Using Mixed Reality (MR) in Online Learning

Twenty-first century learning environments are technologically advanced places. Mixed Reality (MR) refers to the practical blend of physical and digital environments. It offers the opportunity to significantly increase students' engagement and learning by re-imagining pedagogical approaches used in traditional educational spaces (such as teacher/learner presence, immediacy and immersion) through the affordances of digital learning.

This **Guide** explores two types of MR learning experiences especially suited for BYOD (Bring Your Own Device) online environments:

1. **Augmented 360 panoramic views**, where Augmented Reality (AR) is used to add context and content to the physical world and a means of interacting with it.
2. **Virtual Reality (VR) experiences** that take the learner into a virtual environment, whether fictional or a simulation of reality, and provides opportunities to interact and learn while fully immersed in this virtual space.

In a later guide we explore a logical extension to implementing MR in online learning, that of mobile mixed reality (MMR) which augments a user's view of the real world with location-specific information in the form of simple text, image, multimedia or 3D graphics.

What is Mixed Reality?

Mixed Reality (MR) is a blend of the real and virtual worlds. The reality-virtuality spectrum (see Figure 1) was first proposed by Milgram and Kishino (1994). In this model, 'Augmented Reality' (AR) keeps the real world central but enhances it with digital information while 'Virtual Reality' (VR) tricks your senses into thinking you're somewhere else.

Other than the real world (the one we live in!) these are the two most common approaches.

8 October 2020

High-fidelity simulation ... Low-fidelity simulation

Real environment — Augmented reality — Augmented virtuality — Virtual environment

Mixed reality
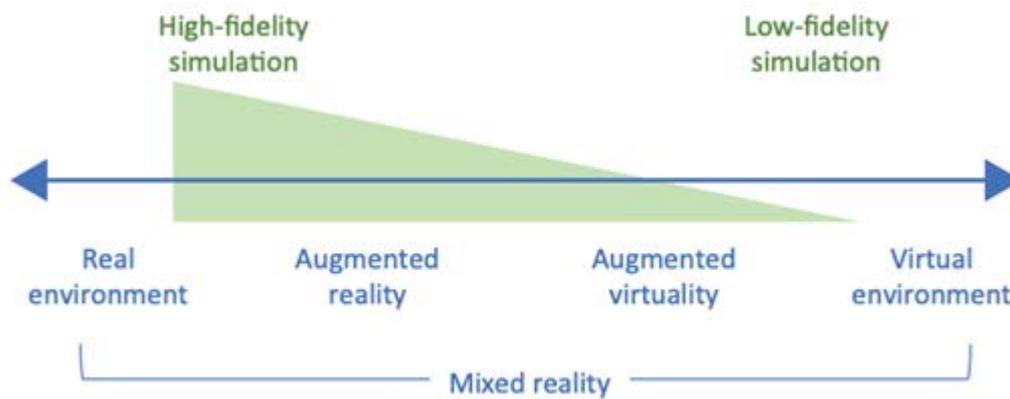
Integrating MR into the online teaching and learning environment enables traditional pedagogical tools and approaches (viz. presence, immediacy and immersion) to be used in new ways, to enhance student learning outcomes, motivation and engagement even when students are physically separated from one another and their teachers (Bronack, 2011).

Many education MR experiences are currently designed to be viewed via apps on smartphones. This offers institutions a low-cost BYOD environment for students to participate in MR experiences, making their use in online education ubiquitous (can be accessed almost anywhere), self-directed and hands-on.

This Guide will present examples of MR experiences which:

- deliver authentic learning in an online teaching and learning environment;
- lead to deeper immersion and student engagement; and
- can be easily replicated using low-cost hardware and apps.

Using Augmented 360 Panoramic Views in Online Courses

A 360 video or image panorama is a series of videos or images which have been 'stitched together' with software to produce a view in multiple directions.

Integrating Augmented Reality with 360 panoramic views can provide both online and on-campus students with learning opportunities that simulate a physical visit to that site (Gheisari et al., 2015).

