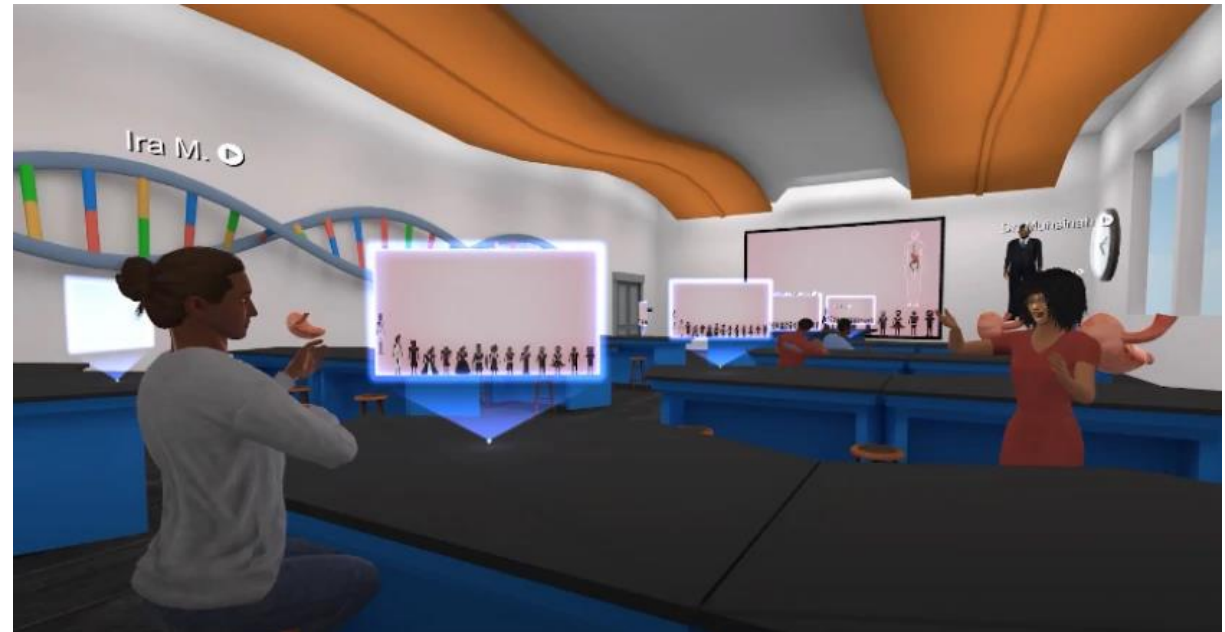# Open Education Week 2023

Extended Reality (XR) Open Educational Resources (OER):

- What is XR?
- Use Cases
- Resources for XR Experiences

UW Extended Reality Resource Repository

A screenshot from a promotional video from VictoryXR shows a virtual classroom with avatars communicating with each other.

Image: VictoryXR

Gillian Dabrowski, Centre for Extended Learning
Mark Morton, Centre for Teaching Excellence

UNIVERSITY OF WATERLOO

Territorial Acknowledgement

XR Example of a Commitment to Advancing Reconciliation:

Georgian College, Indigenous Language Learning (course taught with VR)

Fig 1. Student using VR headset to connect to the Indigenous Language House.

Fig 2. Elder's avatar interacting with students in the Indigenous Language House

Images: Students learn indigenous language using virtual reality. Georgian College. (2021, June 18).

What is XR?

Virtual Reality (VR)
Fig 2: **Virtual Reality** at uOttawa – moot trials in the metaverse.

Uottawa's Faculty of Law takes moot trials to the metaverse.
Image: Logothetis, P., & Relations, M. (2022). University of Ottawa.

Augmented Reality
Fig 1: **Augmented Reality** on the Factory Floor, via Deloitte

Virtual and augmented reality: Making the factory of the future real.
Image: Deloitte (2022).

XR Devices and Level of Immersion

Non-Immersive	>	Immersive
Mobile AR/VR	Desktop AR/VR	Headsets AR/VR

What is XR?

Mixed Reality (MR), Complex AR, Holography

https://universemagazine.com/wp-content/uploads/2022/04/20211008_062354_hololens_first_image.jpg

Fig: NASA military surgeon Dr. Josef Schmidt "holo-ported" to the International Space Station.

