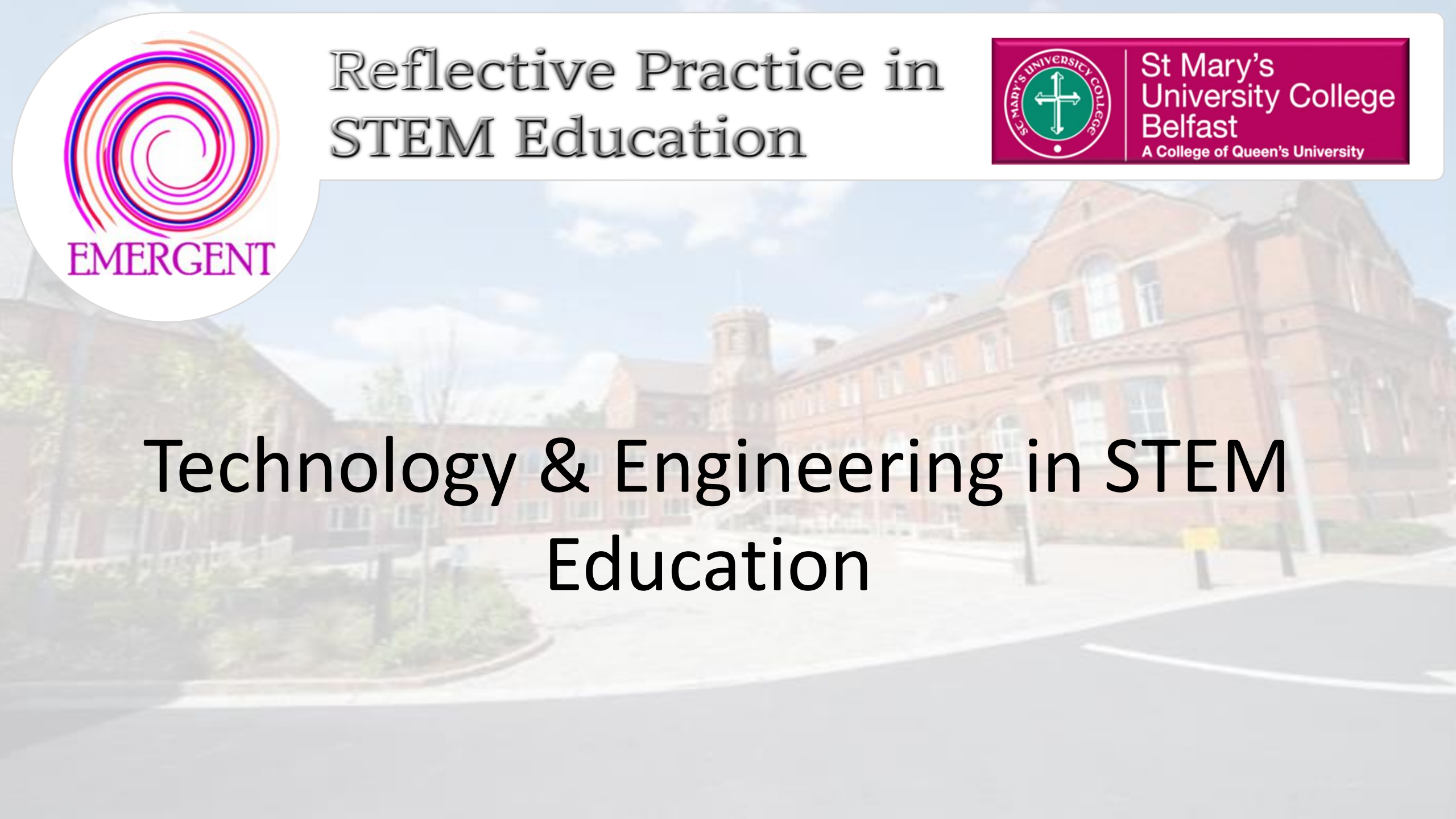
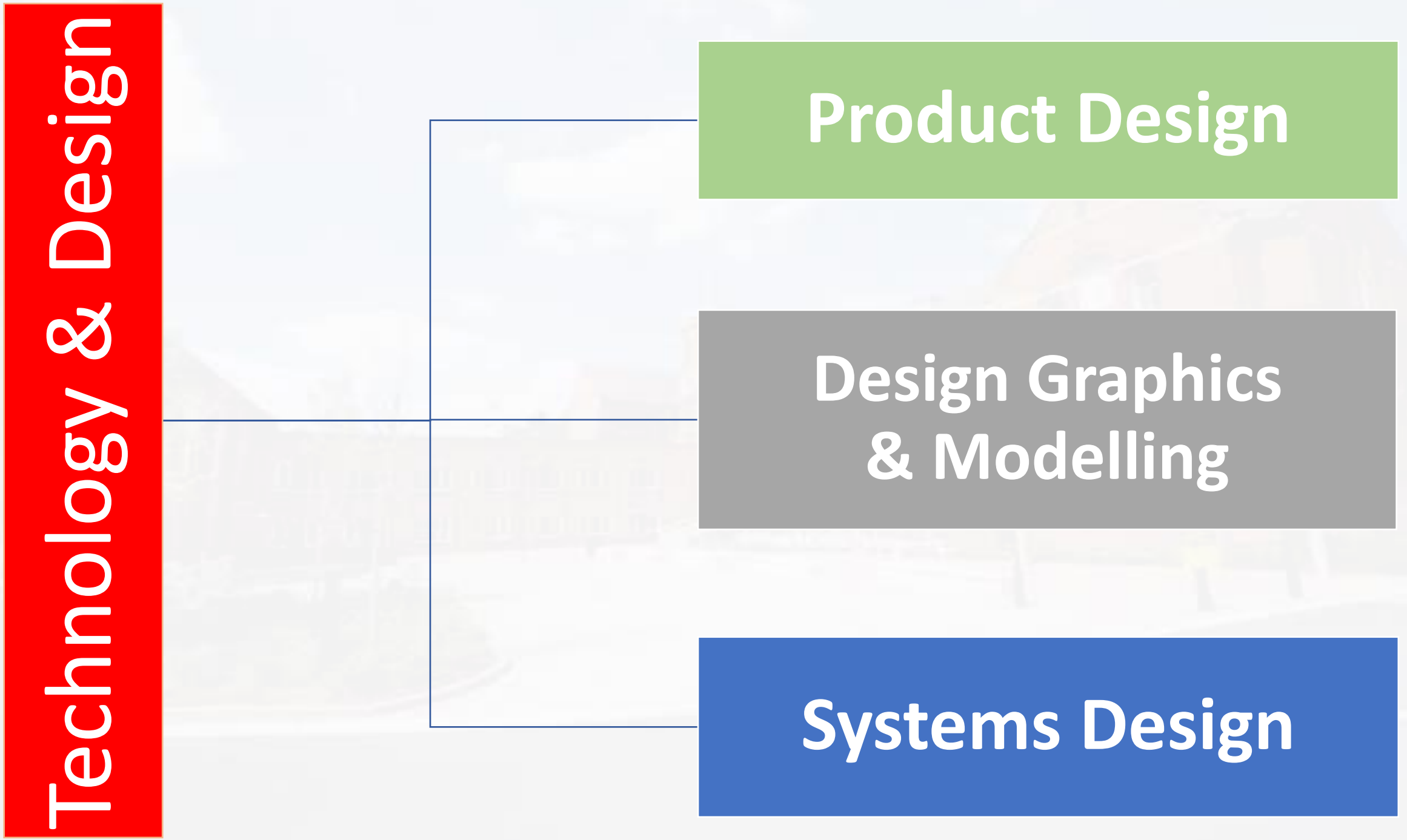


