



Can Extended Reality Replace 'Real' Learning Experiences?

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I am speaking this week at GITEX Global, the world's largest tech and start up event, on the theme of Extended Reality. Extended Reality (XR) technologies have moved from the periphery to the core of education's future, with immersive experiences offering new ways to engage students, simulate environments, and foster creativity. The possibilities for virtual and augmented reality, which blend real-world and virtual elements into a cohesive learning experience, seem boundless. But despite the promise of XR as a transformative educational tool, a crucial question remains: can XR replace traditional learning? Or is its real value found in complementing existing educational methods?

In preparation to discuss this question and many others with my fellow speakers and conference participants, I will delve here just for a moment into the potential and limitations of XR technologies, drawing on current applications, educational challenges, and the broader implications of XR as both a tool and possible replacement for conventional learning environments.

Maybe this will prompt you to engage with myself, Dr Zhang and Prof Kachaamy as we debate the opportunities and issues this week?

Enhancing Engagement and Creativity in Learning

One of XR's most compelling arguments is its ability to heighten student engagement and creativity. Unlike traditional classroom environments, which rely heavily on passive learning (listening, reading, observing), XR offers an immersive experience that allows students to *do*. Whether it's conducting virtual science experiments, touring historical sites in 3D, or simulating real-world scenarios like medical procedures or engineering tasks, XR gives students the chance to engage with content in dynamic and interactive ways. Research suggests that this level of engagement not only boosts knowledge retention but fosters creativity, as students can manipulate virtual environments and test hypotheses in ways impossible in physical classrooms.

Dr. Christina Yan Zhang from the Metaverse Institute advocates for this aspect of XR, arguing that immersive technologies allow learners to "experience the world beyond their immediate surroundings," a benefit particularly relevant in fields like architecture, medicine, and engineering, where real-world simulations can be far more engaging than textbook theories. The ability to walk through a virtual version of the Colosseum or the Great Wall of China, for instance, offers a visceral experience that books or videos cannot replicate.

However, while XR holds promise in enhancing engagement, it raises the question: does increased immersion necessarily lead to deeper learning? It's important to recognise that engagement alone is not synonymous with understanding. Many critics of XR in education point out that its high-tech allure could distract from learning objectives. Instead of focusing solely on the immersive aspect, educators must ensure that XR content is pedagogically sound and integrated into a broader, thoughtfully designed curriculum.

Simulating Hands-On Experiences: Can XR Rival Traditional Learning?

One of the key promises of XR is its ability to simulate hands-on experiences. Virtual dissection tables for biology students, interactive chemistry labs, or even flight simulators for aviation trainees are just a few examples of how XR replicates practical learning. In fields like healthcare and engineering, where real-world practice is crucial, XR provides a safe environment where students can make mistakes without real-world consequences. This ability to simulate high-risk scenarios makes XR especially useful for fields that require hands-on training.

Yet, can these simulations truly rival the tactile, sensory, and often unpredictable experiences of real-world practice? Georges Kachaamy, Director of the Center for Research, Innovation, and Design at the American University in Dubai, notes that while XR can closely mimic hands-on experiences, it cannot fully replicate the unpredictability of real-life learning situations. “You can simulate the flight,” Kachaamy explains, “but can you simulate the feeling of turbulence or the panic of an engine failure in real-time? There are certain intangibles that XR, for all its sophistication, simply cannot reproduce.”

Furthermore, the limitations of XR in developing certain skills, particularly those that rely on fine motor control or physical dexterity, become apparent in fields like surgery or craftsmanship. VR surgery simulations, for example, are remarkable tools for teaching procedure, but they cannot fully replicate the tactile feedback of cutting tissue or the resistance felt when suturing. As such, XR should not be viewed as a wholesale replacement for hands-on practice but rather as an augmentative tool that prepares students for real-world challenges in safer, lower-stakes environments.

