

MAKE XR

HOW ANY TEACHER

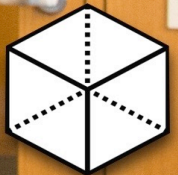
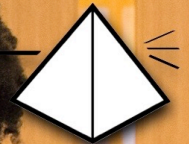
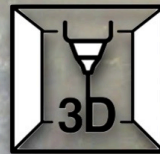
CAN TRANSFORM

LEARNING VIA

EXTENDED

REALITY

VR • AR • 3D +



BY JONATHAN NALDER

FUTUREWE.ORG

ST PETERS LUTHERAN COLLEGE

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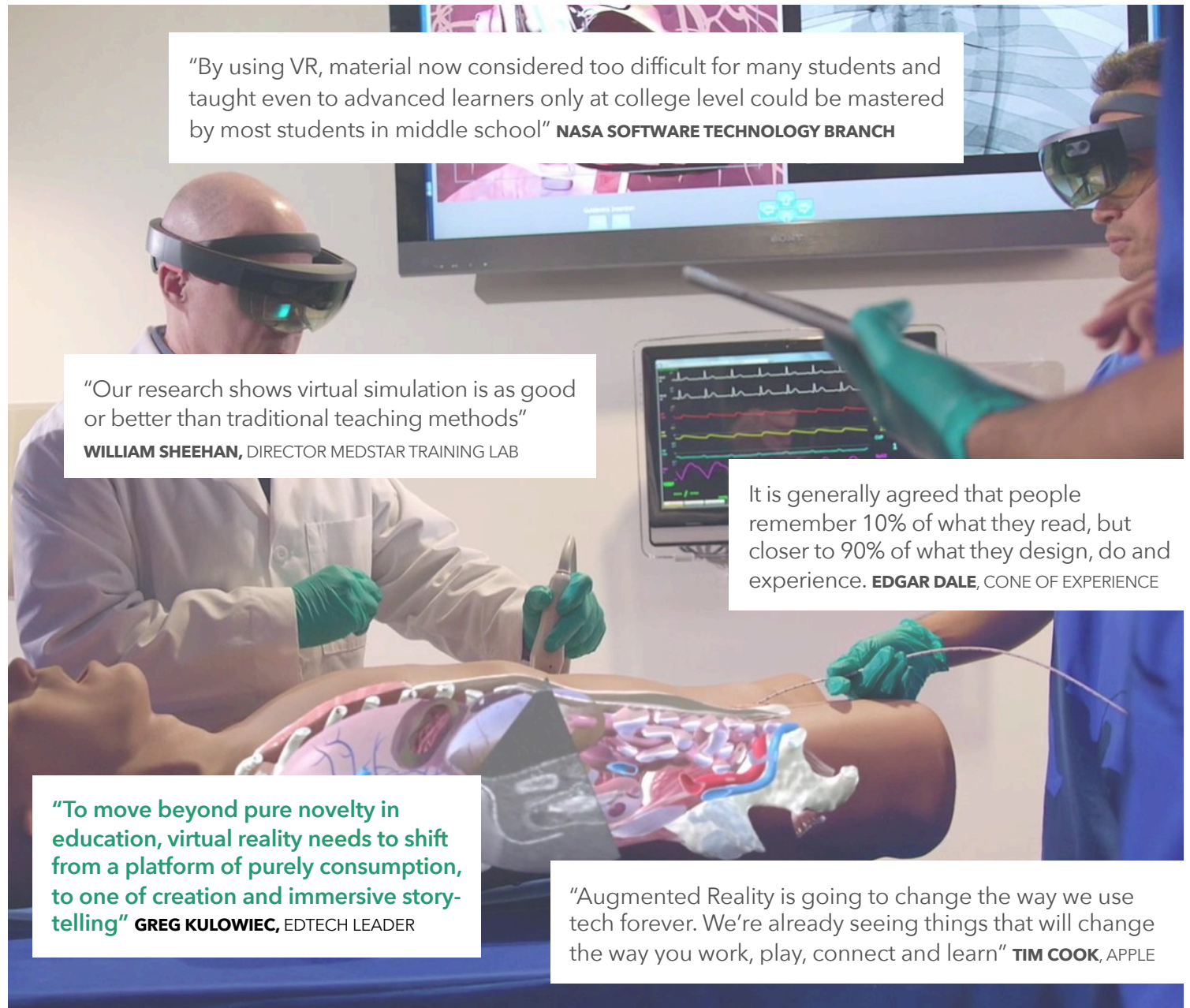
7. Examples: 'Make XR' mapped to Curriculum

