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Integrating Mobile Mixed Reality to Enhance Learning Before, During and After Physical Field Trips

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Introduction

- Digital tools open up many new opportunities for students to enhance their learning during off-site physical field trips.
- Mixed reality (MR) tools can provide new opportunities to support learning before, during and after the physical field trip, merging real and virtual worlds to extend students' learning

Augmented and Virtual Reality (AR and VR)

Augmented Reality (AR)

Enables interaction with a physical environments enhanced by digital materials.

Teachers and students can develop their own MR experiences to supplement a real field trip (RFT) experience

Mixed Reality (MR) Continuum

Virtual Reality (VR)

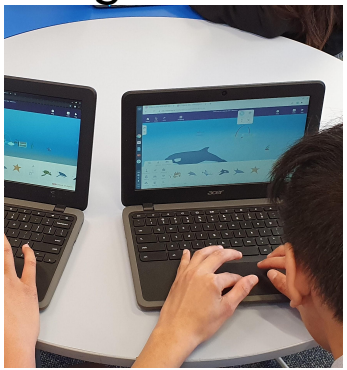
Can be used before or after a field trip for preparation or to support post-trip reflections. They can also be used as a replacement for a RFT.

Virtual Field Trips (VFT) Approaches

Preparing for a RFT

A real field trip (RFT)

Revising after a RFT



- They can also be used in combination with physical field trips
- The before-during-after pedagogical sequence is important in gaining the full benefits from field trips

Augmented Field Trips (AFT) Approaches

Augmented real field trip (RFT)

Preparing for a RFT →  → Revising after a RFT

- AR provides an in-situ/ place-based learning approach
- Experience can be enhanced by additional digital materials provided while on the RFT
- Content can be triggered by visual or location-based triggers

Project Context

- Three scenarios drawn from a larger and ongoing research project to explore how MR can be integrated into cross-curricular learning
  - Initiated in 2020 with two high schools in New Zealand exploring how MR can be used to support learning across the curriculum
- The focus Yr9 (13-14yrs) students undertaking a PBL project learning about environmental sustainability and their RFT to the landfill
  - *How can MR support their learning?*

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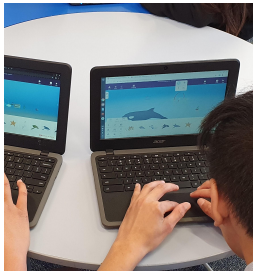
The Three Scenarios

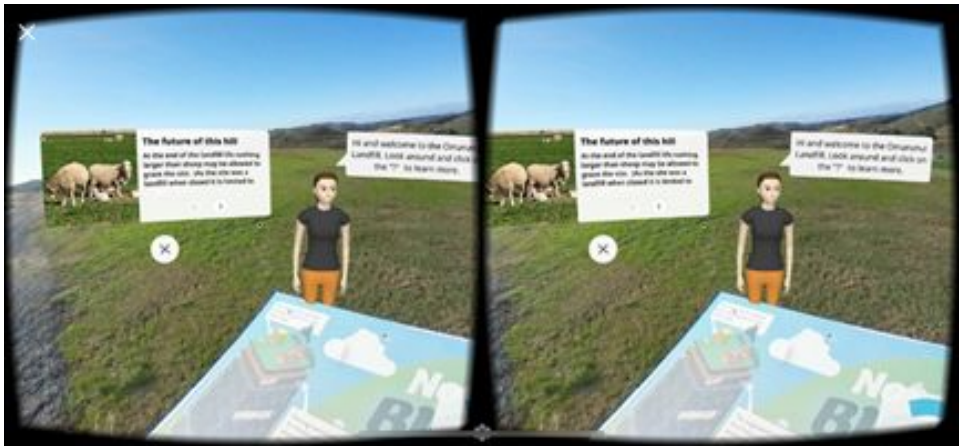
1. A virtual field trip is used prior to a physical field trip to help prepare students for their visit (pre)
2. An augmented reality experience is used during the physical field trip (intra)
3. After the field trip, students build on their experience of virtual reality to create their own virtual tours (post)