In an educational setting views are frequently augmented with information related to the content and context of the scene, to make the experience authentic and interactive for the student. The augmented information can be in the form of text, audio, image, video or any other format compatible with web-based technologies.

Augmented 360 panoramic views can be easily created with relatively low-cost hardware and software.

Example 1 – 360 Panorama Images of a House Construction

This example is taken from a UniSA Online Construction course (CIVE 1005). It provides students with an experience of walking through a construction site while at their desk and includes videos with additional information. In conjunction with other online learning activities in the course, students use the annotated panoramas to learn the basic elements, procedures and practices associated with the domestic building and construction industry. They become familiar with the terms and terminology of the industry and conversant with the numerous facets of the construction industry.

The AR experience can be viewed on a computer, tablet or mobile phone but is not available for head-mounted devices (HMD).

Click on the image below to open a new browser window and a 360 panorama showing the timber framing stage in the construction of a domestic house. Use the drop-down menu (top centre) to go back in time to see the different stages of construction and use your mouse to move left and right around the building site and to zoom in and out to see detail. Watch the embedded videos, images and text that augment the panorama to provide a total experience for students.

The high-resolution images used in this example were photographed with a DSLR Camera mounted on a Gigapan™ robotic mount and stitched into the 360 Panoramas using Gigapan™ virtual tour software.
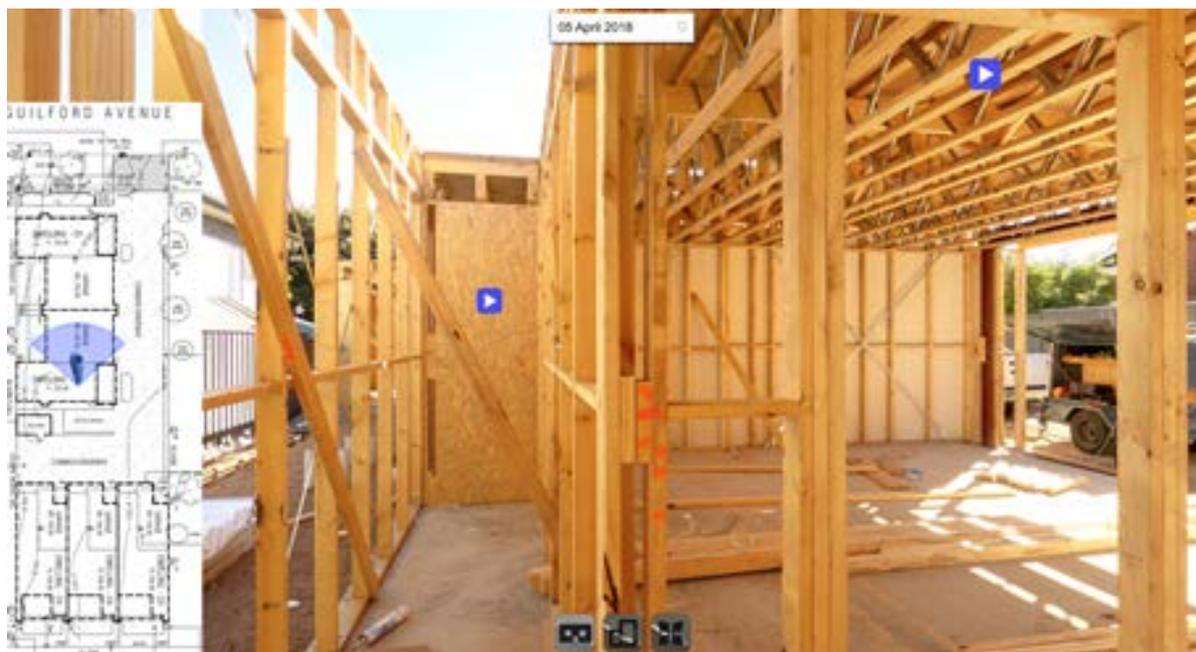
Figure 2 - Augmented 360 Panoramic Views of Timber Framing
(Source: https://uo.unisa.edu.au/course/view.php?id=1322)

Example 2 –3D Model Geo-tour of Hallett Cove

This example is drawn from ProjectLIVE (https://projectlive.org.au) a cross-disciplinary initiative at UniSA which uses immersive visualisation technologies to create flexible, interactive and engaging experiential learning exercises.