Technology & Engineering in STEM Education


Technology & Design
Product Design
Design Graphics & Modelling
Systems Design

Science and Technology

Science and Technology is a compulsory Area of Learning at Key Stage 3. This Area of Learning aims to stimulate pupils' curiosity, enthusiasm and innovation.

Schools can choose to organise pupils' learning in Science and Technology by:

- teaching the subject strands together;
- connecting learning in the subject strands; and/or
- teaching the subject strands separately.

If schools teach Science, and Technology & Design as separate subject strands, they should make connections in Science and Technology.

Creativity and Problem-solving Post-Primary

- NI Curriculum: Thinking Skills and Personal Capabilities
- Creativity and Problem-Solving Strategies
- Teaching and Learning Activities

Technology & Design

In Technology & Design, pupils learn about:

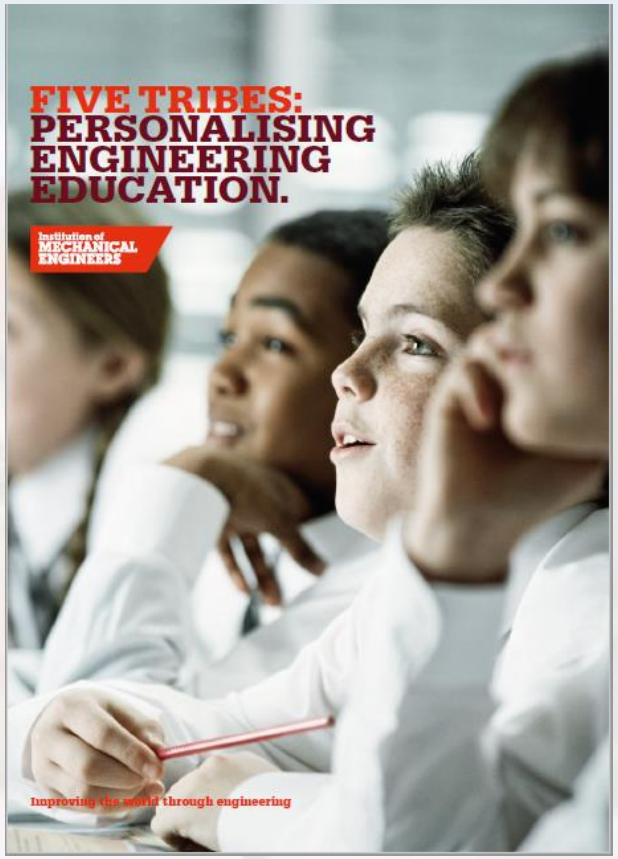
- Design
- Communication
- Manufacturing
- Control

Technology & Design

- Technology & Design encourages pupils to develop creative thinking and problem-solving skills by evaluating design proposals and selecting and using materials that are fit for purpose

- Pupils should have opportunities to research and manage information effectively to investigate design issues. They should also think critically and flexibly, and demonstrate creativity and initiative when developing ideas and following them through

The messages focusing on what pure scientists and engineers ‘do’, are NOT sufficient to persuade the under-represented groups...Careers from STEM need to be described in terms of the personal characteristics required



The research raises questions about whether we should replace the current ‘be like me’ approach, with programmes that take difference into account. It compels us to explore how it might be possible to retain the creative talents and innovative abilities of many young people who do not fit the obvious engineering archetype

https://www.imeche.org/policy-and-press/reports/detail/five-tribes-personalising-engineering-education