KEY IDEAS behind this book:

- [Cone of Experience](#) - Edgar Dale
- [SAMR Model](#) - Dr Ruben Puentedura
- [Future Readiness Framework](#) - FutureWe

MORE: MakeXR.net

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"By using VR, material now considered too difficult for many students and taught even to advanced learners only at college level could be mastered by most students in middle school" **NASA SOFTWARE TECHNOLOGY BRANCH**

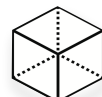
"Our research shows virtual simulation is as good or better than traditional teaching methods"

WILLIAM SHEEHAN, DIRECTOR MEDSTAR TRAINING LAB

It is generally agreed that people remember 10% of what they read, but closer to 90% of what they design, do and experience. **EDGAR DALE, CONE OF EXPERIENCE**

"To move beyond pure novelty in education, virtual reality needs to shift from a platform of purely consumption, to one of creation and immersive storytelling" **GREG KULOWIEC, EDTECH LEADER**

"Augmented Reality is going to change the way we use tech forever. We're already seeing things that will change the way you work, play, connect and learn" **TIM COOK, APPLE**



Thanks to St Peters Lutheran College, Nathan Beveridge, Scott Millar & the CoSpaces & FutureWe communities.

CO SPACES EDU

30-day Pro code:
'COSJONATHANA'

MAKE XR

OVERVIEW:

WHAT XR:
 'XR' means 'extend reality into the digital realm'. It's a 'blanket' term which covers five next-gen digital storytelling technologies that teachers and students can make themselves to support almost any curriculum area.

WHY 'MAKE XR'?
 A. Resources to help Educators navigate emerging visual tech, in practical, classroom-applicable ways.
 B. Improve learning - Maps to: **SAMR Model:** Redefinition via collaboration + content creation; **Cone of Experience:** connection to most concrete, real life context; and **FutureWe Framework:** next gen 'creativity', 'storytelling'

ETHOS:

- Tested for **playful** beginners and pro's
- Chosen for **lowest cost** and **ease of use** vs the quality of tools



3D OBJECTS

'3D Objects' include any shape or model that has been digitally created with three dimensions.

MAKE:

- 3D scan real objects
- Build with 3D software
- Convert 2D to 3D
- Download (eg. Thingiverse)

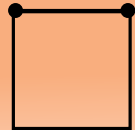
VIEW and TRY OUT:

- On screen
- Augmented Reality
- Virtual reality headset
- 3D print or use laser cutter

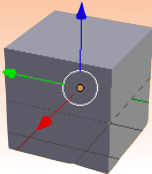
1 dimension



2 dimensions



3 dimensions



DEVELOPED BY: Jonathan Nalder, with St Peters Lutheran College, Nathan Beveridge.
FOR: Use with coaching/ workshop/course.



A . R .

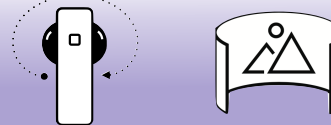
AR or 'Augmented Reality' refers to over-laying digital images, models and text on what we see (via a camera app or headset) to 'augment' or add information and interaction.

MAKE:

- Create or find 3D objects
- Export to software with overlay tools

VIEW and TRY OUT:

- Use camera app viewfinder to see digital overlay on environment (eg. IKEA, Merge Cube)
- Use headset that places vision directly in your eye-line (eg. MergeVR, MS Hololens)



360 DEGREE

360 degree images and video combine vision from two camera lenses and stitch it together so the whole view can be seen as the viewer turns their device or head.

MAKE:

- Capture with 360 camera
- Use app that combines images into a 360 scene
- Use 360 degree search option for stock photos
- Create a scene in 3D software

VIEW and TRY OUT:

- On screen - pan with finger/ mouse or tilt device
- View in a VR headset



V . R .

