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Warren Fearn, W J F (2023) A Service Design Approach: What are the barriers and opportunities of using Augmented Reality for primary science education? In: TPEA 35th Annual Conference (3rd – 4th July 2023), 3rd - 4th July 2023, Bedford. (Unpublished)

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# RaY

Research at the University of York St John

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TPEA 35th Annual Conference (3<sup>rd</sup> – 4<sup>th</sup> July 2023)

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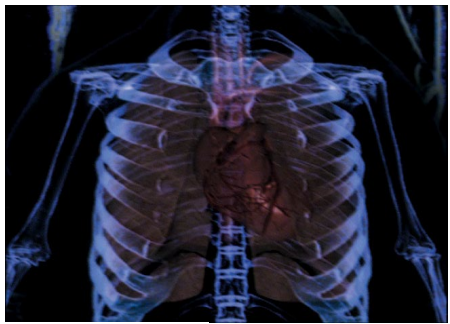
## A Service Design Approach:

What are the barriers and opportunities of using  
Augmented Reality for primary science education?



Warren Fearn  
Senior Lecturer in Design, York St John University



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**ARGON (Ar)**

Point your **iPhone**, **iPod Touch** or **iPad** at the marker to view a 3D hologram

• <b>Discovered:</b>	<b>1894</b>
• <b>Atomic Number:</b>	<b>18</b>
• <b>Atomic Weight:</b>	<b>39.948</b>
• <b>Density At 0 C:</b>	<b>101.325 kPa</b>
• <b>Melting Point:</b>	<b>-189.35 C</b>
• <b>Freezing Point:</b>	<b>-189.2 C</b>

Argon (symbol Ar) is a colorless and odorless gas, makes up 0.93% of our planet's atmosphere. This makes it the third most abundant element in our atmosphere after nitrogen and oxygen. It is a noble or 'inert' gas, found in group 18, period 3 of the periodic table which does not react with other elements under normal conditions.

Uses: You can find Argon used in light bulbs, lasers, double glazing for home and even scuba dry suits!

*(Akçayir, Akçayir, 2017; Wang, et al., 2017; Radu, 2014; Yuen, Yaoyuneyong, Johnson, 2011)*, suggest educators and designers need to collaborate in terms of creating sound pedagogy to develop AR applications that maximise on learning outcomes.

*A study by Silva et al. (2019)* found that although educators did recognise the potential of AR, the adoption of such technologies within mainstream schools is rare.

*(Kerawalla, Woolward, Luckin, 2006; Bistaman, Idrus, Rashid, 2018)* specifically demonstrate AR provides a positive impact on a teaching and learning experience for primary science education.

*(Wellcome Trust, 2017)* that primary teachers within the UK education system are now only managing to devote on average 1 hour and 24 minutes per week in teaching science



- 1) How can AR create new remote experiences outside of the classroom?
- 2) What are the barrier and opportunities for using augmented reality within schools?

# Why use Service Design for AR?

Immersive Experiences



Extended Reality



**Real Life**

This is the real, physical life around us in the world (not digital).

**Augmented Reality**

This is the technology which overlays digital information onto the real world.

**Mixed Reality**

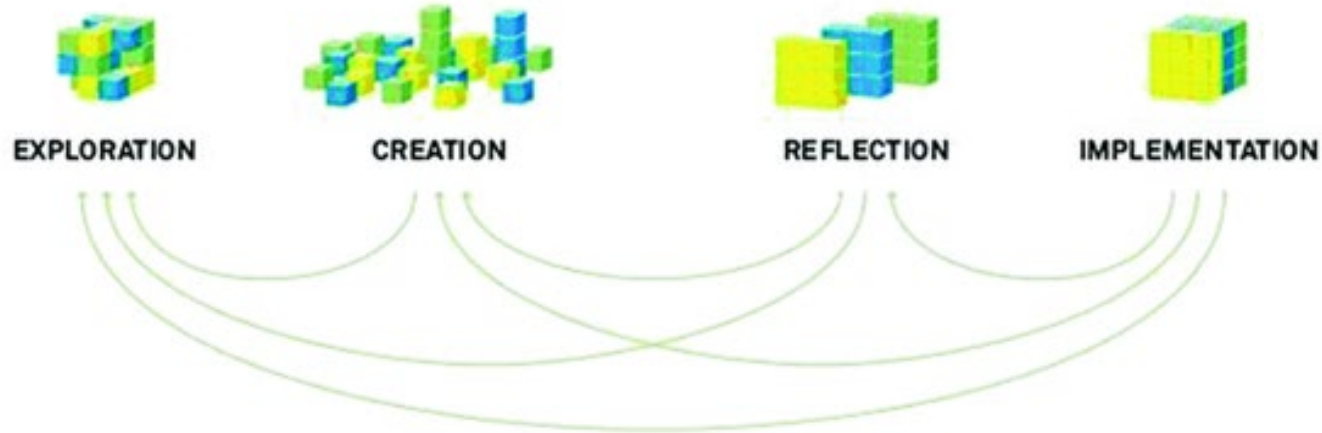
This is the merging of both the real world and the digital world.

**Virtual Reality**

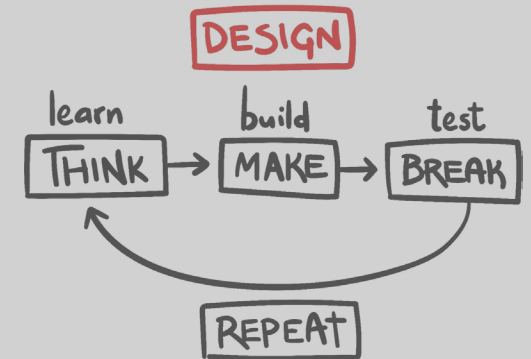
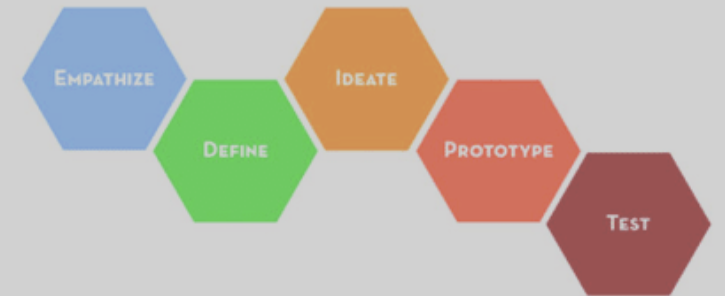
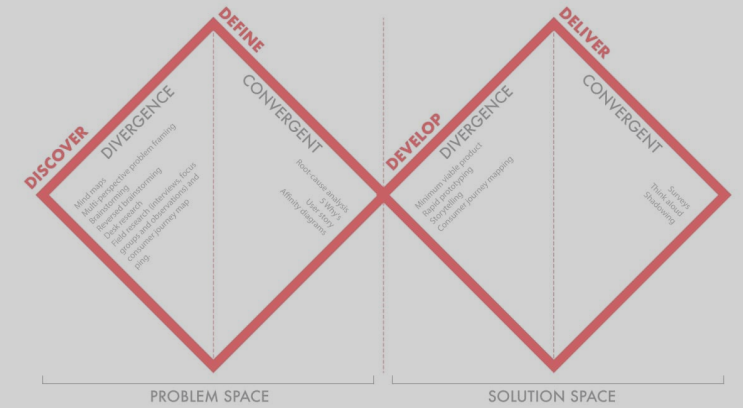
This is the immersing of a user in a completely digital world.