Challenges in Integrating XR into Everyday Education

While the potential benefits of XR are clear, the path to integrating these technologies into everyday education is riddled with challenges. Cost is one of the most immediate obstacles. High-quality XR equipment—virtual reality headsets, AR glasses, haptic feedback devices, and the computing power required to run immersive applications—remains prohibitively expensive for many educational institutions, particularly those in low-income or developing areas. Moreover, developing bespoke XR content requires significant investment in both time and expertise.

Dr. Neil Hopkins, Director of Education at Fortes Education in the UAE, highlights this challenge, noting that “for many schools, especially those in developing regions, the cost of XR implementation is simply beyond reach.” While technological advancements will inevitably lower costs over time, this leaves a gap in access that threatens to deepen educational inequalities between wealthier and poorer institutions.

Moreover, institutions face challenges in adapting curricula to XR technologies. Traditional pedagogy is still heavily reliant on print materials and lecture-based instruction, and educators themselves may lack the training or confidence to integrate XR meaningfully into their lessons. Without proper training, XR risks being used superficially—more as a novelty than as a genuine learning enhancement. Addressing these barriers requires systemic change, from teacher training programs to policy-level investment in XR infrastructure.

Can XR Replace Face-to-Face Learning?

A recurring question in the debate over XR’s role in education is whether it can replace traditional face-to-face learning. Proponents of XR argue that virtual learning environments can replicate much of what physical classrooms offer, from peer collaboration to teacher-student interaction. With avatars and virtual spaces, students can engage in group work, attend lectures, and even socialise in ways that mimic real-life classroom dynamics.

However, critics warn against assuming that virtual interaction can fully replace the nuances of in-person learning. Face-to-face learning provides immediate, non-verbal feedback—facial expressions, body language, and the spontaneous energy of live discussion—that XR, despite its sophistication, cannot fully replicate. There’s also the concern that prolonged immersion in virtual environments may erode essential interpersonal skills, such as emotional intelligence and the ability to navigate complex social situations in the real world.

Kachaamy, whose research spans the intersection of architecture and XR, echoes these concerns: “In architecture, design is as much about human interaction as it is about spatial awareness. While XR can simulate space, it cannot teach the kind of human, emotional response to physical spaces that you only gain through experience.”

Thus, XR is best viewed not as a replacement for face-to-face learning, but as a complementary tool. It offers benefits that traditional classrooms cannot, particularly in terms of accessibility, simulation, and engagement, but it is not a panacea. The goal should be to integrate XR in ways that enhance, rather than replace, the rich, multifaceted experience of in-person education.

Balancing XR’s Potential with Its Limitations

The key to harnessing the power of XR in education lies in striking the right balance between its potential and its limitations. While XR offers unprecedented opportunities for immersion, engagement, and simulation, it cannot fully replicate the complexity and richness of real-world learning experiences. Furthermore, its high costs, technical challenges, and the risk of over-reliance on technology must be carefully managed.

This balance will require a thoughtful approach to implementation—one that recognises XR’s role as part of a broader educational toolkit rather than a standalone solution. For XR to reach its full potential, educators, technologists, and policymakers must collaborate to ensure that its integration is guided by pedagogical goals rather than technological trends. It is essential to invest in teacher training, develop cost-effective solutions, and ensure that XR complements, rather than displaces, the fundamental human elements of learning.

XR as a Complement, Not a Replacement

In conclusion, XR represents an exciting frontier in education, offering new ways to engage students, simulate experiences, and break down the barriers of physical classrooms. Yet, it is clear that XR is not poised to replace traditional education. Instead, its strength lies in complementing and enhancing existing methods. The future of XR in education depends on a thoughtful, measured approach—one that leverages its immersive potential while remaining grounded in the essential, irreplaceable elements of face-to-face learning.

The questions raised by XR’s integration into education are important and complex. How can we balance innovation with sustainability? How do we ensure access and equity in a world where cutting-edge technology is often prohibitively expensive? And most importantly, how do we make sure that XR enhances rather than replaces the human, interactive essence of learning? As we move forward into the future of education, these are the questions that educators, technologists, and institutions must answer together.

