For Online Participants

- Keep camera on and mic off (unless you talk) all the time
- Test the connection: audio, video
- Participate as in the classroom (ask, answer questions, chat with peers, do activities)
- Join group activities when needed
- Indicate your engagement

Poll Everywhere

AR/VR for Learning

Dr. Wang Qiyun

Recap: mobile learning

Use of Mobile devices

Mobility of devices

Mobility of learners

Contents

- A few relevant concepts
- Definitions of AR and VR
- Explore a few examples
- Affordances of AR/VR for learning

360° Photos

- 360° photos: controllable panoramic images that surround the original point where the shots were taken
- Phone: Panorama

- E.g. Louvre Museum

https://www.youvisit.com/tour/louvremuseum/80769?tourid=tour1&

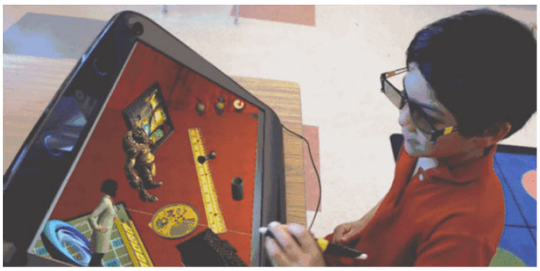
360° Videos

- 360° videos (immersive videos or spherical videos): recordings where a view in every direction is recorded at the same time
- YouTube : search for 360 degree videos
- Use the headset to watch: more immersive

Virtual Reality (VR)

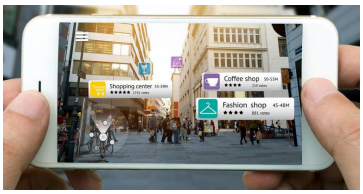
- the use of computer technology to create a **simulated** environment that usually really exists
- Users are often immersed and able to interact with the objects in the virtual environment
- A simple example: http://vtour.nus.edu.sg/virtualtour

Virtual Reality (VR)



Augmented Reality (AR)

- An **enhanced** version of the reality created by the use of technology to add digital information (e.g., text, image, video) on an image



E.g. of Augmented Reality

AR Magic Cards (http://en.armagicschool.com/products/pdt2/pdt.php)

AR-3D Science (Android only)

Mixed Reality (MR)

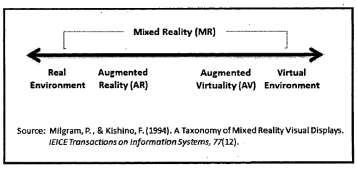
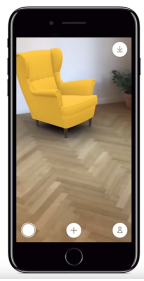


Figure 1. Reality-Virtuality (VR) Continuum

Mixed Reality

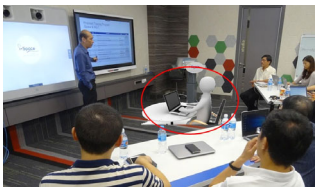
- Blending the physical world with the virtual world: can interact with each other
- E.g. Ikea Place App

https://www.youtube.com/watch?v=cdv0b0nBqPk



Mixed Reality

- Blended synchronous learning environment
- Hologram



Differences/features

- **360 Video** A spherical video allowing the viewer to see in all directions, though there is no freedom to interact with, or move throughout, the imagery.
- **Virtual Reality** A totally immersive experience replacing the "real" world with an alternate one. Interaction with, and movement through, the alternate world via six degrees of freedom is almost always required.
- **Augmented Reality** Overlaying imagery on an existing space, to be seen through an enabled devices, such as a smartphone or glasses. Interaction is optional, but not required.
- **Mixed Reality** Placing new imagery within a real space in such a way that the new imagery is able to interact, to an extent, with what is real in the physical world.

https://medium.com/iotforall/whats-the-difference-between-vr-ar-mr-and-360-139fcf434585

Differences/features

https://medium.com/iotforall/whats-the-difference-between-vr-ar-mr-and-360-139fcf434585

Making 360° Photos

- Install "Cardboard Camera" (app) by Google

Metaverse: An app for making AR

- Metaverse – Experience Browser (app)
- https://studio.gometa.io
- Login using Facebook

Affordances for teaching and learning

- To create an immersive learning environment
- To interact with the objects
- To arouse their interest, curiosity
- To support discovery-based learning

Affordances of AR

Table 2
The advantages of AR in educational settings.