Types of Virtual Reality and Augmented Reality

This image was created with the assistance of DALL·E 2

Virtual Reality

- **360VR**
  - panoramas
  - tours
  - Videos

- **SocialVR (Virtual Worlds)**
- **Simulations**

Use Cases

Familiarize with a Chemistry Lab and Equipment before training.
Earth Science Museum tour

The feeling of "being there" in a classroom (enhancement of a webinar)

Step-by-step training for a specific procedure to gain "experience"

Augmented Reality

- **3D Models**
- **Information Overlay**
- **Location based**
- **Remote Assistance**
- **Mixed Reality, Complex AR**

Use Cases

Interacting with shapes in a Multivariable Calculus Activity
Google "Smart" Glasses – Language Translator
A walking tour of a historical site with interactive media
Collaboration and Just-in-time information
Surgery aid, Teleportation

Use Cases

- **3D Model:** History, Architecture Medieval Church in Calatrava la Nueva, Spain

- **VR Simulation:**
  Health, Medical training Medical Training for Clinicians

- **3D Model/photogrammetry:**
  Architecture, Design Residential Condominium Architectural Visualization

- **Virtual World:** Chemistry Molecule Manipulations

- **3D Models:** WesternU3D – Sketchfab

- **360 Virtual Tour:** Example VR Tour - 360° Interactive 3D VR Distillation Laboratory (uwaterloo.ca)

- **360 Photosphere**: Grand Central Station

- **360 Photosphere:** Forum in Rome

Immersive Content, Platforms, and Tools

Where do I start?

An applied look at how to provide immersive experiences.

University of Waterloo, Extended Reality Repository:
<u>Where to Start: XR for Teaching and Learning</u>

This image was created with the assistance of DALL·E 2

Immersive Content, Platforms, and Tools

Compilations of Resources
- Penn State: Experience Catalogue | IMEX Lab
- *Georgian College:
  Explorations in VR for HigherEd (400+ resources)
- University of Waterloo, Extended Reality Repository:
  Where to Start: XR for Teaching and Learning
- Stanford University: Virtual Human Interaction Lab
- eCampus Ontario

Compilations of Research
- Educators in VR: Zotero EDVR XR Research Library collection with hundreds of articles.
- The University of Rochester: Studio X Immersive Technologies Resources Library also has a great collection of articles by subject.

Open Access Books
- XR Academia: Research and Experiences in Virtual Reality, Augmented Reality, Mixed Reality, and Artificial Intelligence in Latin America and Europe
- Virtual Reality in the Assessment, Understanding and Treatment of Mental Health Disorders

This image was created with the assistance of DALL·E 2

Lesson Plans for Immersive Activities

#DLFteach Toolkit Volume 2: Lesson Plans on Immersive Pedagogy

CC BY or CC BY-NC 4.0

- The Decolonial Walkthrough

- Re-Imagining Campus Spaces

- Decolonizing your Diet

- 3D Modeling for Historical Reconstruction

- Getting Started with 3D Digitization

- Learning in Virtual Spaces *note this is based on a platform that has been phased out, but relative to other platforms.

Learning in Virtual Spaces
by Stephan Caspar

Published: Oct 27, 2021

This session plan introduces students to the experience of learning about language, culture and identity in virtual spaces, through the use of Head Mounted Displays.

Land and Belonging: Teaching North American Landscape Art with Immersive Technology
by Laura E. Smith

Published: Jul 21, 2021

This lesson employs a 360-degree immersive

Building and Testing a VR Module: Working with Students Towards a Usable VR Module to Teach Critical Thinking Skills
by Juliette Levy

Published: Dec 01, 2021

Lesson Plans for Immersive Activities

#DLFteach Toolkit Volume 2: Lesson Plans on Immersive Pedagogy
CC BY or CC BY-NC 4.0

- Teaching Environmental Influences on Quality of Life with 360 Video
  This lesson introduces how 360 video can enhance the education of undergraduate students in fieldwork research in urban places using a critical lens.

- Relational Landscapes:
  360 and satellite images to encourage students to understand and experience Chaco Canyon (850-1150CE) and its monumental architecture as a relational landscape.

- Land and Belonging: Teaching North American Landscape Art with Immersive Technology

- Building and Testing a VR Module: Working with Students Towards a Usable VR Module to Teach Critical Thinking Skills

Other Resources

- CUNY: Activity –A-Frame: Virtual Reality Programming

- UW Extended Reality Repository

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Published: Dec 01, 2021

What Do I Need?