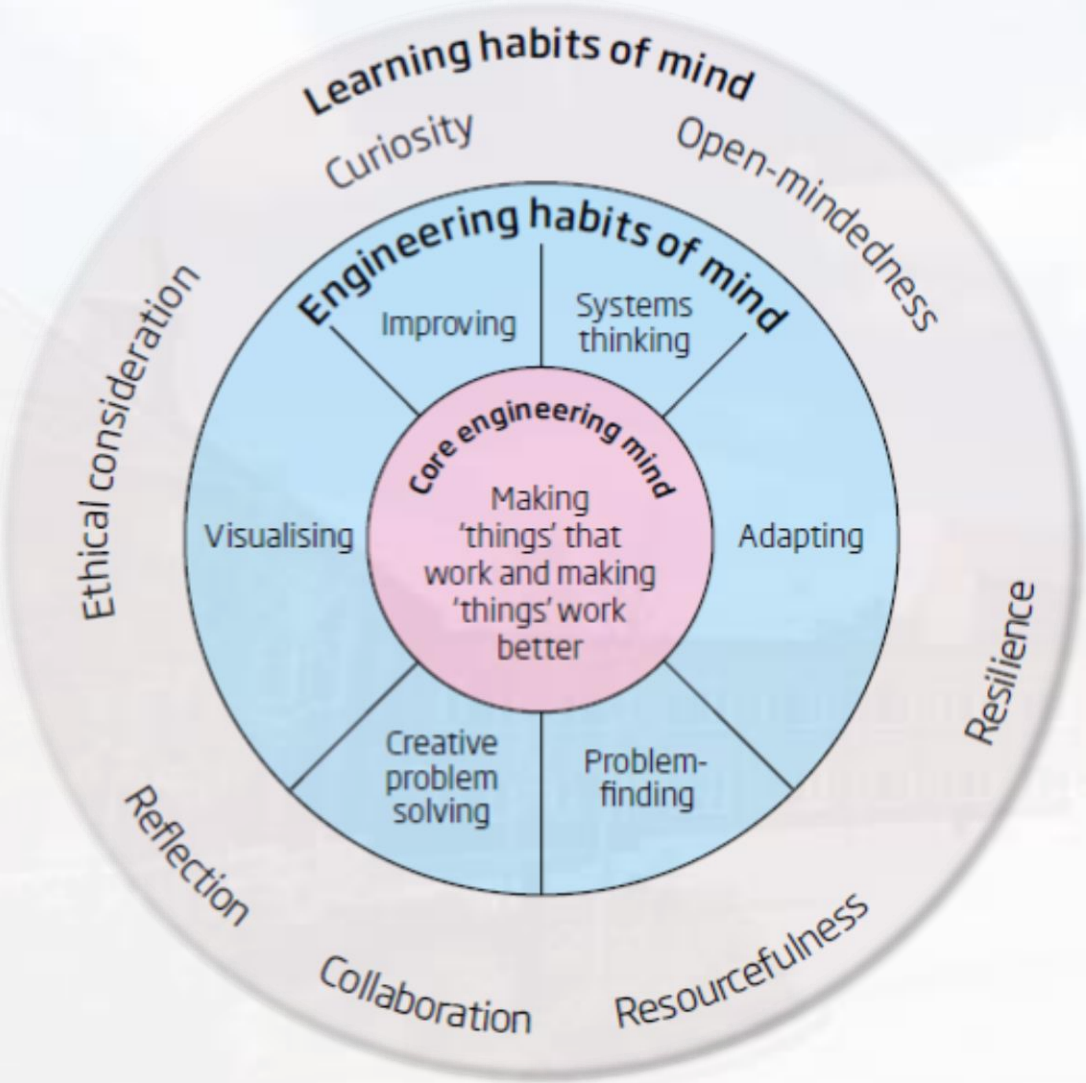
Engineering & Gender

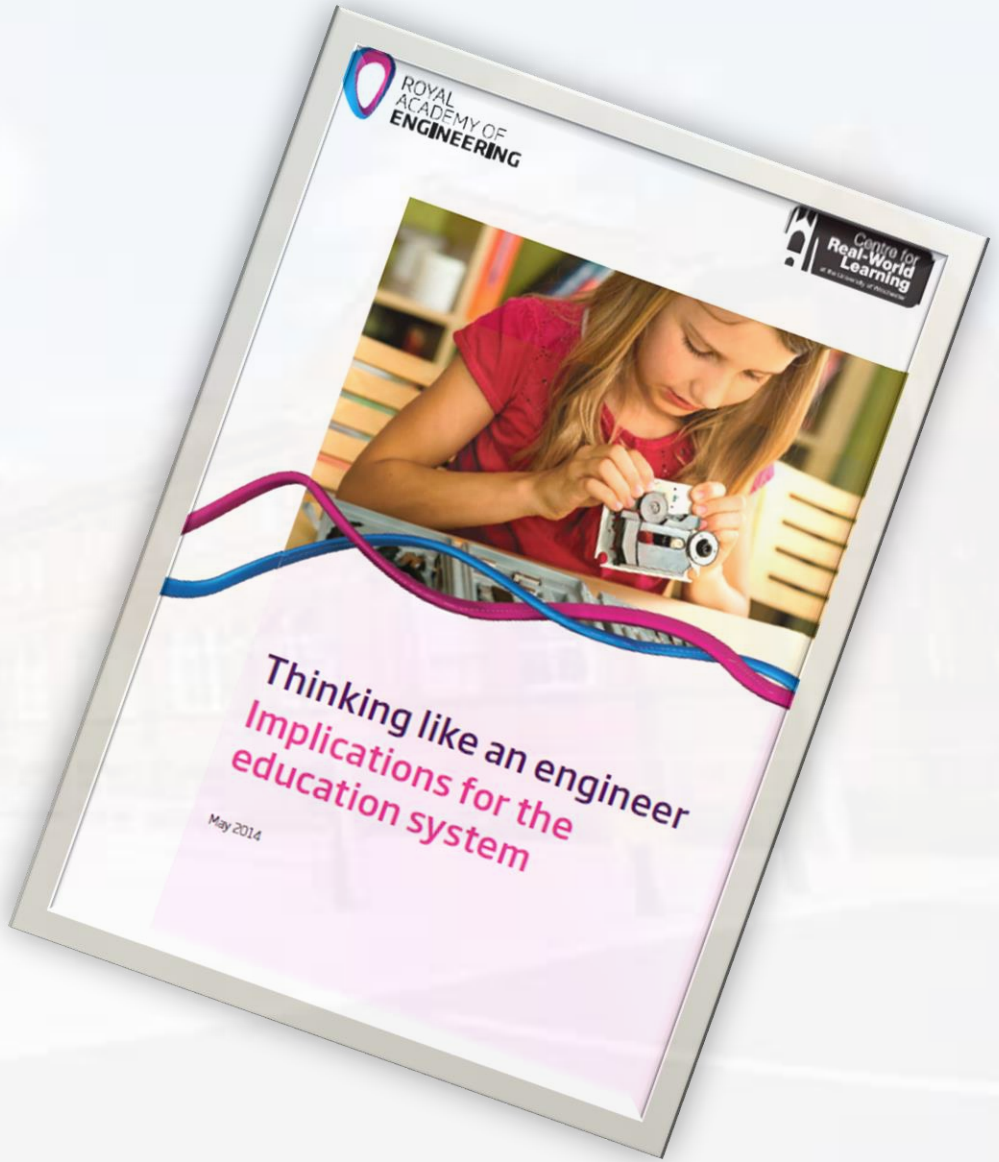
- Engineering as a people focused, problem-solving, socially beneficial discipline
- Shift the emphasis in STEM teaching towards problem-based, contextualised learning
- Nurture engineering ways of thinking in terms of habits of mind
- Create more spaces and opportunities for young people to design and make things particularly by working collaboratively in interdisciplinary groups
- Use Technology and Design as a platform for integrating STEM and creative design and for raising the profile of engineering in schools
- Change the structure of schools education to embed engineering explicitly at all levels, aimed at increasing their understanding of modern engineering

https://www.imeche.org/policy-and-press/reports/detail/big-ideas-report-the-future-of-engineering-in-schools

How to Embed Creativity in STEM Education

- Recognise the value of Creativity to STEM Education
- Potential for inclusive classroom building empathy, collaboration and focus on improvement of peoples lives
- Potential to promote self-efficacy and wellbeing, by fostering the ability to generate creative ideas
- Enable pupils to make connections between learning
- Value and apply Subject Knowledge





https://www.raeng.org.uk/education/webinar-series/previous-webinars/engineering-habits-of-mind

Creativity

- Creativity involves the generation of new ideas that have value
- It involves looking at familiar things with a fresh eye, examining problems with an open mind, making connections, learning from mistakes and using imagination to explore new possibilities
- Designers synthesise what they have learned and apply to new and different situations

Problem-Solving

- A problem is a situation that requires resolution with no immediate or apparent solution
- Problem-solving is a process
- It is a means to use previously acquired knowledge skills and understanding to satisfy the demands of an unfamiliar situation
- Pupils must synthesise what they have learned and apply to a new and different situation
- Problem-solving can promote practice in heuristic thinking


Iterative
Design Process
Define the Problem
Research and Investigate
Generate Design Concepts
Refine and Develop Design Ideas
Build Protype
Test and Evaluate
Reflect and Redesign