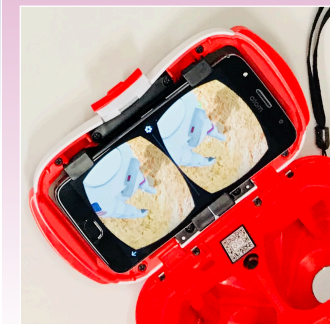
VR or 'Virtual Reality' refers to a 3D environment (digital graphics or 360 video) viewed inside a head-set. Lenses bend what the eyes see to create a perception of reality.

MAKE:

- VR software (desktop, or apps eg. CoSpaces edu)
- Add your 3D objects inside software
- Convert 360 degree footage into VR format

VIEW and TRY OUT:

- Inside VR headset (Low-end Google cardboard + phone, high-end Oculus or Vive)
- Screen - pan around the environment with finger/ mouse or tilt device (WebVR, app)



HOLOGRAM

In this case 'hologram' refers to a method of creating a 'floating' image above the screen of a mobile device that resembles hologram displays seen in movies.

MAKE:

- Build PVC or clear plastic 'prism'-like frame
- Use desktop or mobile apps to turn 2D image into 4 images-in-one
- Load image onto device
- Lay device flat with screen facing up then place plastic frame on top

VIEW and TRY OUT:

- Setup hologram as a display or digital sign for events or offices



Classroom Learning props

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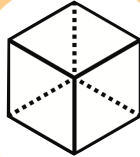
WHY 3D OBJECTS? Physical props can increase student curiosity and connection to content, and offer opportunities for creating content and collaborating in ways that bridges the digital/ real world divide while also giving them next-gen storytelling skills.

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MORE: Read an in-depth guide to 3D printing in schools at [Edutech Post here.](#)

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1. IDEA



Find or make your 3D digital object (prop):

SELECT

Find object ideas that match the task.

A. OPTION: SEARCH

Websites like [thingiverse.com](#) allow you to find an existing 3D object that matches your idea.

B. OPTION: MAKE

Build a customised object (or scene) with Apps such as:

- CoSpaces Edu (iOS, Android)
- Assemblr (iOS)
- Tinkercad (browser)
- Paint 3D (Win10)

D. OPTION: 3D SCAN

Scan real object students can't touch.

SMARTPHONE APPS:

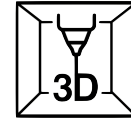
- Qlone app (iOS, Android) • Trnio (iOS)
- 3DF Zephyr (Win) • Scann3D (Android)

3D SCANNER: [Structure.io](#), [Sense](#)

IDEA SOURCES:

- Curriculum (ie. Science = planets, Biology = turtle, Design = clip, History = statue) • Unit Plans
- Student Interests • Community Projects

2. TRY IT



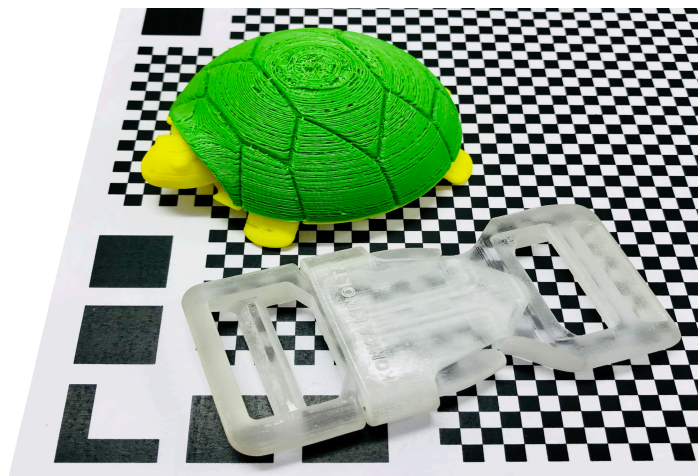
Turn your 3D object idea into a real-world object:

A. OPTION: 3D PRINT

- Import object file to printer software, then export to printer (could be via USB, SD card or WiFi).
- Work with your IT or printing department to develop an accessible 3D printing workflow.
- Use a commercial print service ie. [3DSystems](#)

B. OPTION: LASER CUTTER

- *Some 2D laser cutter designs allow for folding into 3D objects (eg. 'living hinges')*
- Export compatible file to laser cutter vector format and input to cutter (via USB, SD card)



3. LEARNING TASK



Student Activity: Observation Map

A. STUDENT GROUPS

Objects are randomly assigned to groups, and must remain unseen. Next, students pair up as A, B and C. Student B is blindfolded to increase the curiosity factor.