Immersive Content, Platforms and tools

| Pedagogical Use Case, Design of Experience | → | Sources for providing or building experiences: | → | Display Hardware and Interface Access: |

Sources for providing or building experiences:

- Virtual Worlds
- 360° content
- 3D content
- AI 3D Content Generation Tools
- RT-3D Game Engines (custom experiences)

Display Hardware and Interface Access:

- Desktop
- Mobile
- Headset or Glasses

Virtual Worlds

Platforms
- Microsoft Teams (2023: Horizon Worlds and immersive classrooms)
- Horizon Worlds (Meta)
- EngageVR
- Spatial.io
- VRChat
- WondaVR
- Hubs by Mozilla
- Frame (framevr.io) [open source]
- Virbela

Bailenson, J. (2021, November 5). *Stanford "Virtual People" class in the Metaverse.* [Video]. YouTube. https://www.youtube.com/watch?v=gOLI_OIV3nc

Virtual Worlds

Why use a virtual world for teaching and learning?

o   Increase Social presence
o   Orientation/Welcome Class
o   Community Building
o   Relationship Building
o   Remote Communication
o   Engagement
o   Collaboration
o   Group Work
o   Interpersonal communication skills
o   Peer discussion
o   Collaborative problem identification
o   Instructor insight into student understanding
o   Instructor oversight (O'Connor, 2017)

Harnessing technology to transform the future of public-private cooperation.

A vision for a Global Collaboration Village
Author: Klaus Schwab, Founder and Executive Chairman, World Economic Forum
This article is published in collaboration with Forbes.

Dive in to the Global Collaboration Village ocean experience.   Image: Image: Accenture

360 Images, Tours, and Videos
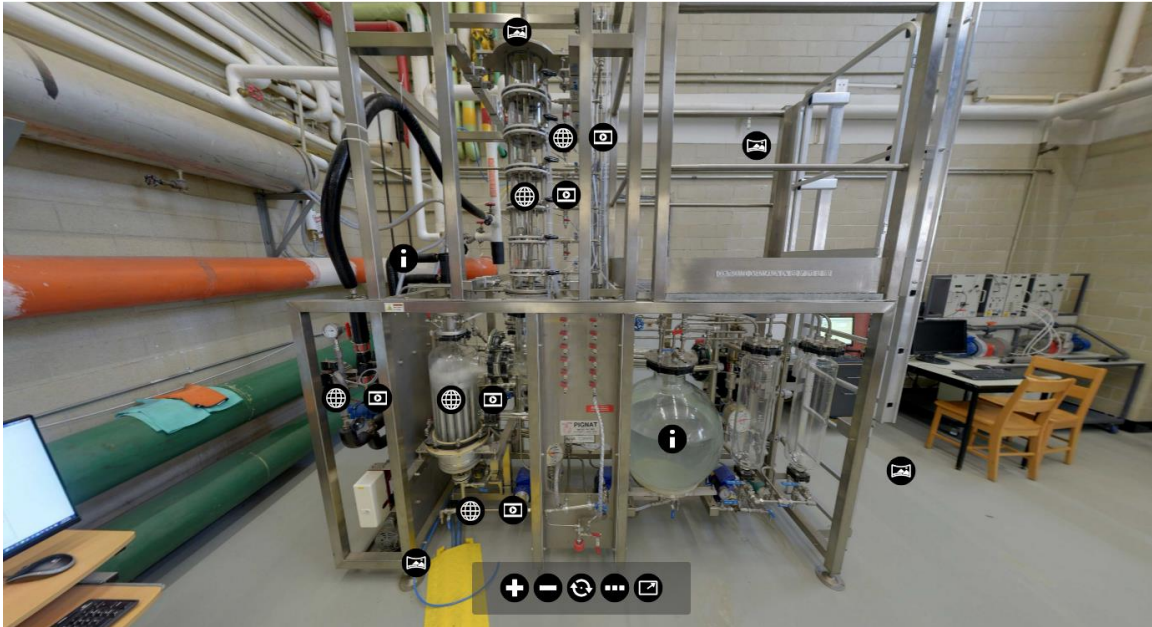
University of Waterloo, ChE Lab, Virtual Tour

Centre for Extended Learning staff: Felicia Pantazi, Antonina Joukova

- **Support at the University of Waterloo**
  - ITMS camera, workflow documentation in progress, Centre for Extended Learning ADT Request System for support

- **Content**
  - Google Maps
  - UW Extended Reality Repository
  - University of Toronoto 360 Essentials: A Beginner's Guide to Immersive Video Storytelling – Open Textbook
  - Carleton University Pedagogies & VR, VR in Education Guide