# Design Methodologies

## Service Design Thinking Process



Stickdorn, Hormess, Lawrence and Schneider (2018)  
This is Service Design Thinking



# 5 Principles of Service Design

## 1. User Centred

Experiences are customer focused.

## 2. Co Creative

All stakeholders are part of the process.

## 3. Sequencing

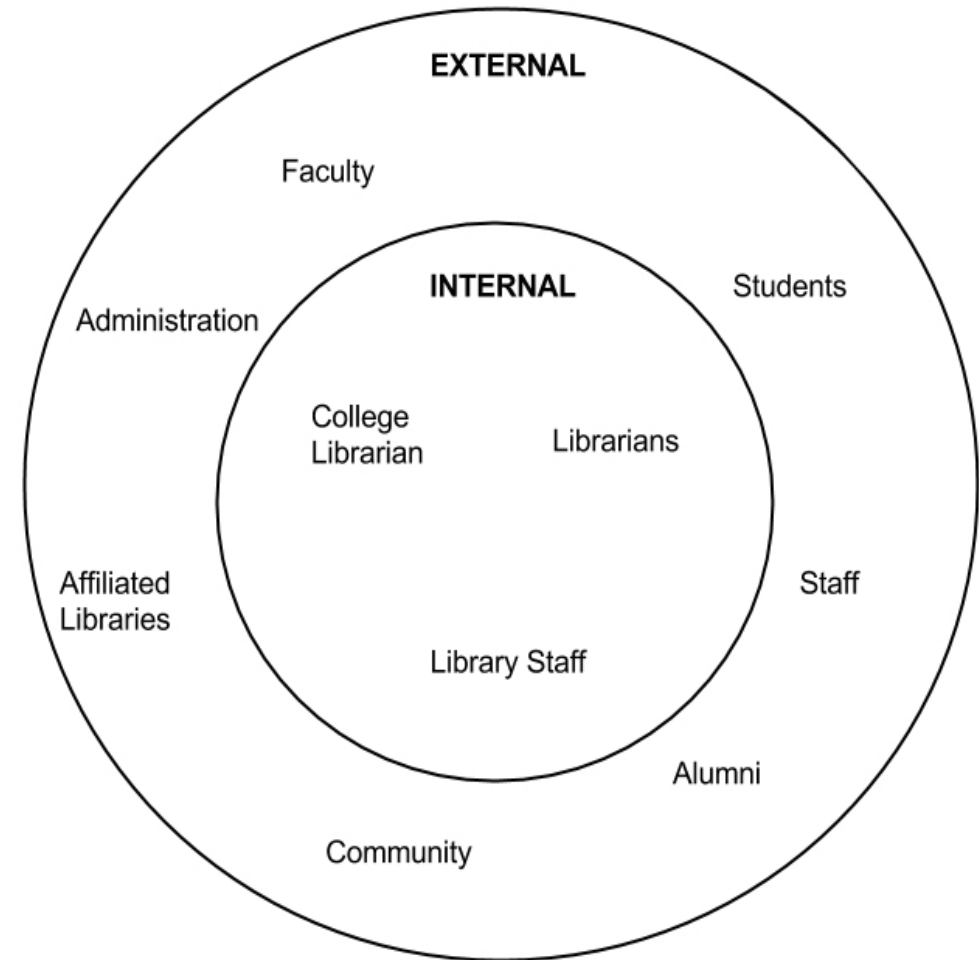
The service should be visualized as a sequence of interrelated actions.

## 4. Evidencing

The service should be visualized in terms of physical artefacts.

## 5. Holistic

The entire environment of a service should be considered.



# Stakeholders

## Education

Ebor Academy Trust, York, UK / Centre for Industry Collaboration

York St John University, Education Department / EPIC Games, Education Manager.



Tim Moat

Director of Communications  
and Development  
Ebor Academy Trust  
York  
UK



Jake Reeves Kemp

Computing Specialist Lead  
Ebor Academy Trust  
York  
UK



Emma Davies

Science Academy Leader  
Ebor Academy Trust  
York  
UK



Nicky Waller

Primary Science Advisory  
Teacher at CIEC  
(Centre for Industry,  
Education & Collaboration)  
University of York  
UK



Dr Katy Bloom

Associate Professor  
School of Education,  
Languages, and Psychology  
York St John University  
UK



.....and **KS2** pupils.

# Exploration. Methods.

## Service Safaris

Classroom Observations

Shadowing - Day in the life (Teacher/Pupil)

## Contextual Interviews

In-depth conversations (Teacher / Pupil)

What do they want / need?

Where are there barriers and opportunities?

## Customer Journey Maps

What are the key touchpoints?

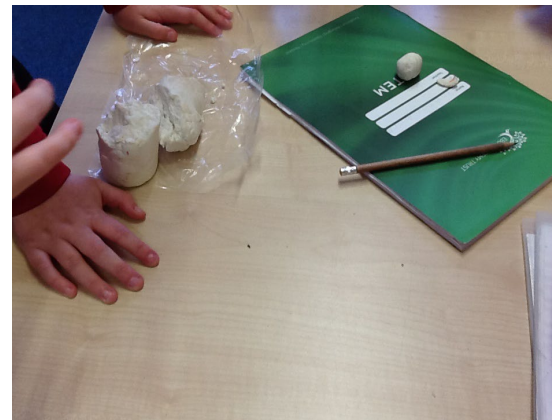
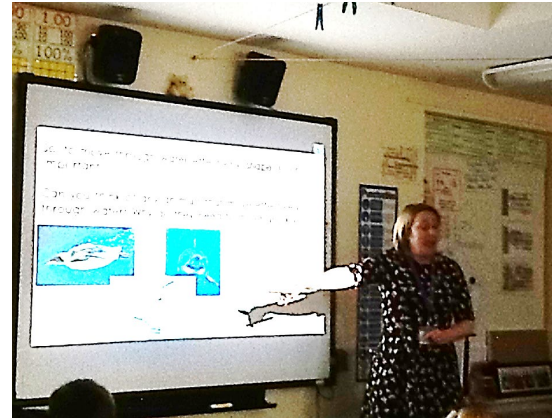
Emotional Implications.

Empathy.