Hallett Cove is one of the best-known geological sites in Australia and internationally and has been declared a Geological Monument and Heritage Site.

Click on the image below to open a new browser window and experience an annotated 3D model of Hallett Cove. 'Visit' the different sites (there are 18) to explore immersive 360 images, interactive 3D outcrop models and deep zoom images of this amazing landscape. Orbit around with a left mouse click on a computer screen or use your finger to rotate the panorama on a mobile device.

If you want to experience most of the MR functionality without visiting every site, be sure to check out Site 11, the Wave-cut platform where the pop-up screen contains links to both 3D scans of rocks and superb 360 views of the surrounding landscape.

The high-resolution images used in this example were photographed with a DSLR Camera mounted on a Gigapan™ robotic mount. 360 images were stitched together in Kuula™ software and 3D models were created from his-res images in Sketchfab™ software.
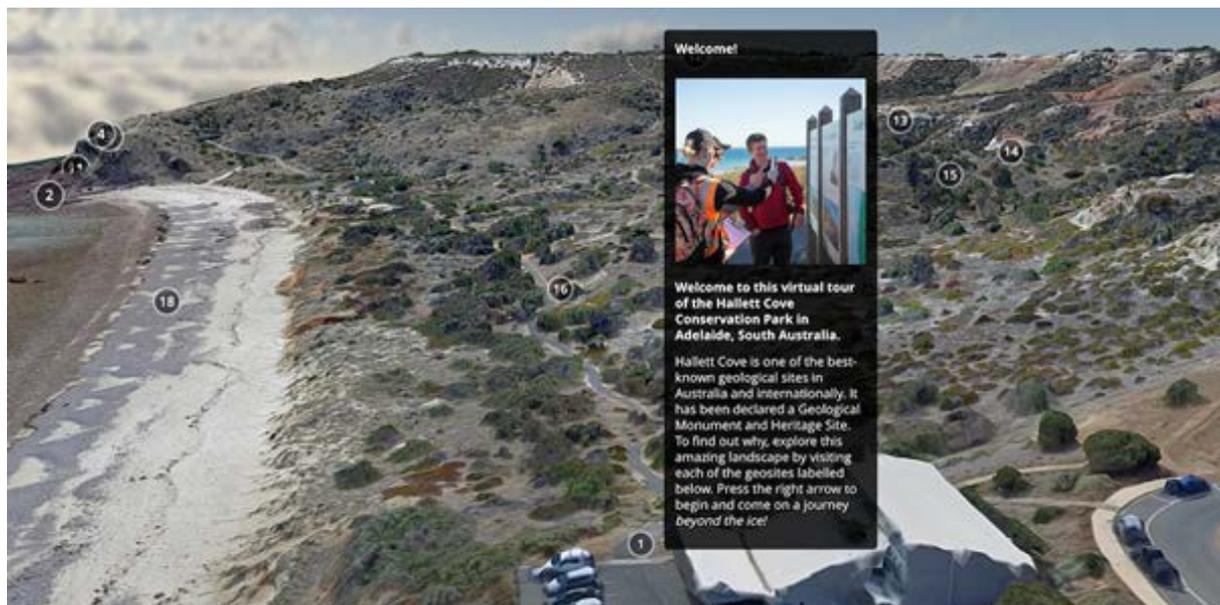

Figure 3 – Hallett Cove 3D Model Geotour (Source: UniSA Project LIVE http://projectlive.org.au)

Example 3 - Virtual Health Hub

This example of a Virtual Health Hub was developed by the Auckland University of Technology Learning Transformation Lab (altLAB) for its online (and on-campus) Health School students to encourage engagement and experience with the health teams with whom they will collaborate in real world situations upon graduation (Cochrane et al. 2018). AltLAB (https://altlab.aut.ac.nz) is a similar service entity to the UniSA Teaching Innovation Unit.