- **Creator Platforms**
  - WondaVR
  - PanoVR
  - Matterport
  - A-Frame

3D Content and Creator Tools
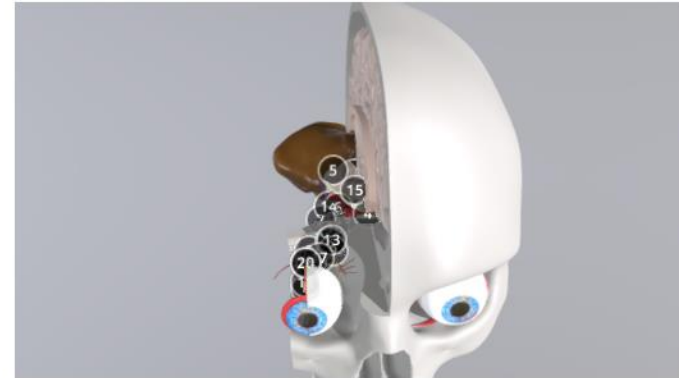
General 3D asset sources
Modelling of complex structures, concepts, or phenomena that a user can interact with (e.g., architecture and modelling)

Content:

- UBC 3D Educational Resources
- Smithsonian 3D Digitization
  - DigitalLife3D
- MorphoSource

- AR Skeleton Anatomy

- Sketchfab

Creator tools:

- Blender

Nerves of the Eye
3D Model

University of Dundee, CAHID PRO
FOLLOW
👁 801   ☆ 6

3D Capture

Rebain, D., and Matthews, M., (September 13, 2022) *LOLNeRF: Learn from one look*. – Google AI Blog. Retrieved February 1, 2023, from https://ai.googleblog.com/2022/09/lolnerf-learn-from-one-look.html

Photogrammetry

Photogrammetry is a method for scanning real-life objects or spaces into the 3D format with a camera.

Tools

- <u>Polycam</u>

- <u>Epic Games: RealityCapture</u>

- <u>Scan-verse</u> Apple

- <u>Nvidia: Instant NeRF</u> (drone images)

  o **Example**
     <u>Google Earth</u>

AI

AI will be helpful for supporting to build 3D
content that can be used to create XR experiences.

Opportunities

- Less technical expertise required.

- Productivity tools to save time and reduce costs.

Challenges

- Deep fakes, more opportunities for misinformation, and deception?

- Copyright? (Getty versus Stablediffusion)

- Bias and misconception.

- Errors and inaccuracies.

AI: Text Editors

Text Editors

- Chat GPT
  - Writing Audio Scripts or chatbot avatar scripts
  - Unity C# code (to create custom simulations)
  - Storyboarding
  - Alternate formats for Accessibility
- Microsoft Bing AI
- Google Bard
- Quillbot

AI: Text to Image

- OpenAI's DALL-E2
- Stable Diffusion
- Stability.ai: DreamStudio
- Google Brain
- Microsoft's NUWA-Infinity
- Dream
- Midjourney
- StyleGAN
- Icons with AI: iconifyai.com

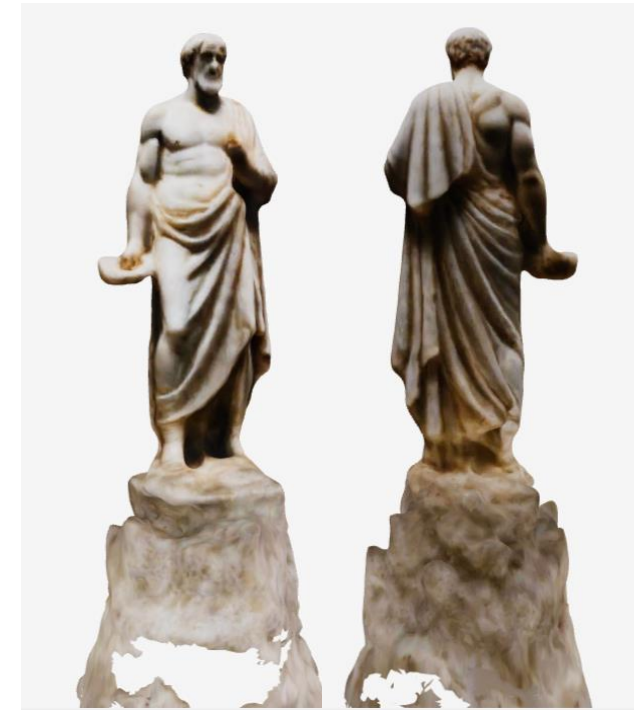- Plugins for Blender, Photoshop, and GIMP