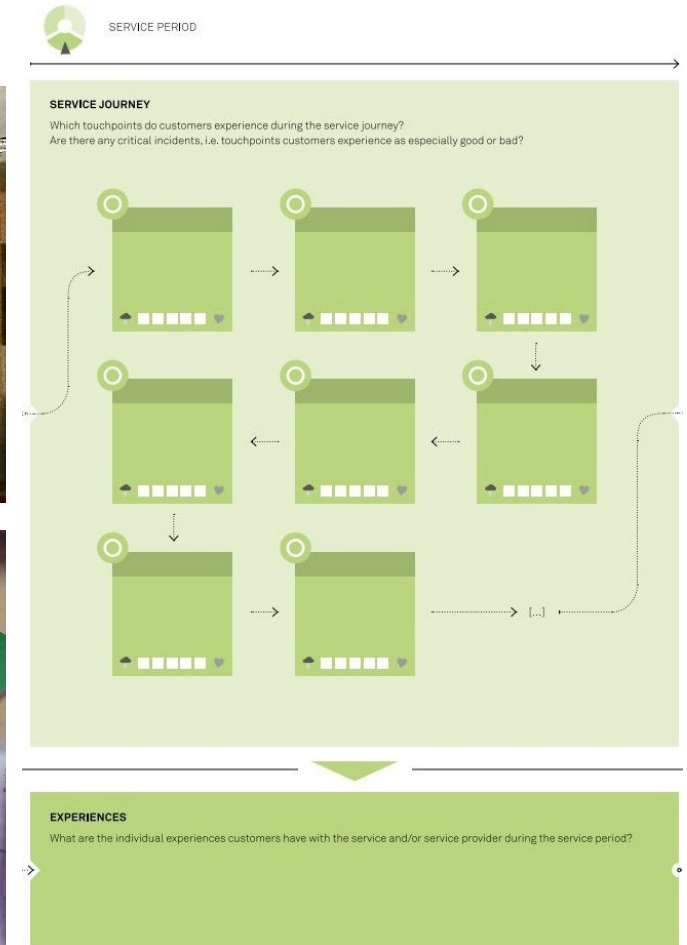
## Questionnaire

Distributed out to primary schools in England

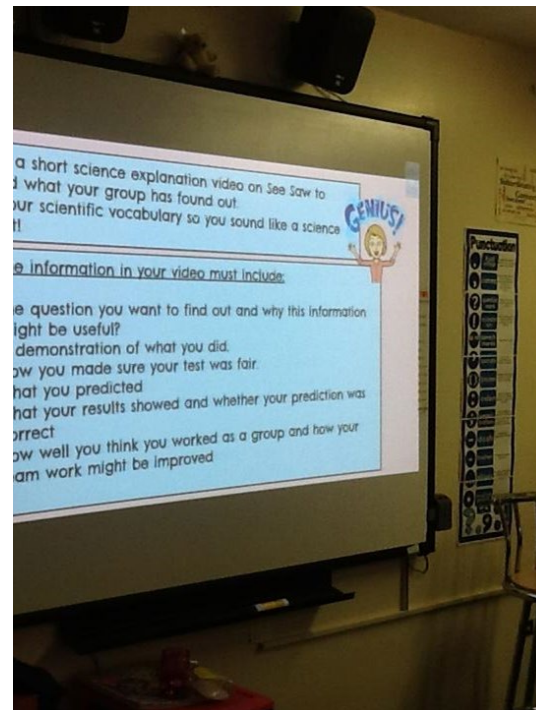
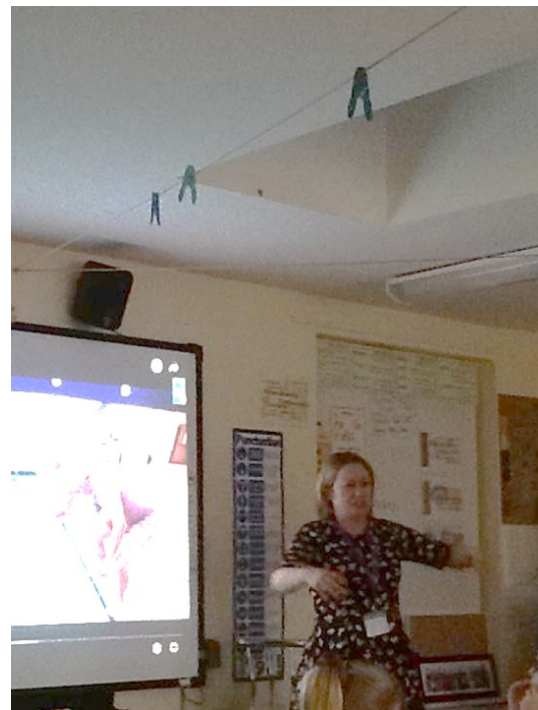
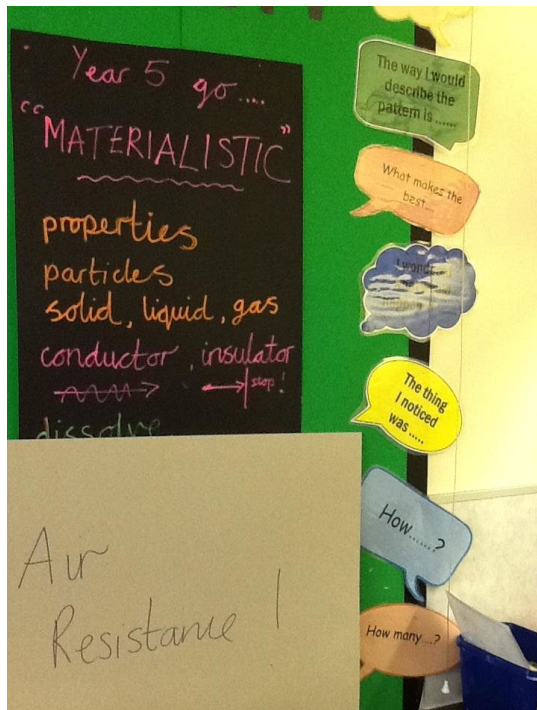
57 responses



Robert Wilkinson Primary Academy, York, UK.