Inductive categories	Sub-categories	f	Sample research
Learner outcomes	Enhancing learning achievement	32	Lu & Liu, 2015
	Enhancing learning motivation	10	Chiang et al., 2014a
	Helps students to understand	7	Kamarainen et al., 2013
	Provide positive attitude	6	Wojciechowski & Cellary, 201
	Enhancing satisfaction	4	Han et al., 2015
	Decreases cognitive load	2	Santos et al., 2014
	Enhancing confidence	2	Lu & Liu, 2015
	Enhances spatial ability	2	Lin, Chen, & Chang, 2015
Pedagogical contributions	Enhances enjoyment	8	Ibáñez et al., 2014
	Raising the level of engagement	6	Liu & Tsai, 2013
	Increases interest	4	Zhang et al., 2014
	Provides collaboration opportunities for students	3	Lin, Duh, Li, Wang, & Tsai, 201
	Facilitates communication between students and lecturer	2	Zarraonandia et al., 2013
	Promotes self-learning	2	Ferrer-Torregrosa et al., 2015
	Combines the physical and virtual worlds	1	Dunleavy et al., 2009
	Allows learners to learn by doing	1	Hsiao et al., 2012
	Student-centered technology	1	Kamarainen et al., 2013
	Enables multi-sensory learning	1	Lu & Liu, 2015
	Enables learners to quickly receive information	1	Chiang et al., 2014b
Interaction	Providing interaction opportunities (student-student)	4	Kamarainen et al., 2013
	Student-material	2	Lin et al., 2011
	Student-teacher	1	Zarraonandia et al., 2013
Other	Enables visualization of invisible concepts, events, and abstract concepts	5	El Sayed et al., 2011
	AR is easy for students to use	4	Di Serio et al., 2013
	Reduces laboratory material cost	1	Ferrer-Torregrosa et al., 2015

(Akçayır & Akçayır, 2017)

Challenges with AR

Table 3
The challenges in AR use within educational settings.

Challenges	f	Sample research
AR is difficult for students to use	7	Munoz-Cristobal et al., 2015
Requires more time	4	Gavish et al., 2015
Low sensitivity in triggering recognition	4	Chang et al., 2014
GPS errors cause student frustration	3	Chiang et al., 2014a
Not suitable for large group teaching	3	Yoon et al., 2012
Causes technical problems (camera, Internet, indoor use)	3	Chang et al., 2015
Causes cognitive overload	2	Dunleavy et al., 2009
Distracts students' attention	2	Chiang et al., 2014b
Expensive technology	2	Furió et al., 2013
Large file size limits the sharing of content	1	Ke & Hsu, 2015
Ergonomic problems	1	Chang et al., 2015
Difficult to design	1	Chang et al., 2014
Inadequate teacher ability to use the technology	1	Dunleavy et al., 2009

NTU AR

- https://www.youtube.com/watch?v=wrHG82964AE
- NTU Virtual and Augmented Reality Technology Enabled Lab (VARTEL)

- Group assignment

Reminder

- 3rd Reflection by next Tues
- 4th AU: comment and response

Examples

- Ikea (https://www.youtube.com/watch?v=cdv0b0nBqPk)
- YouTube Video (e.g., VR space)
- AR Magic Cards (http://en.armagicschool.com/products/pdt2/pdt.php)
- Metaverse – Experience Browser (app)
- AR-3D Science
- Augment