Images created with the assistance of DALL·E 2
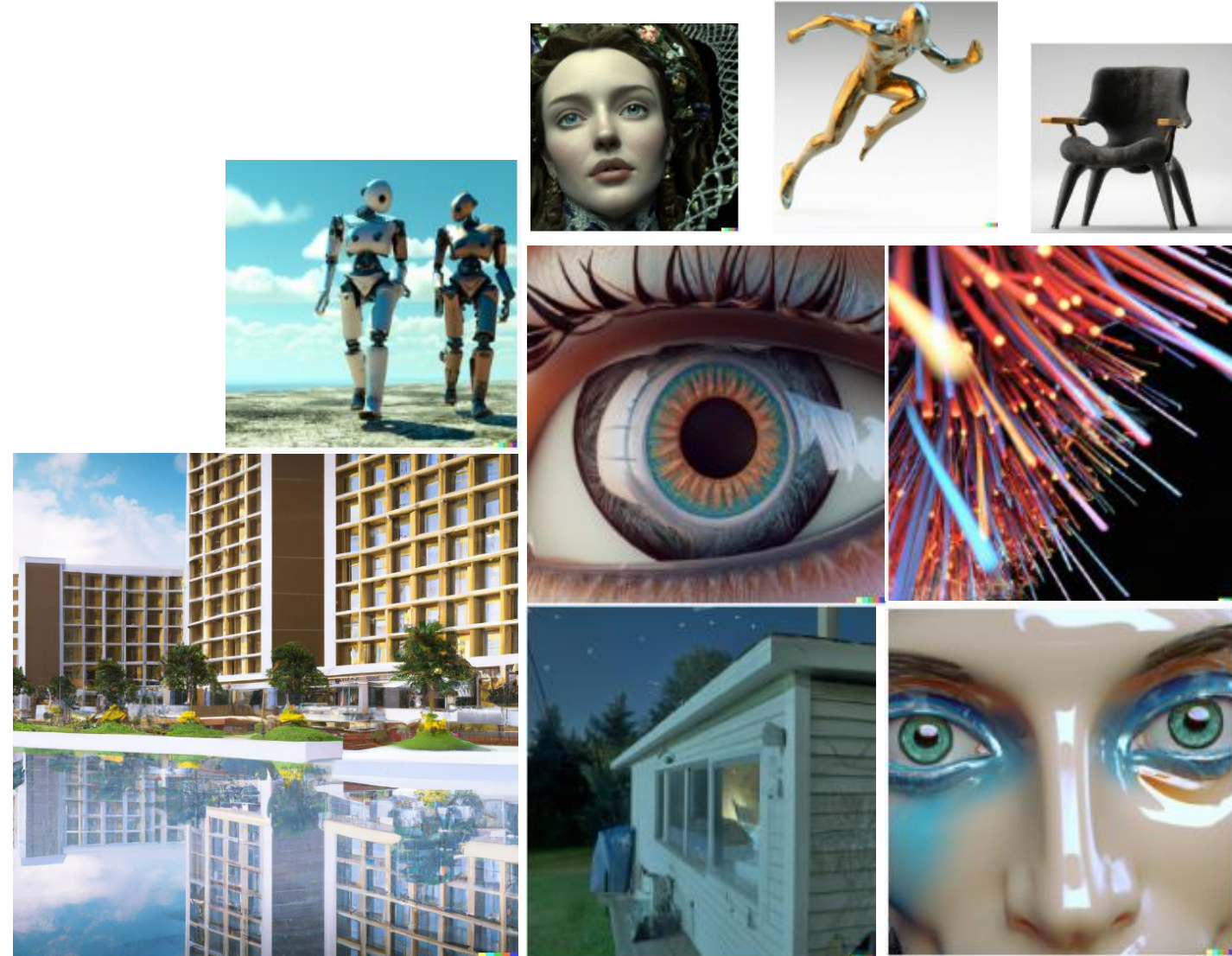
AI: Text to 3D

- LumaLabs <u>3D object</u> created completely by AI
- <u>AI Creator Tools - SIMULACRA</u>
- <u>Point-E (OpenAI)</u>

Resource: <u>1000+ AI tools (aicyclopedia.com)</u>

Images © <u>Luma AI (lumalabs.ai)</u>

AI: Avatars

Image © UnReal

Text to Chatbot Avatars

AI content generation tools can help in creating natural language interactions and chatbots.