B. EXPLORE OBJECT

A and B each take turns holding and verbally describing the object (blindfolded student goes 1st).

C. RECORD OBSERVATIONS

Student C records their describing words.

- They can also optionally record the activity
- They can also take images for a later report

D. MIND MAP

Students together create a mind map of words, with C adding any they observed were missed.

E. RESEARCH

Students next use word cloud as a framework for research report about curriculum topic, attaching findings to the visual structure and comparing to other groups.

F. PUBLISH

Students attach images of the object and share their word cloud and research using a blog or tools like [thinglink.com](#). Other students view and give feedback.

Augment Learning Tasks

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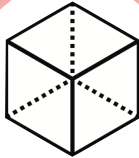
WHY AR? Lets you bring any learning object or scene into your environment to look and walk around it. This spacial understanding is a next level of visual learning which students can also create and share themselves.

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HELP: To find help and new ideas, access groups like the [CoSpaces Edu forum here](#), or search for the hashtag [#ARVRinEdu](#)

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1. IDEA



Find or make your 3D digital object:

SELECT

Find an object idea that matches your learning task.

A. **OPTION: SEARCH**

Websites like thingiverse.com allow you to find an existing 3D object that matches your idea.

B. **OPTION: MAKE**

Build a customised object (or scene) with Apps such as:

- CoSpaces Edu (iOS, Android)
- Assemblr (iOS)
- Tinkercad (browser)
- Paint 3D (Win10)

IDEA SOURCES:

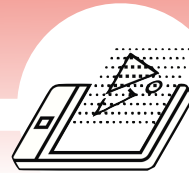
Curriculum (ie. Science = planets, Biology = turtle, Design = clip, History = statue)

Unit Plans

Student Interests

Community Projects

2. TRY IT



See your 3D digital object projected in the real world via a device screen:

A. **OPTION: ATTACH TO REAL-WORLD SURFACE**

- Open 3D object file inside apps such as AR+, CoSpaces Edu or Paint 3D
- Activate AR camera mode
- Tap screen to place on a flat surface

B. **OPTION: MERGE CUBE** MergeVR.com

- Setup a Miniverse account to upload your 3D object, then enter code in 'Object Viewer' app to overlay it on a cube held by students
- Or use CoSpaces 'Merge Cube' mode

TIP: Glasses-free or larger-screen AR can support a higher level of collaboration and content creation - see options like zSpace.com



3. LEARNING TASK



Student Activity: Story Sequence

A. **FIND OR MAKE, THEN VIEW**

At the beginning of a unit, students follow steps 1 and 2 to select and view the AR object or scene that matches the new topic.

B. **OPTION: SCREENSHOT**

Students take 3-5 screenshots from different angles and views (over, under). These can include real world objects as a reference.

OPTION: VIDEO

Students screen record for 30secs to 2mins as they move around the object.

C. **SCAFFOLD**

Screenshots/ video becomes the basis for student research on topic - arranging shots in a sequence or storyboard over which they annotate, add narration and research.

D. **PUBLISH**

Students share the 3D object file they made, and their final research overview of images or video - in the form of a blog, eBook, presentation or interactive Thinglink. This demonstrates their ability to teach others about the object/ topic - using next gen storytelling.

Extend learning to 360°

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WHY 360? The extra dimensionality and interaction that 360 images require adds up to additional levels of engagement which can be enhanced further by students making their own and gaining skills in enhanced storytelling as well.

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MORE: Read an in-depth guide to [creating a 360 virtual tour with CoSpaces Edu here.](#)

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1. IDEA



Find or photograph a 360 degree scene:

SELECT

Choose a 360 degree scene idea you can use to make a resource which matches your learning task.

A. OPTION: FIND PRE-EXISTING

SEARCH websites like Google Street View, [Pixabay.com](#) or [Flickr.com](#) to find existing 360 degree images that matches your idea.

B. OPTION: CAPTURE YOUR OWN

Create a specific scene such as a collection of artefacts (ie. museum room) or a freeze frame of people you record yourself.