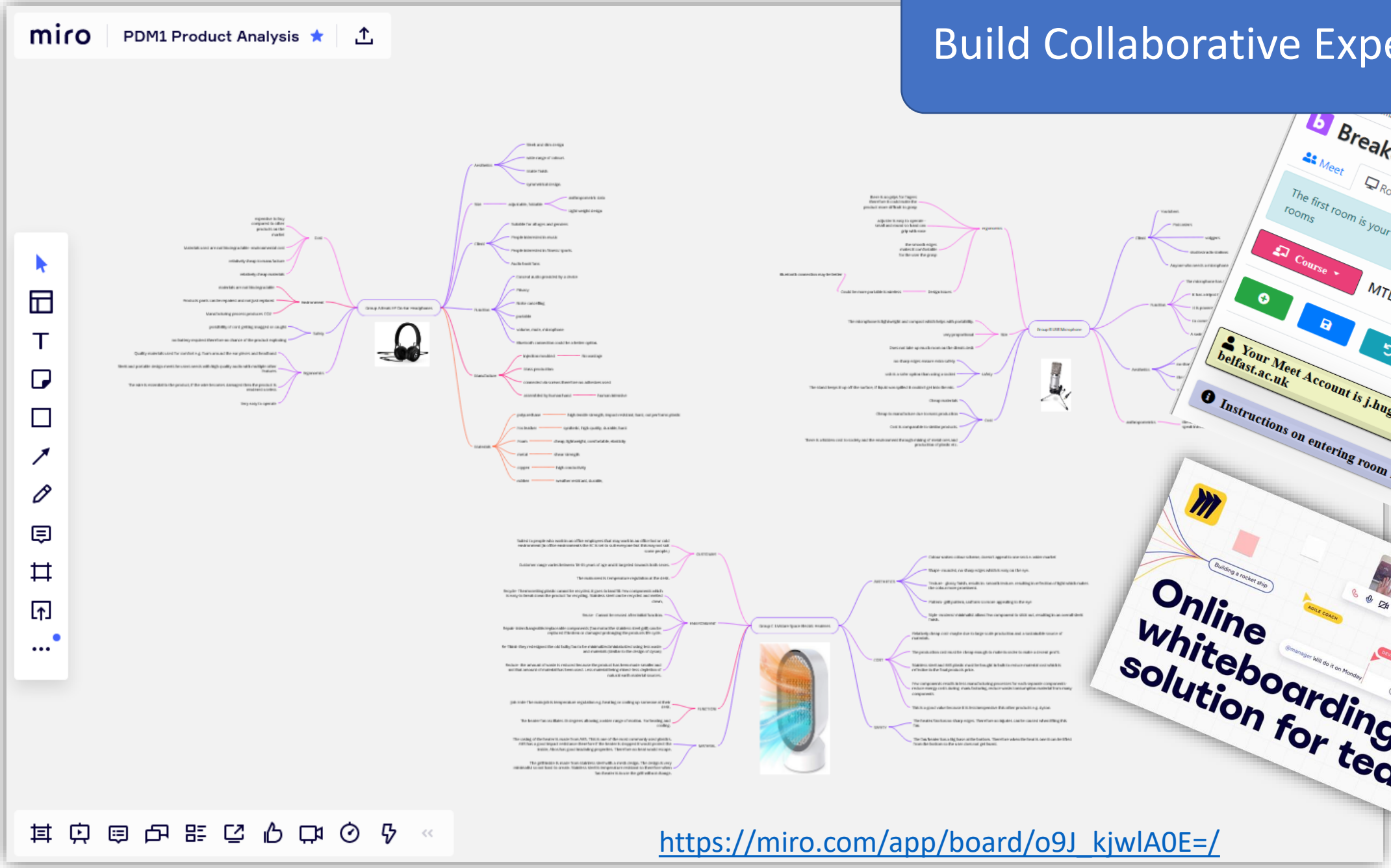
Knowledge and Skills

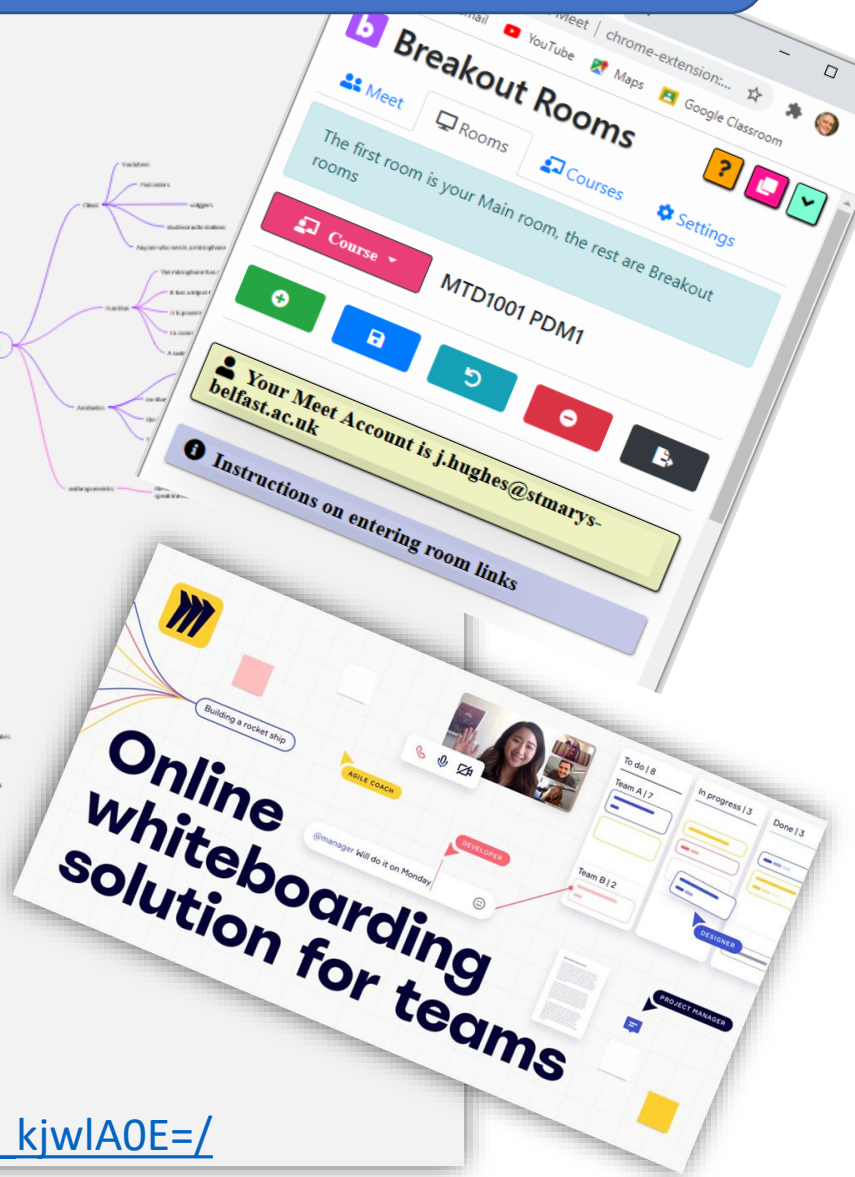
- Design skills- researching, investigation planning, sketching modelling
- Systems and control
- Visualising
- Communication