o In3D: turn people into realistic avatars
o Virbe Virtual Human Creator
   o AI bots Inworld.ai Chat with Hermes

o MetaHuman - Unreal Engine: Meta Human Creator

   o https://youtu.be/OeUBATSJSr0?t=85

o InworldAI

Generate Animations
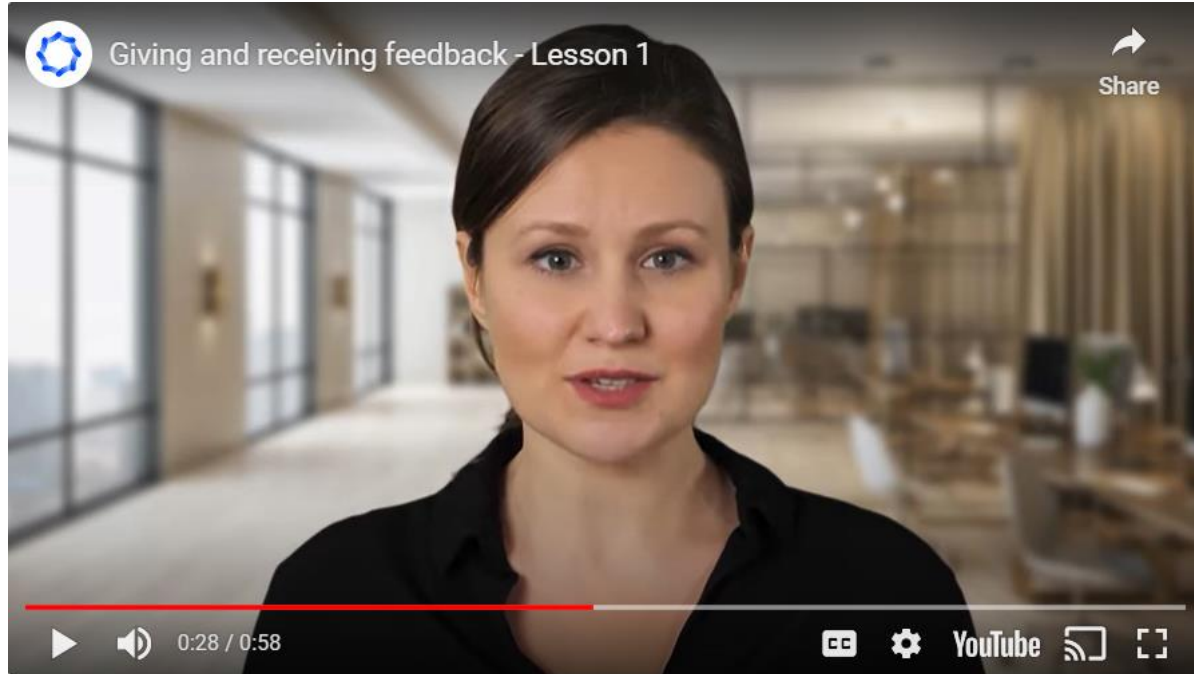
- Kinetix

- Rokoko AI

AI: Text to Audio and Video

Image © synthesia

Audio /Music

Pick a natural voice or clone your voice:

- elevenlabsio
- Resemble.ai
- Murf.ai

Video
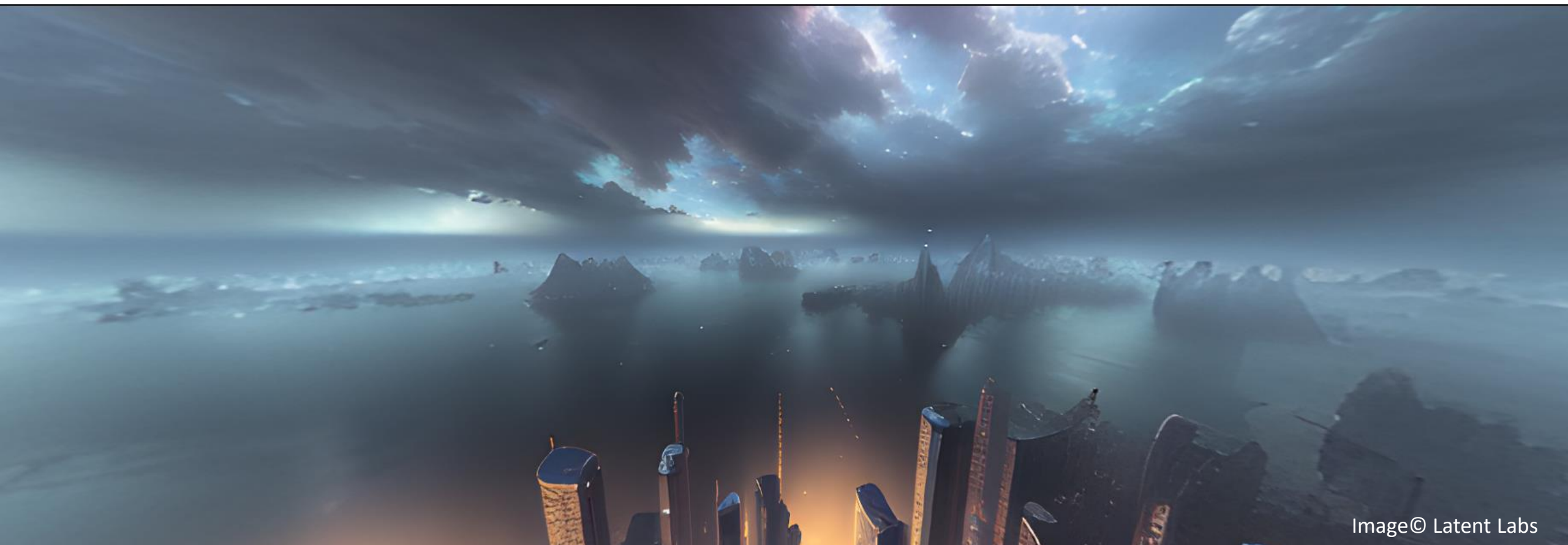
- Synthesia
- SceneScape
- Make-a-Video from Meta