RECORD this scene with a 360 camera:

- Ricoh Theta camera's (US\$200-400)
- Insta360 One (US\$300)
- Smartphone lens ie Fusion360 (US\$40)
- GoPro Fusion (US\$700)

TIPS:

- * Higher cost = more features (ie. better resolution or stitching of images into sphere)
- * 180 degree scenes can be a simple option
- * Use [wirecutter.com](#) for latest reviews

2. TRY IT



How to experience your image in 360 degrees:

A. OPTION: VIEW ON-SCREEN APPS

1. Open image file inside 360 apps (ie. from your camera or RoundMe, LookSee, Photosphere).
2. Next move your device in 3 dimensions to see different sections of the 360 image.

ONLINE

1. Upload to platforms that support 360 images: [RoundMe](#), [Google Tour Creator](#) or [Veer](#).
2. Use mouse or finger to swipe and pan around sections of the 360 image.

B. OPTION: VR HEADSET + iOS/ ANDROID

- Source a VR headset that supports the Google Cardboard smartphone platform
 - Add image to VR app (CoSpaces Edu, Scope)
 - Tap VR button and insert phone into headset
- *Or load into Oculus Go or similar headset



3. LEARNING TASK



Student Activity: Virtual Tour

A. IDEA

First step is to find or capture your 360 image.

B. VIEW

See and experience the image on-screen or in VR.

C. MAKE

1. EDIT

- Use a photo editor (for extra 360-specific options try [Veer](#)) to adjust brightness, shadows and colour so viewers will see details clearly.

2. CREATE TOUR

- Make a guided sequence of one or more 360 images as a virtual tour that showcases student knowledge about the learning topic.
- Use tools such as [RoundMe](#), [Google Tour Creator](#), [Thinglink.com](#) or [CoSpaces](#) to add pop-up links, text, narration and more on top of your 360 images.
 - These tools also allow you to publish and share.

D. BONUS

- Challenge students to take screenshots of the 3 most important sections or items in the 360 image.
- These screenshots can then be annotated and narrated in an eBook or webpage as part of assessment item for the learning task.

Fully-immersive Learning

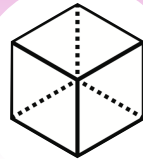


WHY VR? Virtual Reality puts students inside a learning experience far better than previous tools like video, with the higher level of visual immersion often increasing understanding and levels of empathy in a shorter period of time.

RESEARCH ON USE IN CLASSROOMS: Read here at [CommonSense.org](https://www.commonsense.org) on best practice use with students

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1. IDEA



Students find or make VR content to match a learning task:

A. VR HEADSET PLATFORM OPTIONS:

1. Google Cardboard (recommended: *MergeVR mini*)

- US\$10 to 100, + Smartphone
- Universal platform, largest range of free content, easy to load your own content, lower quality graphics, needs phone.

2. Oculus Go • US\$199

- All-in-1 headset + screen, medium graphics, hand controller, growing ability to load content.

3. Oculus Rift or HTC Vive

- US\$350-500 + US\$700-\$2000 PC
- All-in-1 headset + screen, higher quality graphics, hand controllers x2, tracks your position in room, adding your VR content requires higher end skills.

B. VR CONTENT (mapped to learning task)

OPTION: STUDENTS FIND

Headset apps and stores provide links to pre-made content. *Also see Youtube for VR compatible video.

OPTION: TEACHER or STUDENTS MAKE

Build a customised object / scene with Apps such as:

- CoSpaces (free entry-level option iOS, Android, web)
- TinkerCad (free option, most web browsers)
- Paint 3D (free on Windows 10)
- Sumerian (web tool), or Unity 3D (advanced, Win/Mac)

2. TRY IT



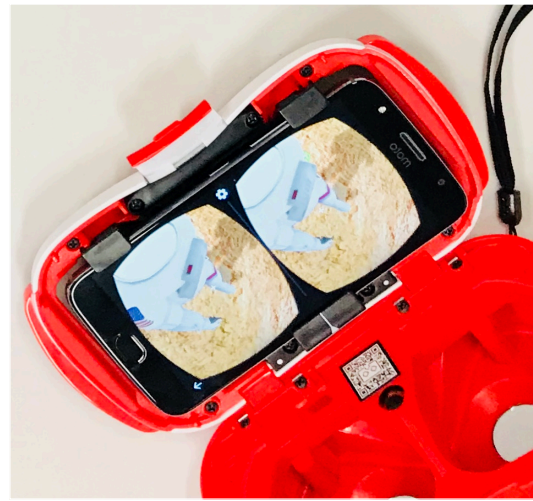
View your VR content in immersive 360 degrees.