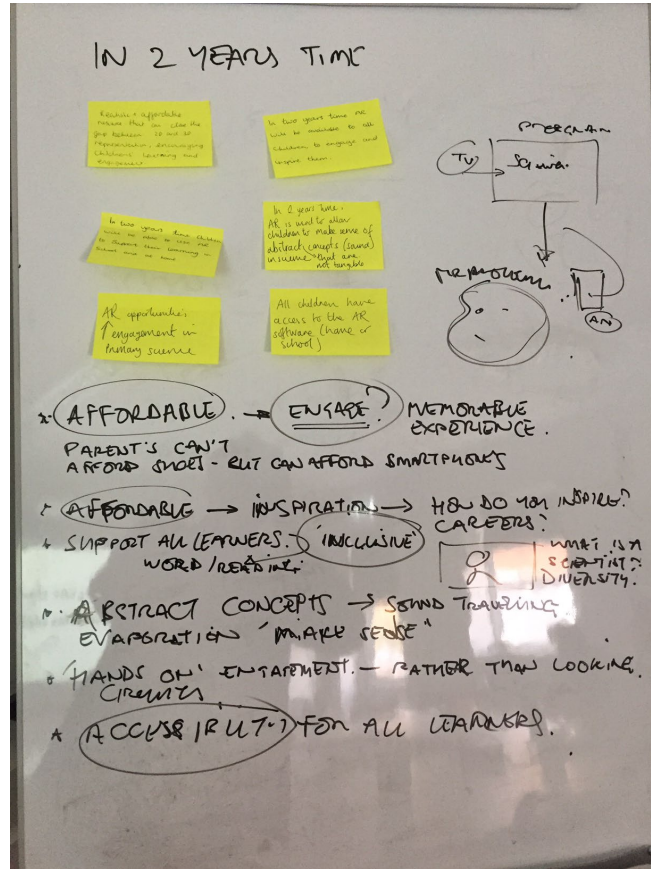


# Exploration: Classroom Observations



/ Comical Videos / Stories happened / Activities / Delivery

# Exploration. Focus Groups / Design Sprints



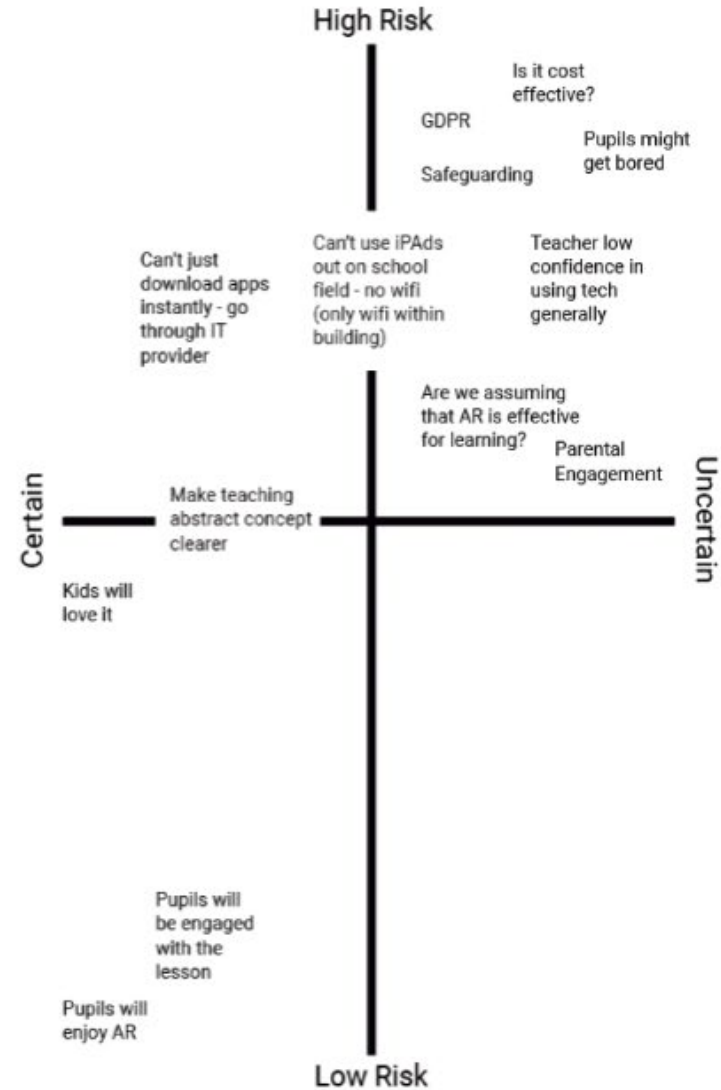
/ Exploring AR products / What do you think?

# Exploration. Empathy Mapping





# Exploration. Empathy Mapping

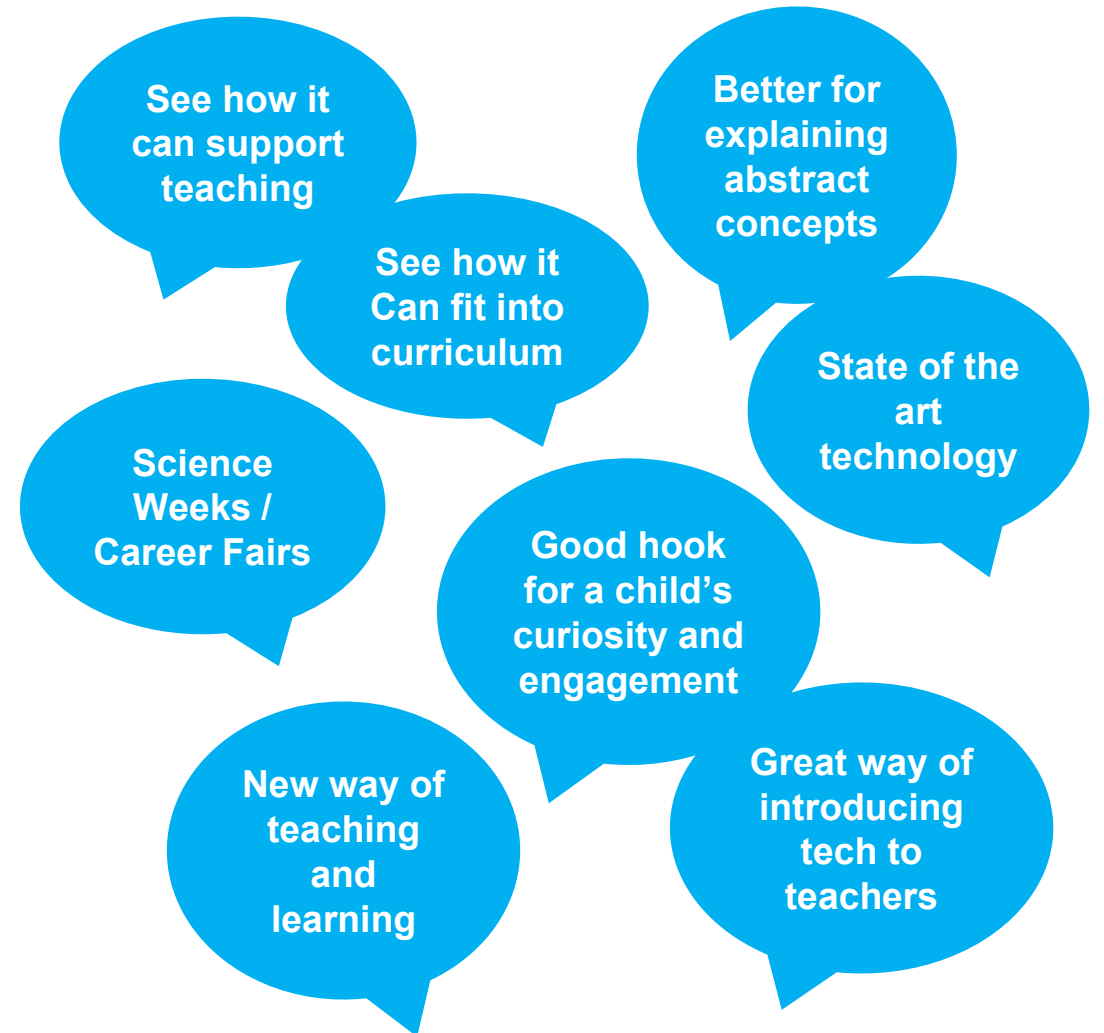


# Exploration. Empathy Mapping

## Challenges



## Benefits



# Exploration. Summary

## Challenges

Affordability & Investment  
Teacher Attitude & Confidence  
IT Infrastructure  
Time Preparation  
CPD & Training  
Inclusive  
Digital Divide  
Access to Devices / Platform  
Level playing field  
Funding for resources

## Opportunities

Curriculum Alignment  
Cross Curriculum  
Connecting Science to Real Life  
Engaging in unique ways  
Science Capital  
Relevance to Real Life  
Abstract Concepts  
Deep Dive  
Blended Learning  
Active & Engaging

VR & AR Applications

28 % - YES

72 % - NO

Class Sizes (30 above)