Learning Experiences that Promote Inclusive STEM Education

- Creativity and problem solving pedagogy
- Inclusive classroom
- Project Based Learning
- Collaboration
- Knowledge and Skills
- Connections to community, industry and design based careers

Build Collaborative Experiences





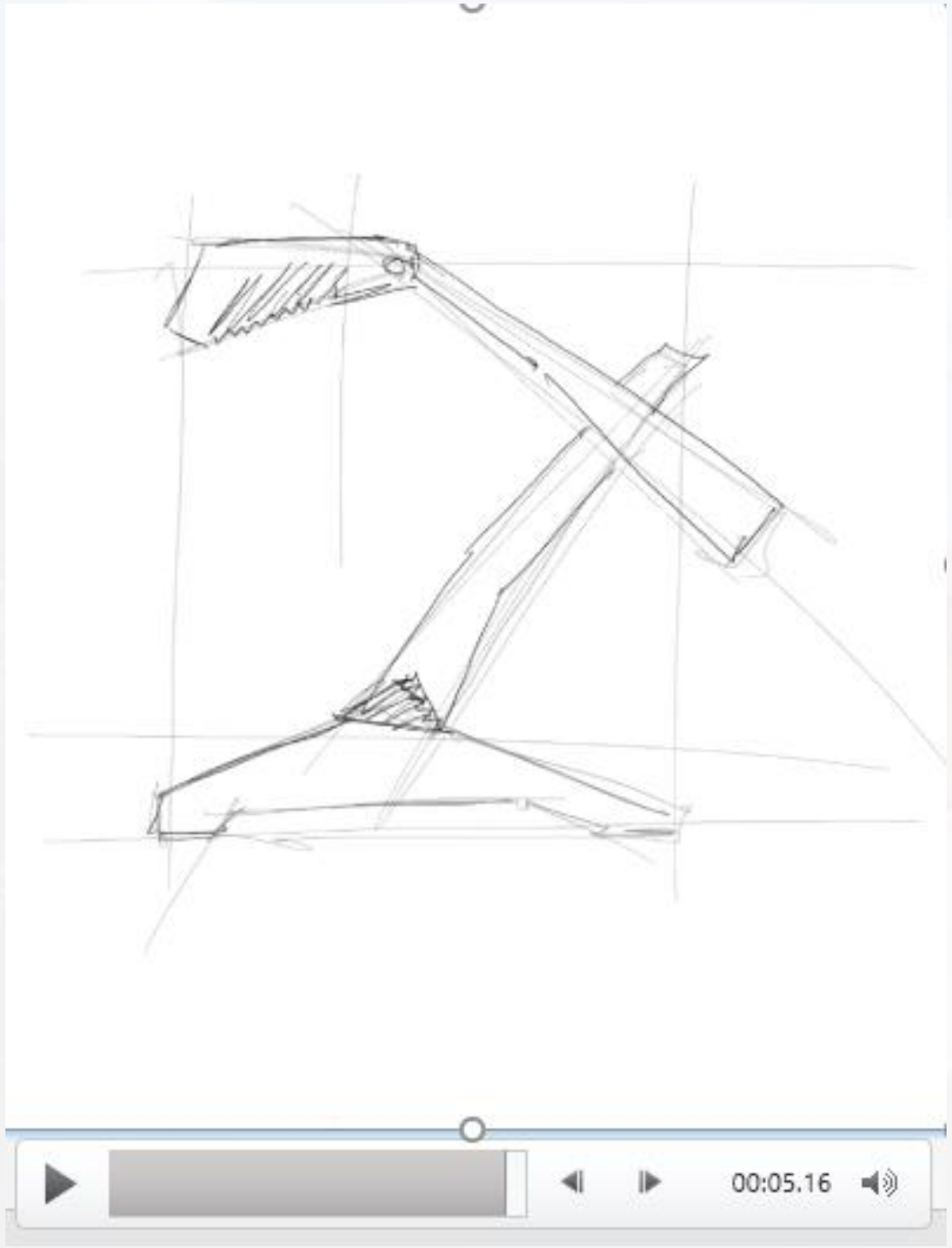
https://miro.com/app/board/o9J_kjwlA0E=/