A. OPTION: VR Headset

- Adjust lenses and strap if needed.
- Open your chosen VR app (for found or made content), follow info to load.

B. OPTION: Web VR

- Some content is also viewable in a web browser '360' mode (check if your VR app supports this).
- While not as immersive, it does allow you to share some content with non-headset users who can pan around a 360 scene with a mouse or finger.



3. LEARNING TASK



Student Activity: Co-teaching

A. FIND OR MAKE, THEN VIEW

- At the beginning of a unit, students follow steps 1 and 2 to select and view the VR scene that matches the learning task.
- See part E - this task can be determined by the needs of the younger student cohort, or be joint.

B. LEARNING TASK CRITERIA

- Teacher prepares a criteria sheet that helps students check how accurate the VR object or scene is as this impacts how useful it will be for part E.
- e.g. historical accuracy, dimensional (size) accuracy

C. LEARNING TASK EXAMPLES

- Encourage students to check if their VR scene or object matches the criteria.
- OPTION - Students can also find or make an example that does *not* match the criteria.

D. INVITE COLLABORATIVE FEEDBACK

- Students pair up to provide feedback.
- Load scene on headset or WebVR then show to the other student who rates it against criteria.

E. CO-TEACHING

- Students now meet with a younger cohort of students and use the best-rated objects or scenes to provide them a learning experience
- Younger students can also give feedback

* Thanks to Ken at AusTech VR for additional advice.

Learning Content that floats

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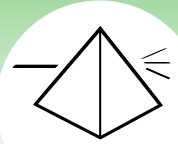
WHY HOLOGRAMS? AR lets you bring any learning object or scene into your environment to look and even walk around it. This spacial understanding is a next level of visual learning which students can also create and share about themselves.

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MORE: Access BOP Industries intro guide to creating Holograms [here](#). (Thanks to Scott Millar for advice on this lesson)

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1. IDEA



Find or make a hologram-ready image, short video or moving GIF that matches your learning task.

To simulate a hologram, you need:

1. A 4-sided clear prism to place on top of a phone or preferably later tablet
 - Make your own (see step 2)
 - Purchase from online store like BOPIndustries.com
2. Image or video converted to 4x mode

A. OPTION: SEARCH

Many hologram apps provide a search function to find pre-made content.

- Holapex or Vloop app (iOS, Android)
- Hologramium 3D (iOS)
- Vyomy 3D Hologram (Android)
- OR: Do an image or video search online or in Youtube for 'hologram 4 sided', then download and transfer to phone or tablet

B. OPTION: MAKE content

Build customised hologram-ready content with the Apps above by importing your own standard images or videos.

2. TRY IT



See your content appear to float in the air as a 3D hologram.

A. OPTION: MAKE hologram prism

- Recommended 'no-tape' method is via Frank Gish instructables.com.
 1. Download prism template and print onto acetate OHP film
 2. Follow instructions to cut out and assemble your pyramid
- Search Wikihow or Instructables for other simple methods of construction

B. SHOW

- Load your image or video onto phone or tablet
- Place prism in centre of screen
- Darken room lights to optimise floating effect



3. LEARNING TASK



Student Activity: Hologram Gallery

A. FIND OR MAKE, THEN VIEW

At the beginning of a unit, students follow steps 1 and 2 to find or make content that matches the learning topic (and a prism), and then test-view a hologram.

B. PLAN HOLOGRAM GALLERY

Students are tasked with choosing 3-5 key points that summarise or tell the story of the learning topic.

- Aim for 15-30 secs of narration or 200 words of text

OPTION: Video Gallery

Students share prisms so they can create a series of holograms, one for each key point.

1. Students are recorded against a black screen speaking their narration from waist up (or head).
- TIPS: Wear bright colours. Use strong light on student
2. Videos are converted to 4x in apps then displayed as loops floating inside a sequence of prisms.