64%

Teaching Science

30% - 2 hrs per week

19% - 1 to 2 hrs per week

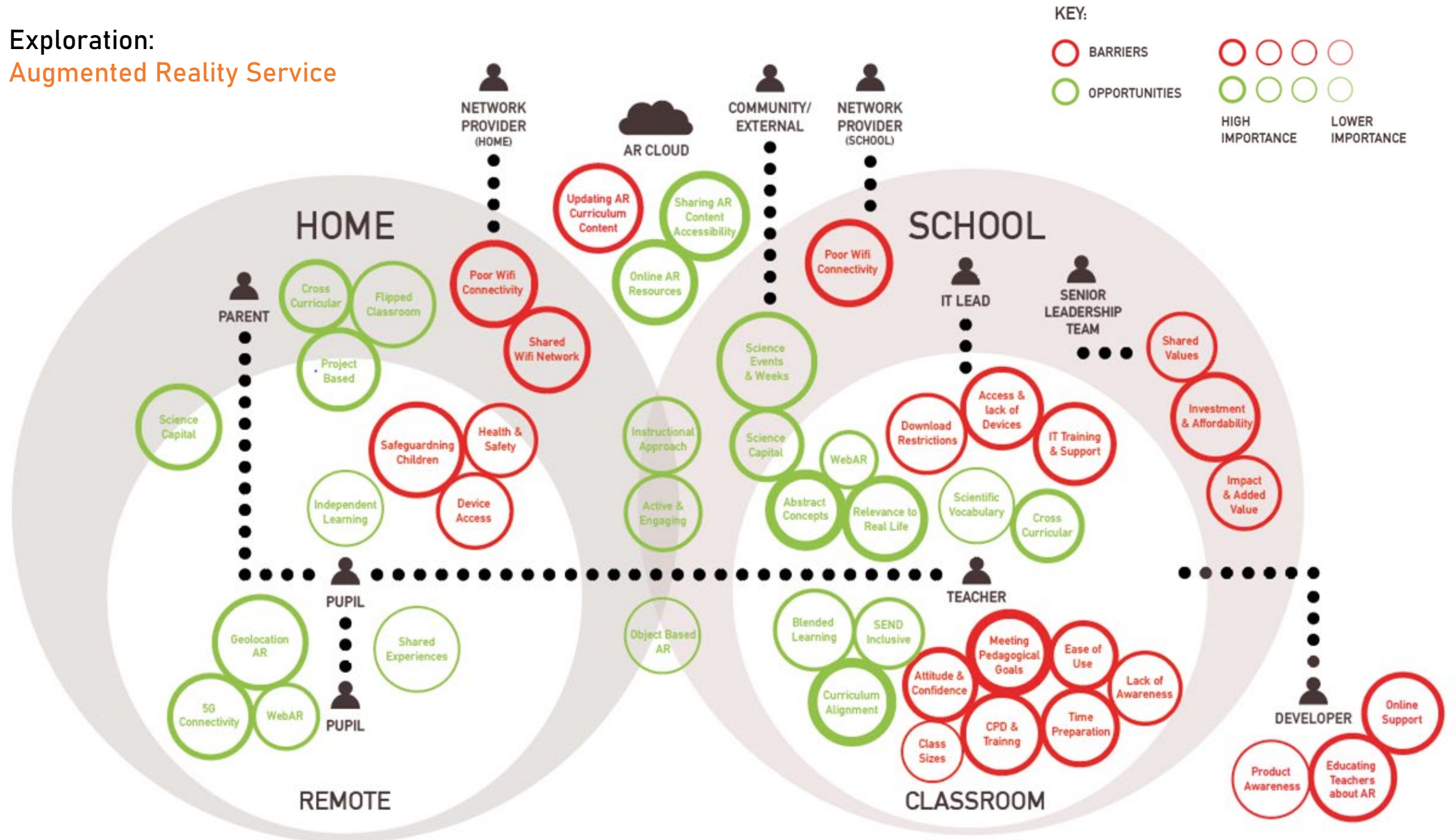
19% - 1hr to 1.5 hrs per week

16% - 1.5 hrs per week

14% - under 1hr per week

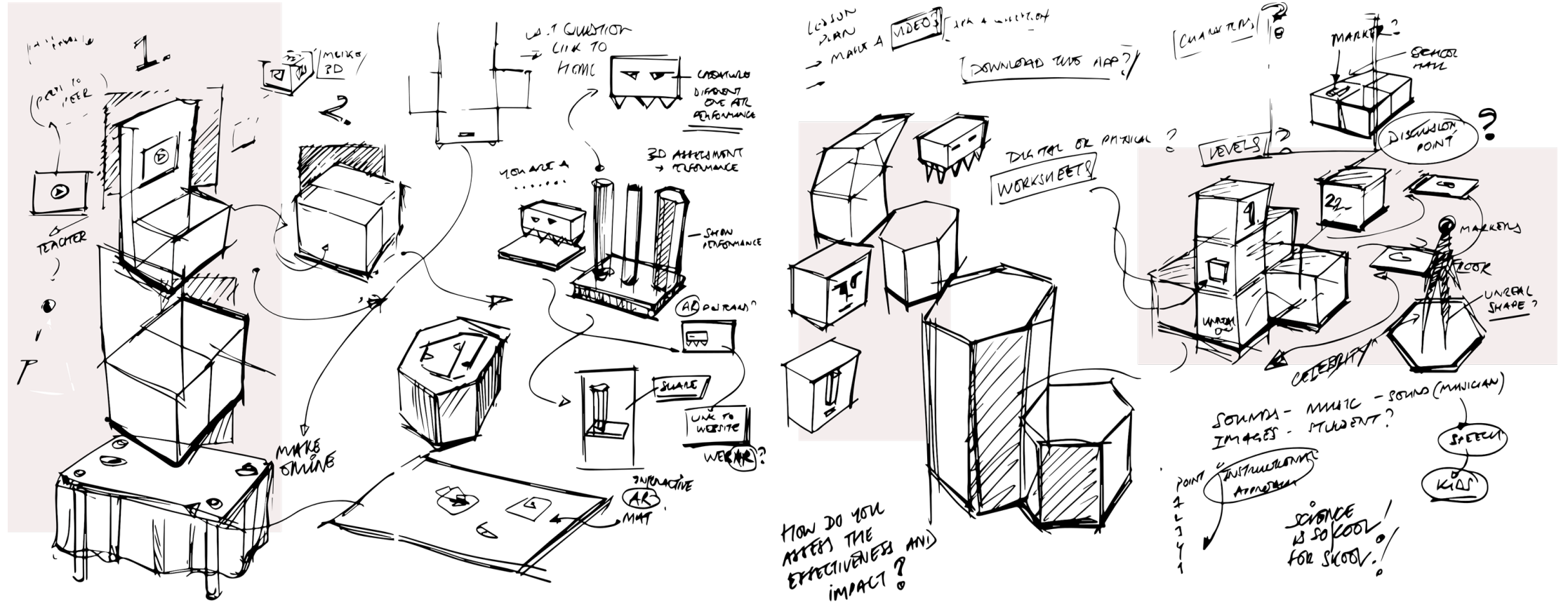
2% - only half term

# Exploration: Augmented Reality Service





# Creation. Concept



/ AR Pop-Up Exhibition

# Creation. Concept



- / Science Event (time preparation)
- / Change Content (Cloud based)
- / Image Recognition
- / Contained under school infrastructure
- / Inclusive (no digital divide)

# Exploration. Empathy Mapping

I love the fact that there is a game and quiz

I like that there is an activity and that its science and my fav colour is purple.

I like how thin it is

It looks fascinating and it would be something I would try to make.

I like how sciencey it is

I like everything about it. 😊

I like all the details on it. Lilly

I think maybe he could use more colours other than purple.-Isla L

I like how they have platforms to stand on if your short like me. Jack.

I like the patterns on them and the shape and I love how its got activities on them.

I think that the technology that goes into it is very fascinating and very interesting. Kels

I really like the color of it. Abril

like that there is quiz activity from logan

I like the shape but it would be fun with more color.dhanush

It's good how they are all different shapes but they should have different sizes and colours. Becca

I think it looks epic because the colors look cool. Leo

I'm attracted to the different shapes scattered all over the shapes, they look very cool.-IslaL

I think it is epic because it looks cool and the colors are awesome. Leo

I like that it will look like its as tall as you.

