and therefore have the potential to enhance education for high-risk environments. An initial review of literature has indicated though that there are very limited examples of rigorous research on the design and application of MR technologies in authentic education, especially for extreme situations such as mountaineering.

In response to this gap/opportunity, this research explores the potential of MR technologies to effectively enhance learning for authentic, high-risk situations. The research uses a Design-based research methodology (DBR) to develop initial design principles informed by key learning theories as they offer recognised and critical approaches for a new way of learning in an extreme environment. Underpinned by a Constructivist paradigm, initial theoretical frameworks identified include Authentic Learning and Heutagogy (student-determined learning). These initial design principles are evaluated through the implementation and evaluation of an MR 'prototype' educational app design solution. The MR app will simulate high altitude environments, therefore, enabling mountaineers to experience and learn how to troubleshoot risky obstacles such as altitude sickness, endless crevasses, ice cliffs and frostbite within a safe simulated environment.

The presentation shows the rationale and significance of the study. It shows that there is a significant opportunity for enhancing and improving learning for high-risk situations such as mountain climbing. The presentation shows that this research will lead to significant outcomes, and there will be a range of tangible benefits. Initial research proves that MR technologies while being utilised in some educational contexts, they have a substantial potential to effectively enhance learning for authentic high-risk situations (such as mountaineering). Specific benefits include the development of:

- Practical applications of MR technologies i.e. prototype MR apps for learning situations
- Optimised design principles for using MR technologies in education
- A better understanding of how design-based research can be applied to MR technologies
- The identification of key affordances for MR technologies in broader learning contexts

And also the presentation shows how learning pedagogies including heutagogy or self-determined learning can be applied. In addition, and most importantly, this research contributes to the reduction in accidents and improve safety in high-risk environments, and the research.



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