1. VR to Support Learning Prior to a Field Trip

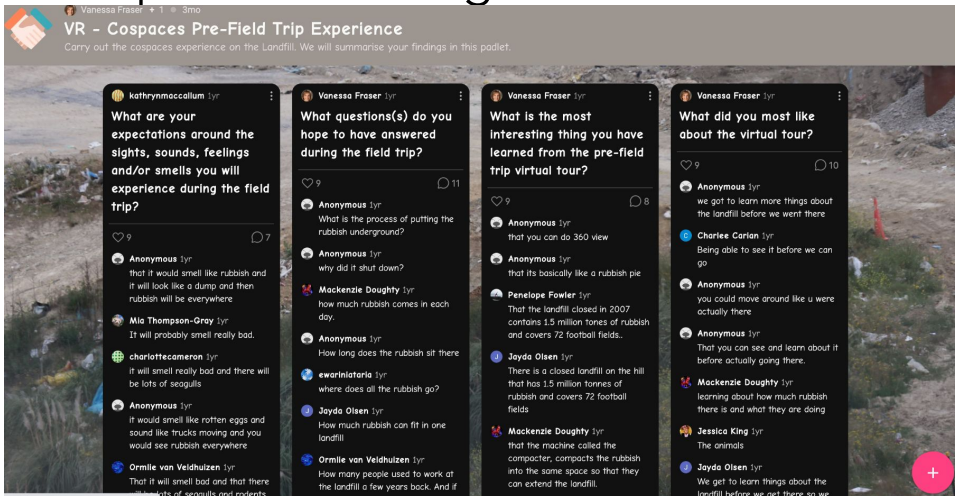
- VFT to support the learning of students prior to their trip to a local landfill to learn about waste management, recycling and sustainability
  - key locations within the landfill
  - Interactive hotspots on 360-degree photos
  - audio of landfill sounds (seagulls, machinery…)



VFT view (mobile stereoscopic)

1. VR to Support Learning Prior to a Field Trip

- Knowledge gaps identified prior to physical field trip
- Padlet used to capture students perceptions, interests and gaps, for example
  - What are your expectations around the sights, sounds, feelings and/or smells you will experience during the field trip?
  - What questions(s) do you hope to have answered during the field trip?



Feedback

"The tour deepened this experience, as you could actually show them what they would see not just talk about it… a really neat little activity that the students could hook into, and it …provided an opportunity to go deeper into the ideas before the actual tour" - Teacher

"It helped because when we saw the things with the information, I had more of an understanding about the things at the landfill" - Student

2. Augmented Reality During Field Trips

- Scavenger hunt activity using a mobile based AR tour (ActionBound)
- Activities undertaken in teams, drawing on information available onsite
- A game-based learning check during the field trip
- Staged-content, gamified support for learning in the field enhances the learning experience and outcomes (Chen, Liu & Hwang, 2016)