Reflective Practice in STEM Education

EMERGENT

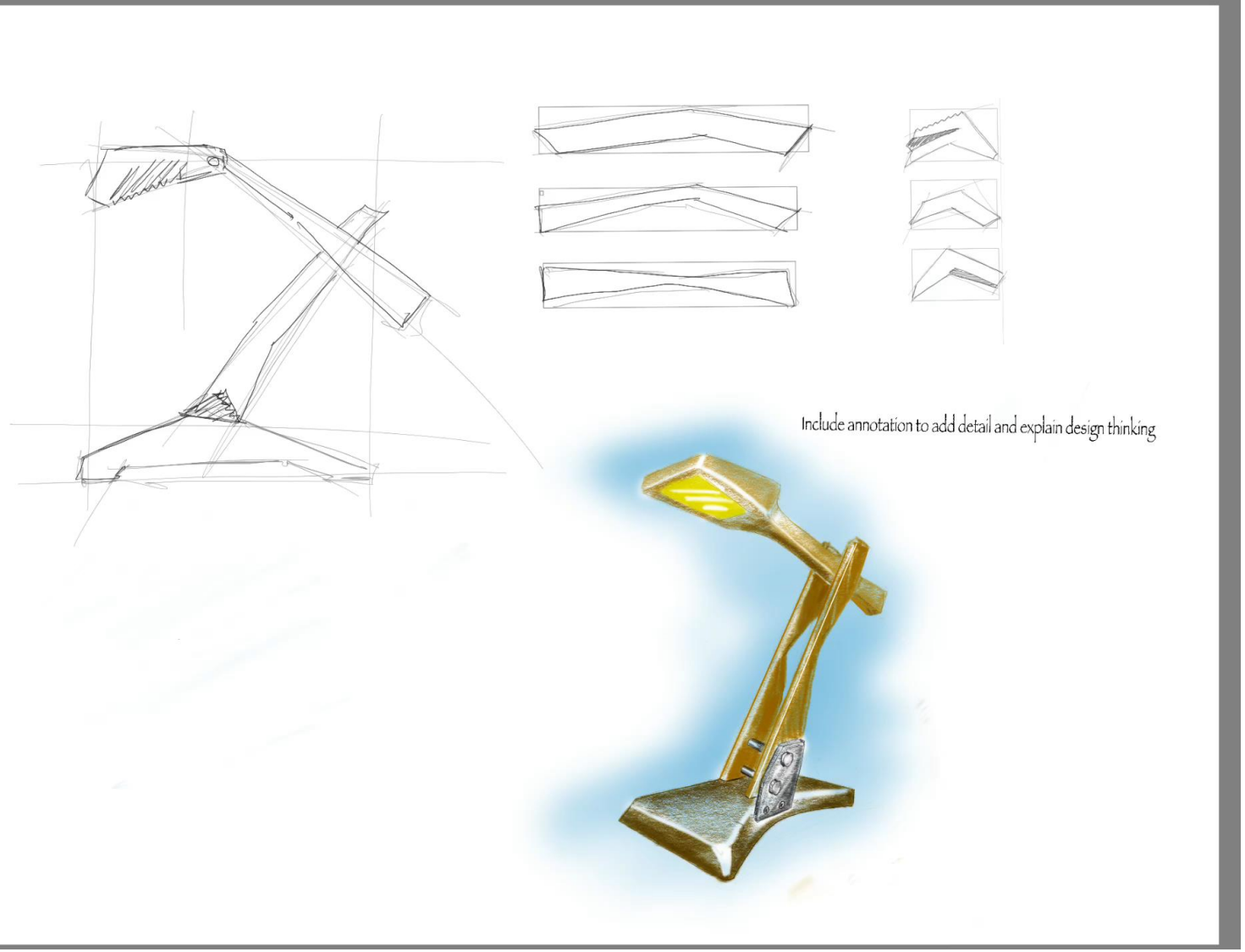
St Mary's University College Belfast
A College of Queen's University

Technology & Engineering



Develop Design Skills

Initial concept design sketches should include crating techniques and use of construction lines to promote flowing lines and cohesion in concept creation



2D SKETCHING

Design Iteration

Design Visualisation in perspective/ Isometric

Render images taking account of light direction material and surface finish

Annotation to clarify design detail

The European Space Agency is hiring for the first time in 11 years

Science & Environment

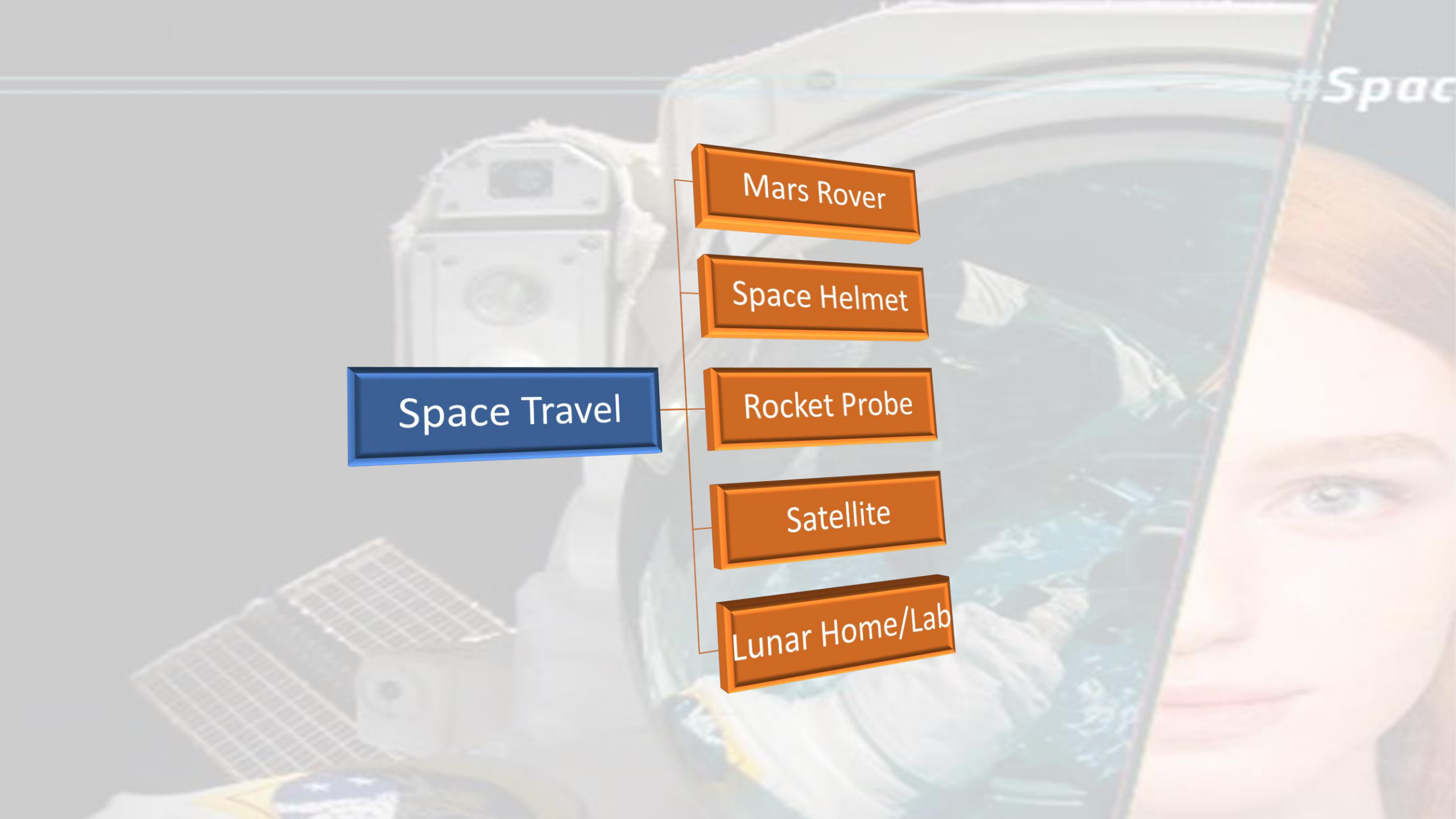
LIVE Mars landing: Nasa Perseverance rover touches down