Click on the image below to open a new browser window and view a 360 panorama of the foyer in the Sir Paul Reeves building at AUT. Use your mouse to pan around the panorama then click on a hot-spot of an associated health discipline to view videos, images, websites and interactive scenarios that simulate the conditions and environment that health students would experience in the real world.

[Note: Not all the hotspots are currently active. Nursing, Physiotherapy and Midwifery are all functioning.]

The images used in this example were recorded with a LG 360 camera and assembled into the 360 Panorama using SeekBeak™ virtual tour software.
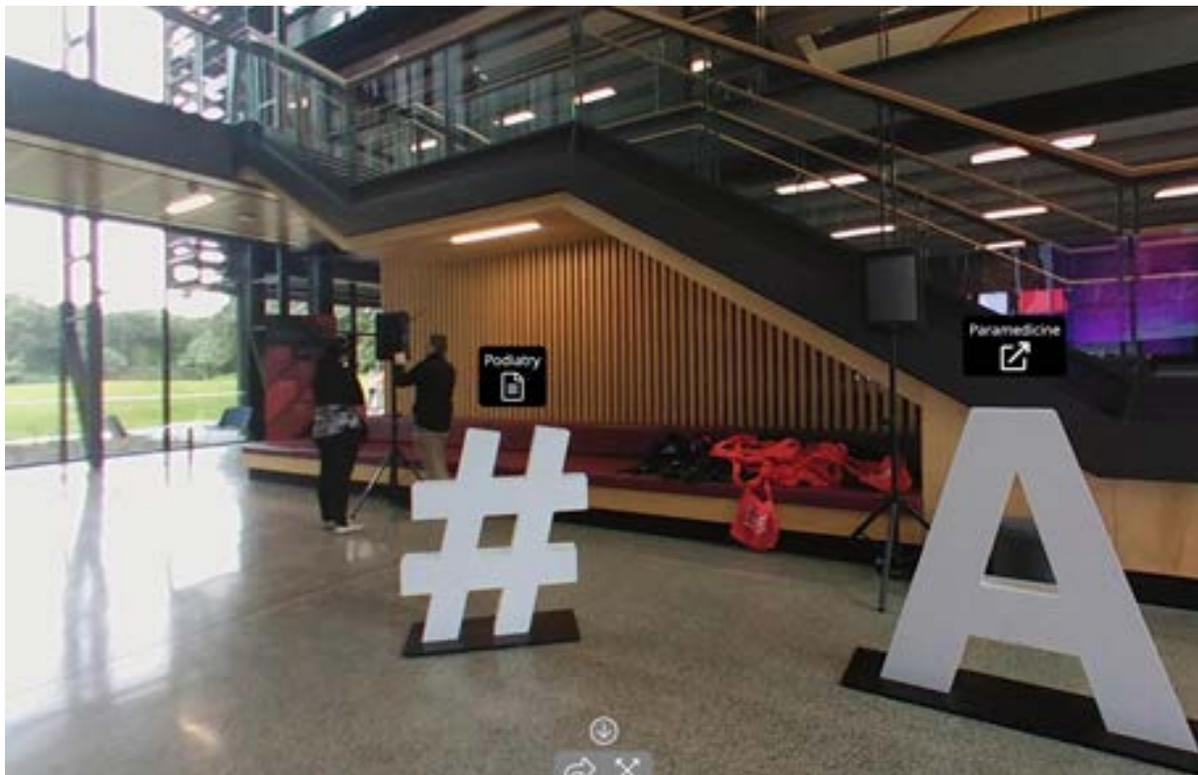

Figure 4 - Virtual Health Hub (Source: Cochrane, et.al. 2018)

Virtual Reality Experiences

Virtual reality (VR) is the term used to describe a three-dimensional, computer generated environment which can be explored and interacted with by a person. That person becomes part of this virtual world or is immersed within this environment and whilst there, is often able to manipulate objects or perform a series of actions to determine what happens in the environment (Virtual Reality Society, 2017).

Viewing a VR simulation on a BYOD can offer online students an inexpensive way to experience situated real-world learning in an authentic context wherever they are located. The focus is not on the need to be in a computer lab where the high-end technology required to display the experience is located, or to use the expensive HMD (head mounted devices) to view it.

