

Designing AR/VR Learning Experiences for K-12 and Higher Education

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Abstract. Join us for an insightful panel presentation with Canadian teacher-scholars, instructional designers, and multimedia developers. Each panellist will share a case study and research findings focussed on integrating AR/VR technologies in service to the teaching and learning mission. We highlight the need for designing immersive learning experiences and environments to meet specific educational goals and learning objectives. Practical recommendations will offer tangible curricular resources and innovative instructional strategies. We aim to inspire and provoke discussion around immersive education challenges and possibilities, including accessibility, safety, assessment, presence, social interaction, and shifting learning into the global classroom. Guests will gain a deeper understanding of how AR/VR technologies are impacting K-12 and higher education.

Keywords: Immersive Learning, Instructional Design, Gamification, Pedagogy, AR, VR.

1 Introduction

The panellists will report a series of five-minute case studies to offer practical recommendations for integrating AR/VR technologies for learning: 1) Meaningful Integration of AR/VR in the Classroom, 2) The Haunted Garage: Gamifying Learning using Mozilla Hubs, 3) AR to Enhance Science Education, 4) Seeing All the Facts You Learned: The Lived Learning Experience of Students in a Pedagogically Focused VR Experience, 5) Immersive Learning through VR in Elementary Science, 6) Reimagining Early Childhood Environments with Immersive Learning, and 7) High School Theatre in Immersive VR. Case study abstracts are described in Sections 2 to 8.

Discussion questions addressed by the panellists (see Fig. 1):

1. If you could make one thing possible in AR/VR for education, to enhance teaching and learning for yourself or your students, what would it be?
2. What are the current technical challenges or pedagogical limitations for immersive education?
3. How can AR/VR learning experiences foster play as a foundation for learning?
4. How can we achieve greater teacher engagement (e.g., providing a good case for those curious about immersive technologies but haven't experienced them)?



Fig. 1. A rehearsal of the panel presentation for the iLRN 2022 conference.

2 Meaningful Integration of AR/VR in the Classroom

AR/VR applications can be integrated into lessons across the curriculum with basic knowledge of technology at a viable cost. AR/VR tools can bridge the gap between students' need for experiential learning and traditional passive teaching methods. This study reviewed research papers on educational AR/VR to synthesize the affordance and constraints for classroom learning. Two detailed lesson plans were created to demonstrate meaningful integration of AR/VR in a science class at the Grade 8 level. Findings report that AR/VR can make learning more engaging, increase students' knowledge retention, create an environment for a better understanding of abstract concepts, and allow students to learn experientially. While integrating new technologies has pedagogical limitations and reluctance from stakeholders, AR/VR can positively change how 21st-century learners interact and learn in the classroom. AR/VR offers meaningful opportunities for all educators to embrace new educational innovations and enhance their daily lessons and teaching routines.

3 The Haunted Garage: Gamifying Learning Using Mozilla Hubs

At the University of Saskatchewan Language Centre, I am a member of a student support team providing cultural, linguistic, curricular, and technological support in a hybrid model for international students. Learning English online hosts benefits in terms of accessibility and recordable content but also has challenges for meaningful student engagement. To enhance the student learning experience, we hosted open Zoom sessions on Fridays for all levels of our program to meet and interact. The design of the Zoom sessions was complex, with many logistical and technical conditions and factors to consider, including multiple time zones, Zoom fatigue, student demographics, varying levels of ability with online gaming, bandwidth and hardware limitations, study environment and terminology. One particularly successful activity was utilizing Mozilla Hubs to introduce Halloween. This activity allowed students to present themselves as something other than just a face on a screen by paralleling the practice of wearing costumes at Halloween using avatars they created. Students embraced the freedom to speak and listen more actively, to have their avatar jump, fly, run, touch, and explore the virtual environment. As Halloween is not a global practice, students were excited about a novel online classroom experience. This activity met the university's *Learning Technology Ecosystem Principles* in terms of being accessible, active, creative, designed for student growth and ownership, and most importantly, enabling connection among students worldwide.

4 Augmented Reality to Enhance Science Education

This research explores the affordances and constraints of an AR beehive exhibit designed to spark students' curiosity about science. In this case study, AR technologies increased intrinsic motivation for interacting with the learning materials, leading to students attaining personal understanding and developing relational connections to science concepts. AR allowed students to explore the beehive exhibit creatively in an interactive digital experience that augmented the physical learning environment. The AR experience offered a situated and contextualized knowledge exchange by connecting science learning with entertaining, hands-on activities. Findings indicate that the AR activities enhanced student agency to learn in their ways and on their terms, thereby increasing critical thinking and curiosity for solving science problems. The presentation will describe the design framework used for developing the AR application and strategies to align the immersive design with specific learning goals.

5 Seeing All the Facts You Learned: The Lived Learning Experience of Students in a Pedagogically Focused Virtual Reality Experience

This research explores the relationship that presence has on learning in virtual environments designed for high school students. Data will be reported from an interpretive phenomenological analysis (IPA) of a pedagogical informed virtual learning experience simulating the solar system. Participants include five grade nine students; methods include semi-structured interviews and video observations. Grounded by a phenomenological lens, the study contributes to understanding the sense of autonomy and freedom (real and illusionary) that participants perceived in the virtual learning experience.

6 Immersive Learning through Virtual Reality in Elementary Science

Many teachers struggle to provide hands-on experiments for their kinesthetic learners. Setting up, cleaning up, and collecting all the supplies for large class sizes is exhausting and time-consuming. While Adobe Flash Player offered a treasure trove of free and accessible science learning tools, Flash was recently discontinued. Teachers who use Flash interactives and animations are now challenged to provide students with supplementary science experiences (without the prohibitive material requirements and extra preparation time). Fortunately, recent advances in immersive technologies allow teachers to offer high-quality, hands-on science learning opportunities through VR. As with most new technologies, teachers are often unsure where to begin or what VR applications are worth their time exploring. This research guides elementary science teachers on meaningful possibilities for integrating powerful and engaging immersive learning experiences into their classrooms and schools.

7 Reimagining Early Childhood Environments with Immersive Learning

Play is foundational to effective early childhood learning environments. By using a multi-sensory approach to learning whereby children are engaged in open-ended play using various learning tools and collaborative opportunities, they can deepen their understanding of the world around them. They form relationships with others and discover new topics they are passionate about pursuing. Integrating play-based immersive experiences to spark curiosity and passion for learning is a novel idea for enhancing early childhood education (ECE). Recent technical innovation in designing immersive environments expands the

possibilities for supporting children to learn in authentic and creative ways within a holistic ECE program. This presentation will explore the benefits and constraints of immersive learning as a catalyst for play-based early childhood learning experiences. I will highlight practical and imaginative ways for integrating immersive learning with the ECE environment to support academic and social-emotional skills.

8 High School Theatre in Immersive Virtual Reality

Grounded by current literature on the affordances and limitations of immersive virtual reality (IVR) for learning, this research followed high school students designing an immersive theatrical performance. A youth theatre group was tasked with writing, workshopping, directing, rehearsing, and performing a play for a live studio audience in AltspaceVR. Findings report how youth are experimenting with immersive technologies to take traditional theatre in new directions, including responsive narrative, actors/actresses performing as digital avatars, and placing the audience within the storyline. The presentation will highlight pedagogical strategies and design recommendations for working with youth to integrate IVR theatre experiences in secondary education.

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