I like it because it looks like he put lots of effort in it and might of spent a long time doing it From Lilly

I like it because the patterns are different From Lilly

i like how it is the same size as you

I like how it could be the same size as you but it should be a bit smaller I also love the images and how they represent the actual subjects. Becca

I like how big and disined it is

I like the shapes they are and I like how there is lots of pictures that represent a different subjects I also like the different sizes.

I like the shape but i think its should be another color.

I like this because it's really cool because it's so huge and is as big as us. LOIS

I think it is amazing and really cool but it should have another color.Abril

I like that

I like that it's the same size as me from logan

I like the shapes and how creative it is, this also requires a lot of skill and i also love the images. Kels

I like it because the design is awesome and the videos activities etc.

I like how he made them so that they are the same size as a kid so that it isn't hard to scan. Jack

/ EPIC / SIC



# Creation. Themes (Climate Change)

## 1. Renewables

Touching on the wind turbine (learning about parts of the turbine)

## 2. Habitats

Choosing options to help an animal survive. Shelter, food, water (problem solving)

## 3. Materials

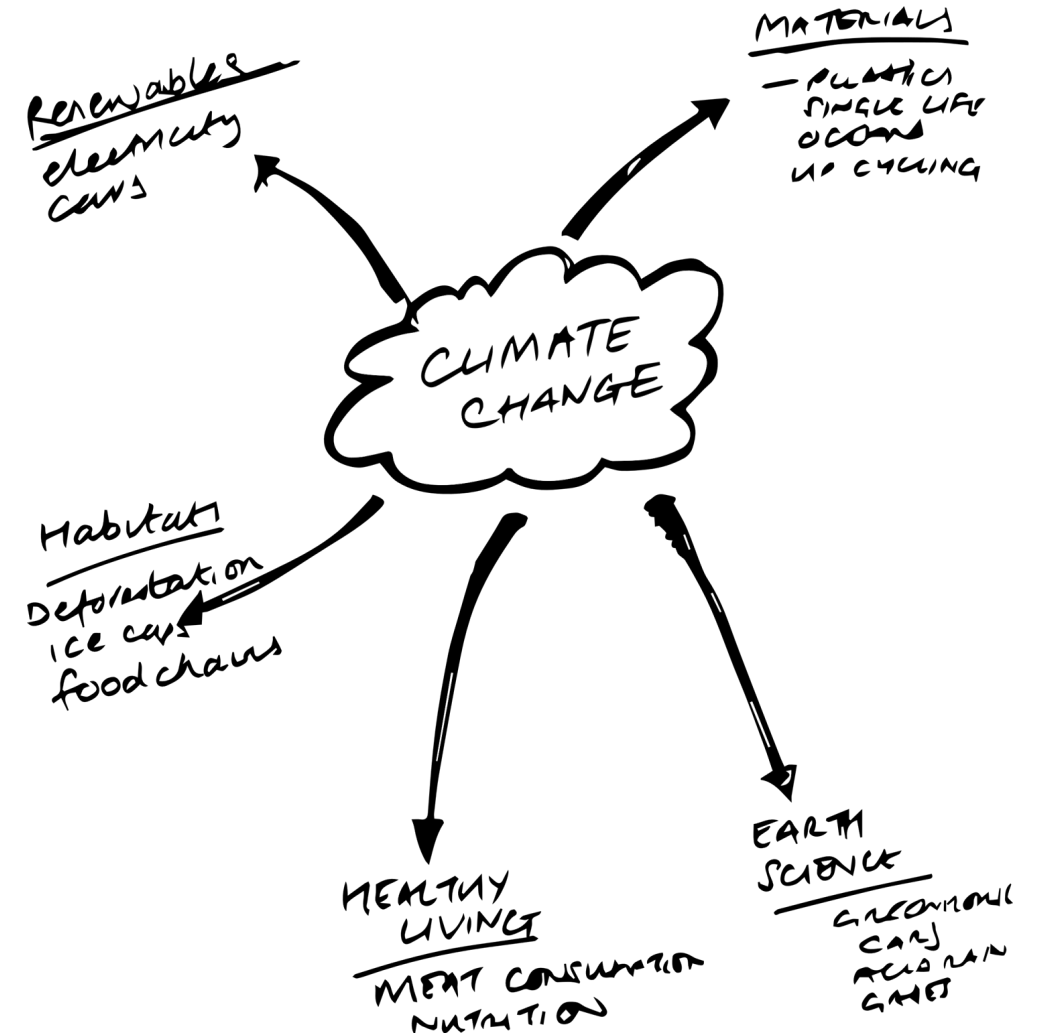
Choosing which materials to remove from the ocean to stop pollution (gaming)

## 4. Healthy Living

What is a burger made from? (what's in a burger)

## 5. Earth Science

Character in a car, too hot. Using dial to get hotter and colder (slider to make temp hotter and colder)



# Creation. Customer Journey Mapping



1 / QUESTIONS (3)