- D-ID

- Video Transcription: oTranscribe (MIT)

AI: 360

Text to 3D Virtual World Content

- Anything World — Text to 3D , Versy.ai , Latent Labs 360° panoramic
- Skybox Lab (blockadelabs.com), CSM 3D Worlds

Image© Latent Labs

What Do I Need?

Immersive Content, Platforms and tools

Pedagogical Use Case, Design of Experience

→

Sources for providing or building experiences:

- Virtual Worlds

- 360° content

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- AI 3D Content Generation Tools

- RT-3D Game Engines (custom experiences)

→

Display Hardware and Interface Access:

- Desktop
- Mobile
- Headset or Glasses

Real Time 3D Creator Tools (Game Engines)

Specialized platforms to design, develop, and deploy any kind of XR experience for any device (VR, AR, web, mobile, headset)

- o <u>Unity</u> (many free instructor and student training resources and courses)

- o <u>A-Frame</u> Open source, build VR experiences with HTML and JavaScript. Great choice for students and educators who want to create VR experiences quickly and easily, without having to write a lot of code.

- o <u>UnReal Game Engine</u>

VR HEADSETS

Open VR Headsets

- Somnium VR1 Headset (DevKit)
- OSVR (Open Source Virtual Reality Headset)

Resource

- The best VR headsets for 2023

Image © OSVR

AR Creator Tools

- ISTE 23 Resources for Bringing AR and VR to the Classroom
- Learn how to create a dinosaur AR experience
- How to Create 3D Content and See it in AR
- CoPilot Designer

- Zappar - Apps on Google Play

- Studio (gometa.io)

- Quiver 3d
- Merge Cube AR/VR
- CoSpaces Edu: Make AR and VR

Open Platform

- The Open University's Institute of Educational Technology: MirageXR

- eTwinning Webinar – Designing Learning Experiences in Augmented Reality

GENERAL RESOURCES

Virtual Worlds

- Learning in Virtual Spaces · #DLFteach Publications (pubpub.org)

AI 3D Content

- Practical Guide to AI in the Metaverse | by Alan Smithson | Jan, 2023 | Medium

General AI Tools Lists

- Generative AI MegaList 2023
- There is an AI for that

- 1000+ AI tools (aicyclopedia.com) [Free AI tools]

Photogrammetry

- Introduction to RealityCapture and photogrammetry | Epic Developer Community TIME Magazine Names NVIDIA Instant NeRF a Best Invention of 2022 | NVIDIA Technical Blog
- Getting Started with Instant NeRF post , Instant NeRF projects

Lesson Plans on Immersive Pedagogy

- #DLFteach Toolkit Volume 2: Lesson Plans on Immersive Pedagogy

REFERENCES AND ADDITIONAL READING

Immersive Pedagogy

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Virtual Worlds:

- O'Connor, E. A. (2017). Developing Community and Building Knowledge Online Using a Virtual Reality Environment and Student-Created Videos. *Journal of Educational Technology Systems,46*(3), 343-362. doi:10.1177/0047239517736874

- P. Mourtzis, S. Mystakidis (2022) IMPROVING ONLINE LANGUAGE LEARNING INTERACTIVITY WITH MULTIUSER VIRTUAL REALITY ENVIRONMENTS: PREPARING FOR THE METAVERSE, *ICERI2022 Proceedings*, pp. 57-65.