Screen Views from the AR Activity

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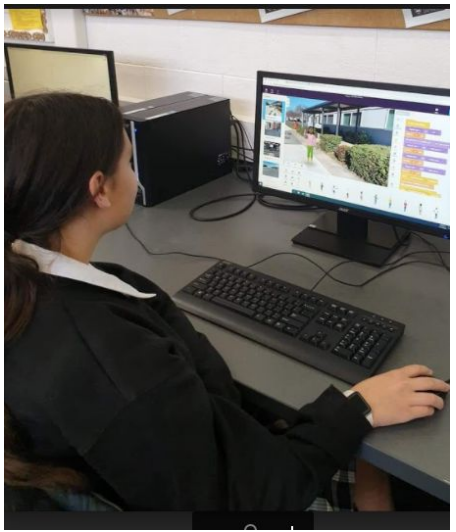
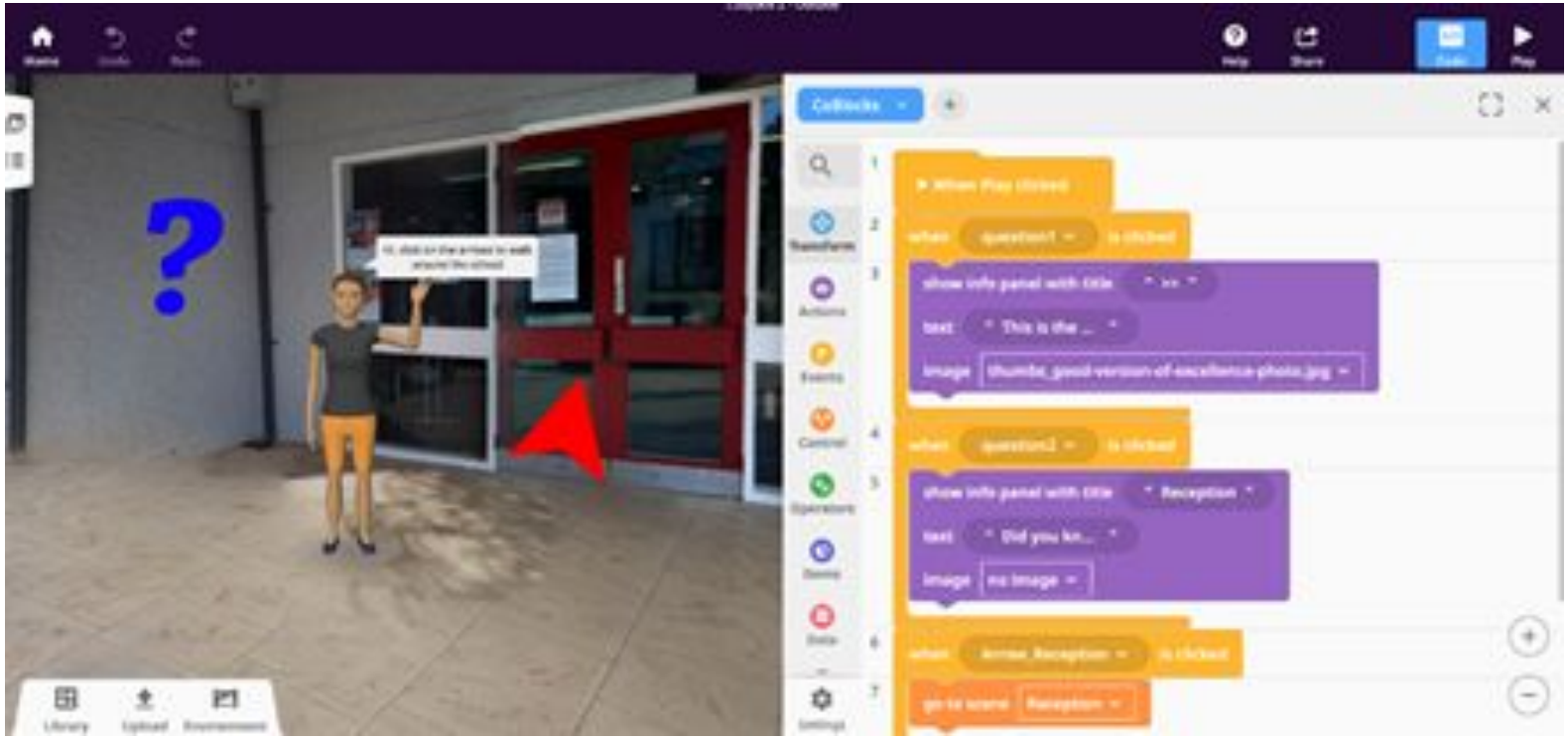
3. VR to Support Learning After the Field Trip

- Students created their own VFTs based on their own school environments
  - taking their own 360° photos and integrating information they had researched themselves.
- Focus was to situate learning in the school context, e.g where recycling bins were located and apply what they learnt about the importance of recycling and sustainability.



Student Virtual Tour In Development



Integration of Computational Thinking

The act of creating these field trips provided opportunities to integrate digital technologies to support constructionist knowledge creation.

"Students have been incredibly engaged in the process and have found ways in which to use AR and VR to help them understand concepts that would have otherwise been less accessible." - Teacher

Summary

- This study recognises the importance of a pedagogical structure that provides for pre-, intra-, and post- activities when organising field trips
- MR has been integrated into each of these three stages of learning
- This model is grounded in extensive literature that supports this relationship between virtual and physical field trips and the benefits that can accrue.