2 / DISCUSSION

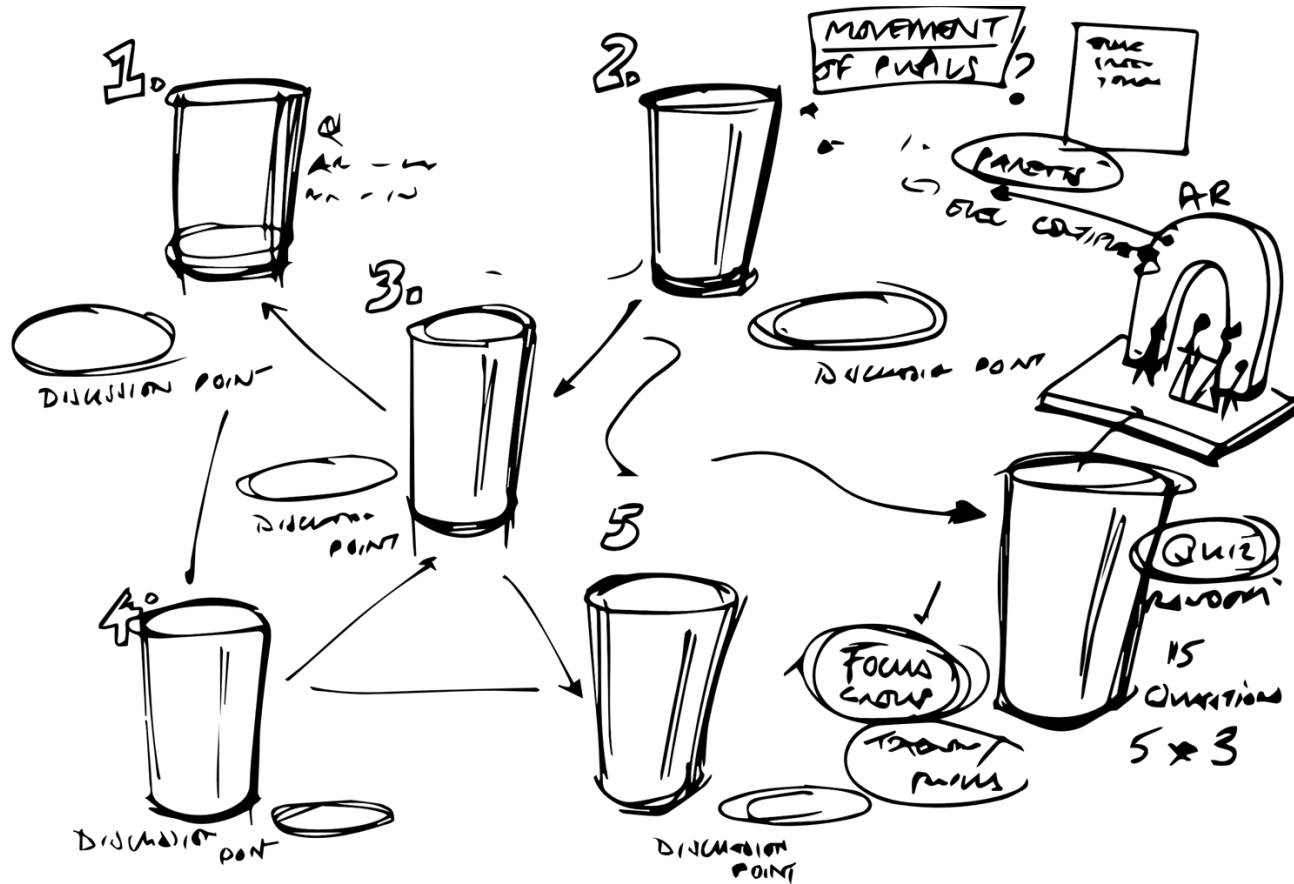
3 / AR VIDEO

4 / AR ANIMATION

5 / AR INTERACTION

6 / QUIZ

# Creation. Customer Journey Mapping



/ Discussion Points

/ Environment  
School Hall, Classroom

/ Style  
(doesn't matter - more important content)

/ CPD Online Videos  
Training and support

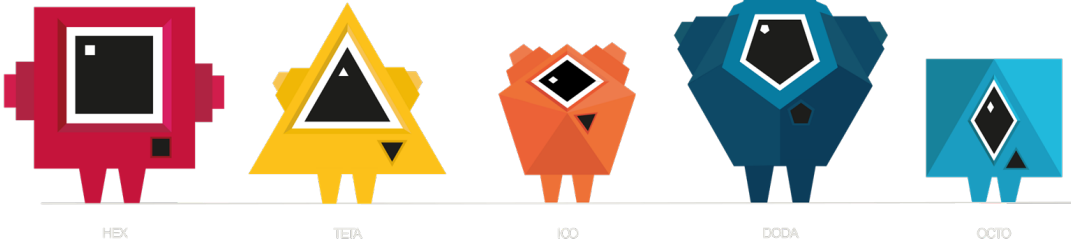
/ Accessibility  
AR Roadshow, Ordered Online

/ Worksheets (95%)  
different learning styles and record

/ Science Capital (63%)  
Triggering experiences from home  
Type of Device (Tablet vs Phone) screen size

# Creation. Concept

## / Platonic Solids



HEX

TEIA

IOO

DODA

OOTO



# Creation. Storyboarding

3.

Narration:

( 12 Seconds ) Located above the forest floor is the understory layer. Small shrubs and trees can grow here. Understory plants often produce flowers that are large and easy to see.

FRAMES  
1525 - 1825

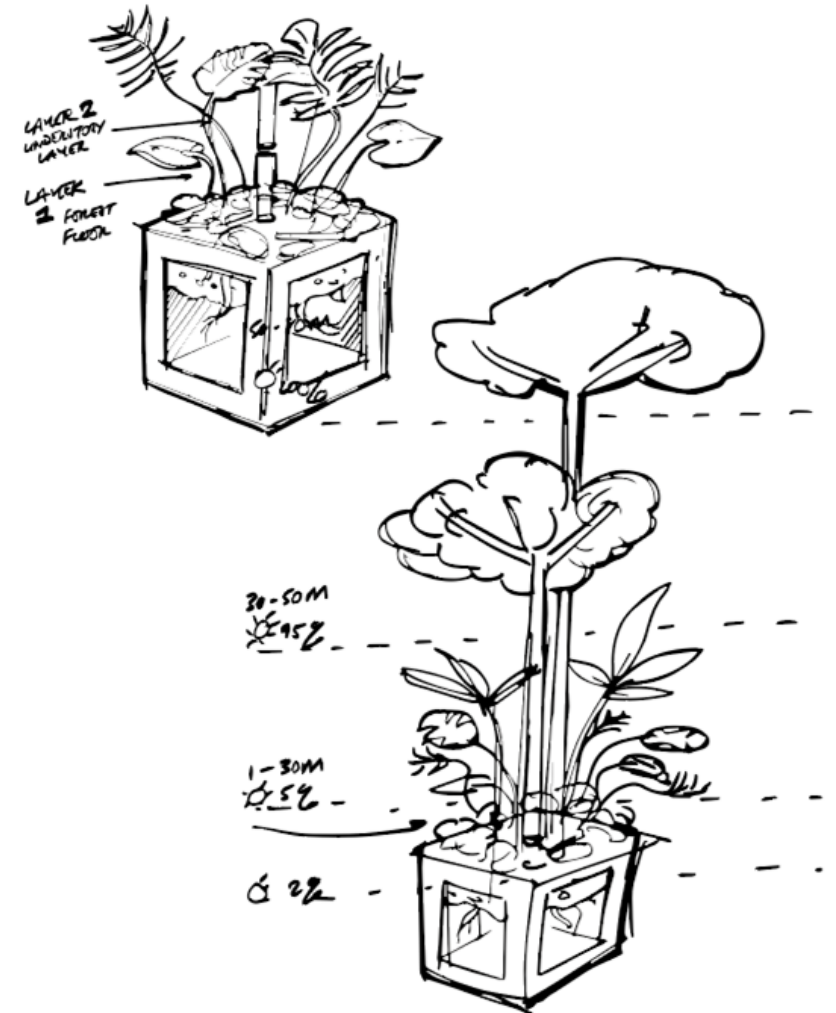
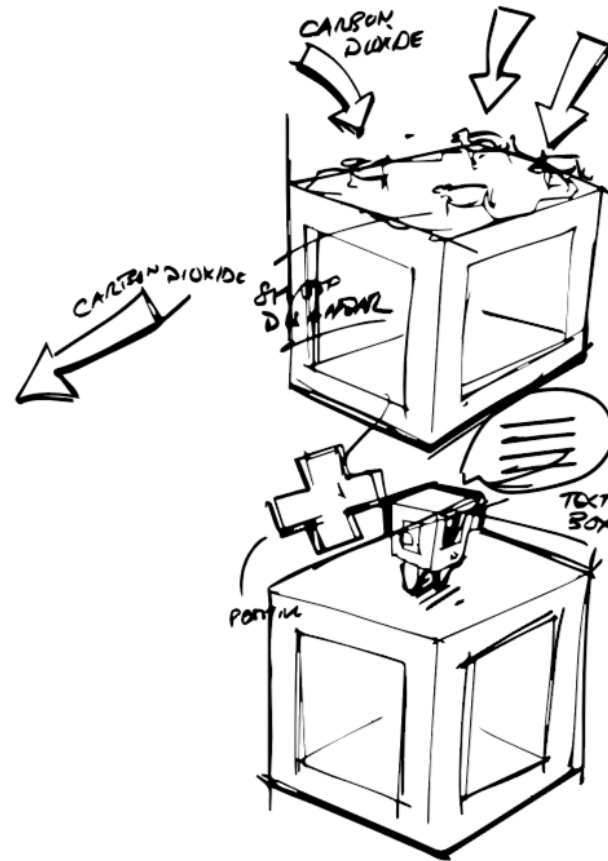
( Animate the visibility of each layer )

( 12 Seconds ) The canopy layer forms a dense network of leaves and branches as a roof over the two remaining layers. With so much food available, more animals live in the canopy than any other layer in the rainforest.