360 Panoramas:

- Rosendahl, P., Wagner, I. 360° videos in education – A systematic literature review on application areas and future potentials. *Educ Inf Technol* (2023). https://doi.org/10.1007/s10639-022-11549-9

3D

- Frazee, J., Guarcello, M., Hauze, S. & Woodbury, D. (2022). Open Educational eXtended Reality: Why Now?. In T. Bastiaens (Ed.), Proceedings of EdMedia + Innovate Learning (pp. 944-953). Online: Association for the Advancement of Computing in Education (AACE). Retrieved November 24, 2022 from https://www.learntechlib.org/primary/p/221396/

ADDITIONAL READING: ENGINEERING

Use of Virtual Reality to Improve Engagement and Self-Efficacy in Architectural Engineering Disciplines
https://doi.org/10.1109/FIE49875.2021.9637182
E. Erdogmus, E. Ryherd, H. A. Diefes-Dux and C. Armwood-Gordon, "Use of Virtual Reality to Improve Engagement and Self-Efficacy in Architectural Engineering Disciplines," *2021 IEEE Frontiers in Education Conference (FIE)*, Lincoln, NE, USA, 2021, pp. 1-7, doi: 10.1109/FIE49875.2021.9637182.

A Mixed Reality Teaching Course for Formal Higher Education
https://doi.org/10.23919/iLRN55037.2022.9815961
B. Hensen and R. Klamma, "A Mixed Reality Teaching Course for Formal Higher Education," *2022 8th International Conference of the Immersive Learning Research Network (iLRN)*, Vienna, Austria, 2022, pp. 1-5, doi: 10.23919/iLRN55037.2022.9815961.

An open source engineering practice assistant training system based on virtual reality
https://doi.org/10.1109/FIE44824.2020.9274192
Z. Sun, D. Zhang, X. Luo, Q. Cao and Z. Li, "An open source engineering practice assistant training system based on virtual reality," *2020 IEEE Frontiers in Education Conference (FIE)*, Uppsala, Sweden, 2020, pp. 1-4, doi: 10.1109/FIE44824.2020.9274192.

Work-in-Progress: Virtual Reality System for training on the operation and programing of a Collaborative Robot
https://doi.org/10.1109/EDUCON46332.2021.9454059
C. V. Hurtado, A. R. Flores, V. Elizondo, P. Palacios and G. Zamora, "Work-in-Progress: Virtual Reality System for training on the operation and programing of a Collaborative Robot," *2021 IEEE Global Engineering Education Conference (EDUCON)*, Vienna, Austria, 2021, pp. 1650-1653, doi: 10.1109/EDUCON46332.2021.9454059.

SlicerVR for Medical Intervention Training and Planning in Immersive Virtual Reality
https://doi.org/10.1109/TMRB.2020.2983199
C. Pinter *et al.*, "SlicerVR for Medical Intervention Training and Planning in Immersive Virtual Reality," in *IEEE Transactions on Medical Robotics and Bionics*, vol. 2, no. 2, pp. 108-117, May 2020, doi: 10.1109/TMRB.2020.2983199

A Digital Twin implementation for Mobile and collaborative robot scenarios for teaching robotics based on Robot Operating System
https://doi.org/10.1109/EDUCON52537.2022.9766583
E. A. Avila, D. P. Chapa, I. D. Arenas and C. V. Hurtado, "A Digital Twin implementation for Mobile and collaborative robot scenarios for teaching robotics based on Robot Operating System," 2022 IEEE Global Engineering Education Conference (EDUCON), Tunis, Tunisia, 2022, pp. 559-564, doi: 10.1109/EDUCON52537.2022.9766583.

ADDITIONAL READING: HEALTH AND PHARMACY

- Virtual simulation for various healthcare professions

- USC Standardized patient

- e-Learning for Healthcare Professional Students

- An Introductory Over-The-Counter Simulation For First-Year Pharmacy Students Using A Virtual Pharmacy

- Mobile-Based Augmented Reality Application in Pharmacy Schools Implemented in Pharmaceutical Compounding Laboratories: Students' Benefits and Reception

- Meeting pharmacy educational outcomes through effective use of the virtual simulation MyDispense

- Virtualized Gamified Pharmacy Simulation during COVID-19

- Development of a Web-Based Virtual Simulated Learning Environment for Pharmacy Practice Education

ADDITIONAL READING: HEALTH AND PSYCHOLOGY

- Open Access Book:

    - Virtual Reality in the Assessment, Understanding and Treatment of Mental Health Disorders

- UBC 3D resources

    - Holobrain

ADDITIONAL RESOURCES: MATH

- PrismsVR
- CalcFlow
- GeoGebra AR
- Augmented Reality and Parabola Challenge | OER Commons
- Write Systems of Equations using Augmented Matrices | OER Commons