Example 4 - Ambulance Simulation

This example like the previous one was developed by the Auckland University of Technology Learning Transformation Lab (altLAB) and shows a VR clinical simulation used in paramedical courses at AUT.

Its aim is to increase the authenticity for educating first responders to the real-world stresses involved in critically analysing environmental factors, patient diagnosis and treatment in paramedicine. The app used to view this simulation is free and it can be made immersive by using a mobile phone and an inexpensive HMD (e.g. Google cardboard goggles). You will need the free **WondaVR app** (http://wondavr.com) installed on your mobile phone and if possible, a HMD (e.g. Google cardboard) to view it, however it can also be viewed on a mobile phone screen for a less immersive experience.

For more details of the framework used for designing MR-enhanced clinical simulations and results of altLAB's surveys and biometric studies on the students undertaking the simulation, see Cochrane (2020).

Follow the instructions below to experience the VR simulation.

1. Download and install the free **WondaVR** app for either Android or Apple phones.

2. Open the app and scan the QR code opposite to load the video.

3. Place your mobile phone into a HMD (e.g. Google goggles) as per instructions for the device (optional).

4. Ensure you have open space around you (perfect for social distancing!) then look around and stand up.

5. Choose the appropriate viewing mode in the app (either mobile phone screen or HMD device).

6. A video will load and begin to play. The initial scenes show a waterfall for 30 seconds. This is to acclimatise you to the VR technology if using a HMD.

7. In the next stage you will transition to a static 360 panorama of the back of the ambulance including ambient sound. Move around to view the inside of the ambulance. Look up and down. Listen to the sounds and read the incoming message of an accident. To move between scenes, position the white dot, located in the middle of your view, over 'NEXT' or 'BACK' for three seconds.

8. By choosing 'NEXT', you will transition to a video of an accident scene in a garage with a patient, then to a more detailed scene of the 'patient' with your emergency equipment laid out around you.

9. What is your diagnosis? Which equipment will you use? How will you treat the patient? Does the prognosis given the vital signs look good?

Figure 5 – Paramedicine VR (Source: Aiello and Cook, 2019)

Example 5 – High-end VR Immersive Virtual Tour of Hallett Cove

This example, like a previous one, is drawn from ProjectLIVE (https://projectlive.org.au) at UniSA. It is a high-end virtual tour that sees players become immersed in a VR quest to realistically experience Hallett Cove's deep geological secrets. An element of gamification is introduced with challenges, tasks and rewards to unlock as players move between the geo-sites in the adventure. Simple gamification elements such as immediate feedback and earning rewards for completing challenges successfully are strongly influential on increasing the students' drive in engaging in these games either within the walls of a classroom or anywhere as an online learning experience.

To fully experience the Hallett Cove VR Tour you will require high-end hardware and software including a Steam-VR capable HMD (e.g. the Oculus Rift and Rift S, HTC Vive, Pro and Cosmos, Valve Index and Windows Mixed Reality HMDs). Players also need to ensure that Windows Mixed Reality and SteamVR software is installed on their computer. The VR files can be downloaded from https://bit.ly/hallett_cove.

However, by clicking on the image below you will open a new browser window to experience a less immersive version of the same VR tour on a computer screen or mobile device without a HMD.

Figure 6 – Hallett Cove VR Virtual Tour
(Source: UniSA Project LIVE http://projectlive.org.au)

If you would like to ask online teaching and learning questions related to this guide you can look through our FAQs, write to TIU@unisa.edu.au, have an online consultation with a member of the TIU or complete the online modules as part of Introduction to Engaging Learners Online.

Disclaimer:

The University of South Australia does not specifically endorse any of the proprietary software used to create the MR experiences described in this guide.

If you would like to ask online teaching and learning questions related to your course, you can look through our [FAQs,](#) write to [TIU@unisa.edu.au,](#) have an [online consultation with a member of the TIU](#)or complete the online modules as part of *[Introduction to Engaging Learners Online](#).*

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