OPTION: Image Gallery + Poster

Same as for video gallery, except:

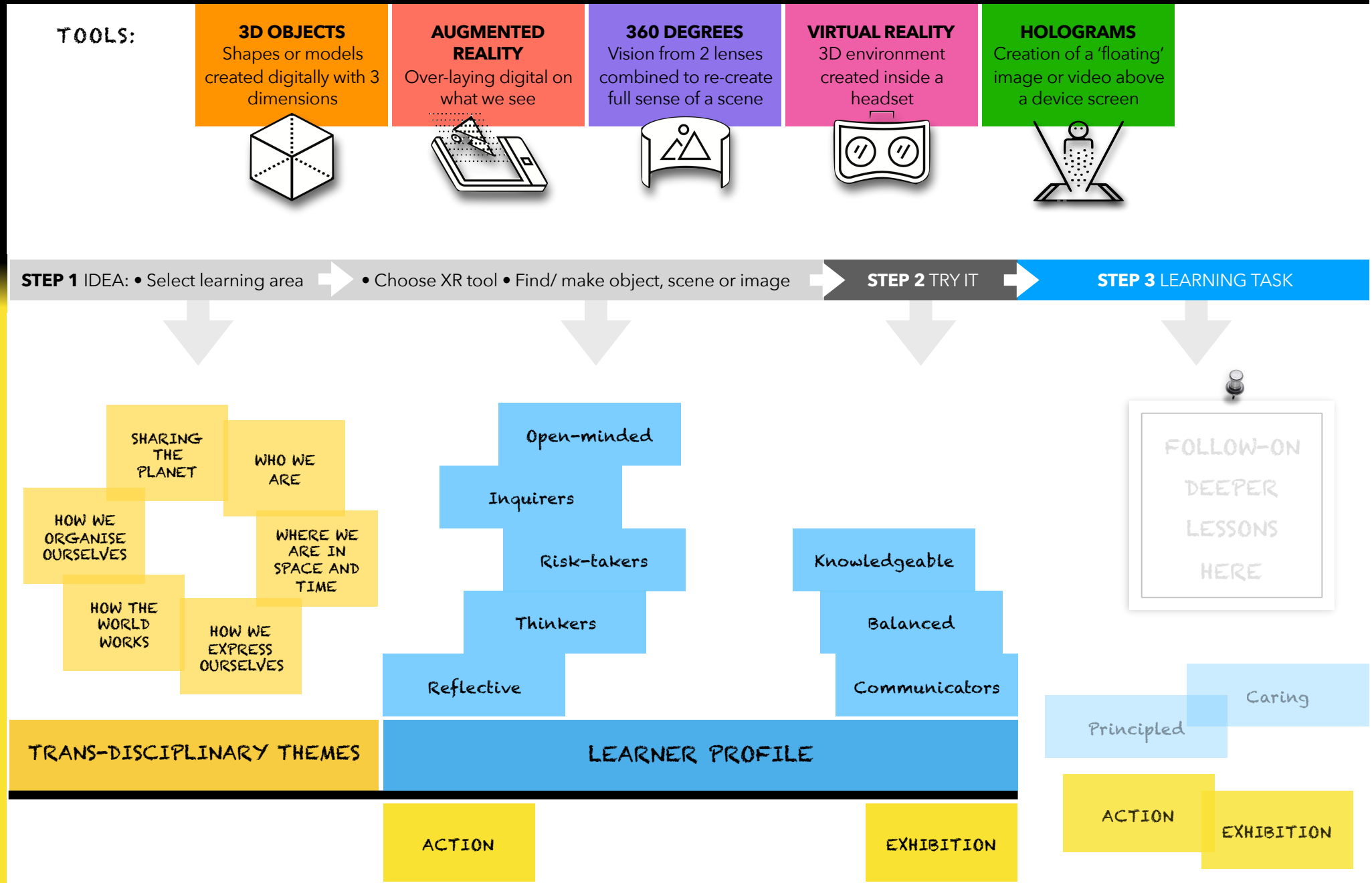
1. Students strike a pose or photograph an object related to learning task, and
2. A poster of text accompanies each prism

C. PUBLISH

Students share 4x videos or images + poster to blogs or a project site to receive feedback from fellow students.

CURRICULUM EXAMPLE 1: International Baccalaureate PYP

Mapped to Make XR 'Extended Reality' tools:



Curriculum Example 2: Australian Curriculum

Mapped to Make XR 'Extended Reality' tools:

HOW: Australian Curriculum