FRAMES  
1825 - 2125

( 11 Seconds ) The top layer of the rainforest is the emergent layer, where trees can grow up to 60 metres tall due to larger amounts of sunlight. Here, you will find living bats, butterflies and awaiting predators such as hawks and eagles.

FRAMES  
2125 - 2400



Creation. Concept



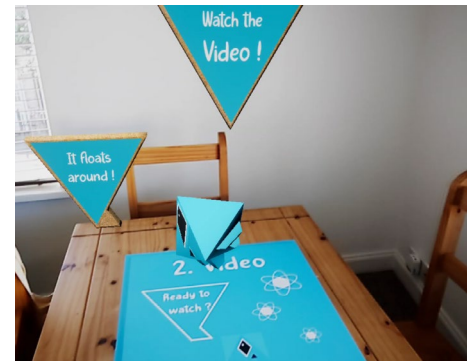
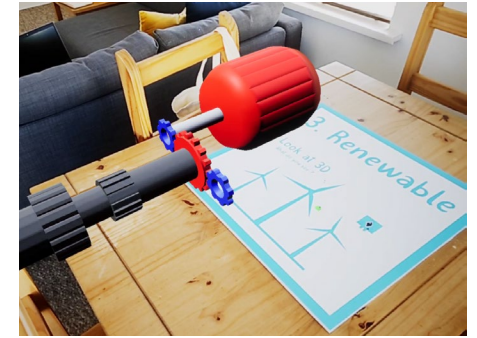
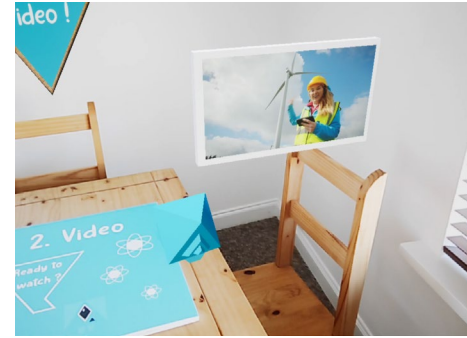
Creation. **Concept**



Creation. **Concept**



# Creation. Augmentation



# Implementation. Phase 2.

/ 6 to 8 Ebor Trust schools

How did the service work? What is the impact? Information needed to support teachers.

/ Pupil Quiz

Quizzes Software (Data Collection of 15 multiple questions) *Quantitative Data*

/ Focus Groups

Teachers & Pupils (What do they think of the AR experience? What are the peripherals? *Qualitative Data*

/ Observations

AR Interactions / Service. *Qualitative Data*



<https://www.epic-science.com/>

## / Brands

How will we work in the Metaverse? Roblox, Fortnite, Minecraft

## / New pipelines

to make things (take an image and convert into 3D textured model) AI

## / Geolocation

learn as you go (OECD – Future of Schooling)

## / WEB 3.0

Trigger 3D experiences without apps / triggers



/ Kiesha Matsuda – Hyper Reality

# Thank you.

For more information:

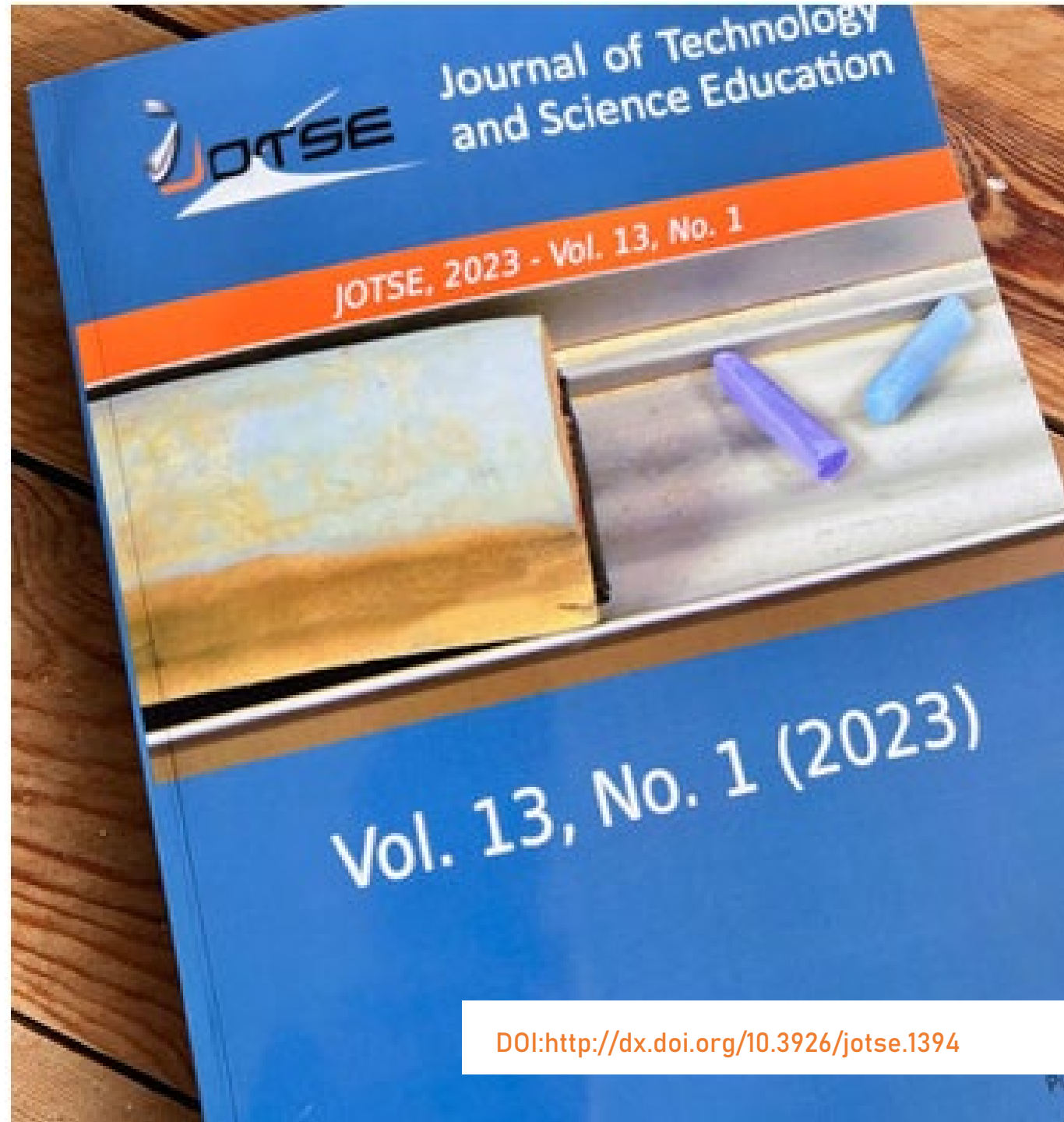
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DOI:<http://dx.doi.org/10.3926/jotse.1394>