The first aircraft to fly on another planet

BBC

How long does it take to get to Mars and why is it so difficult?

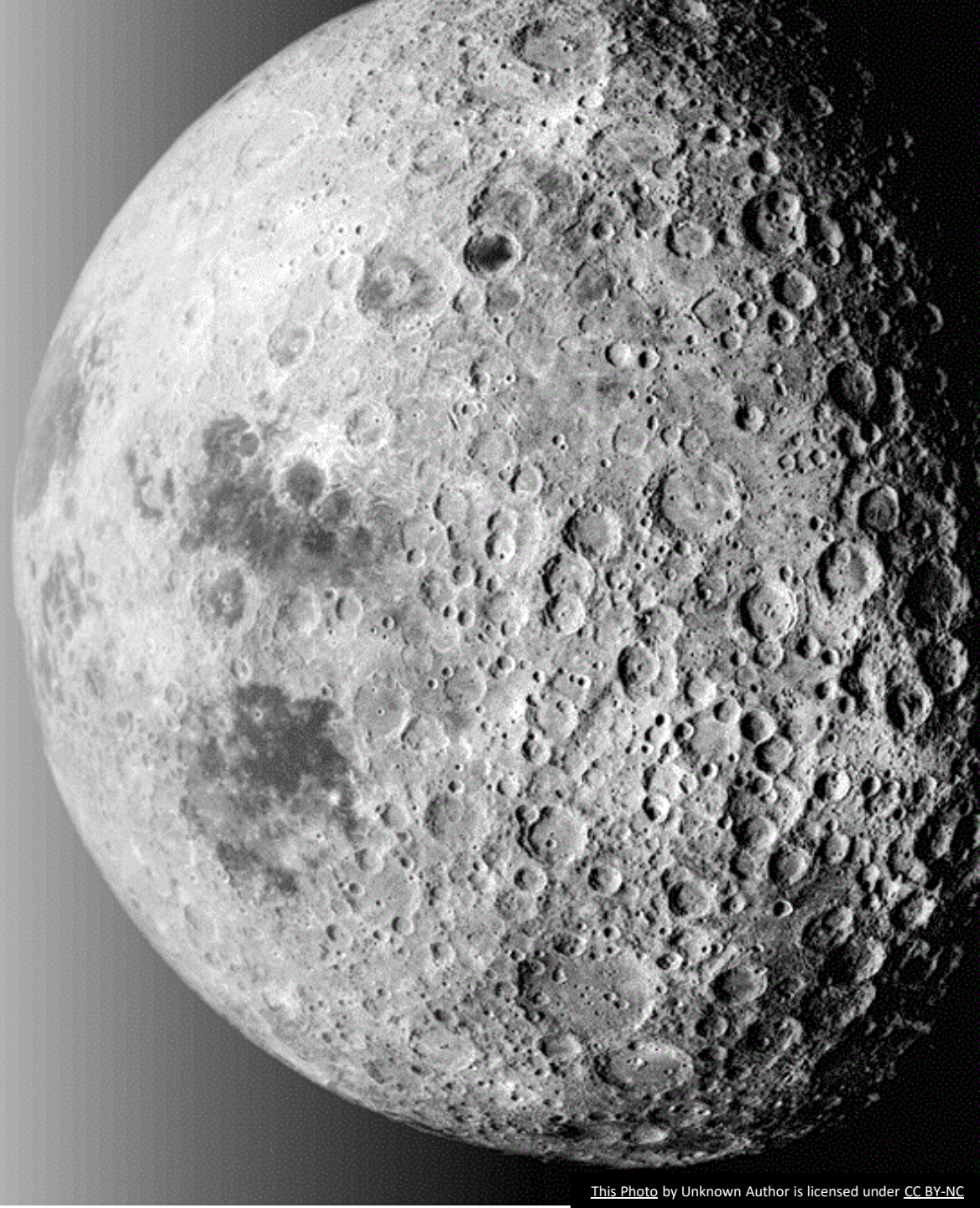
BBC

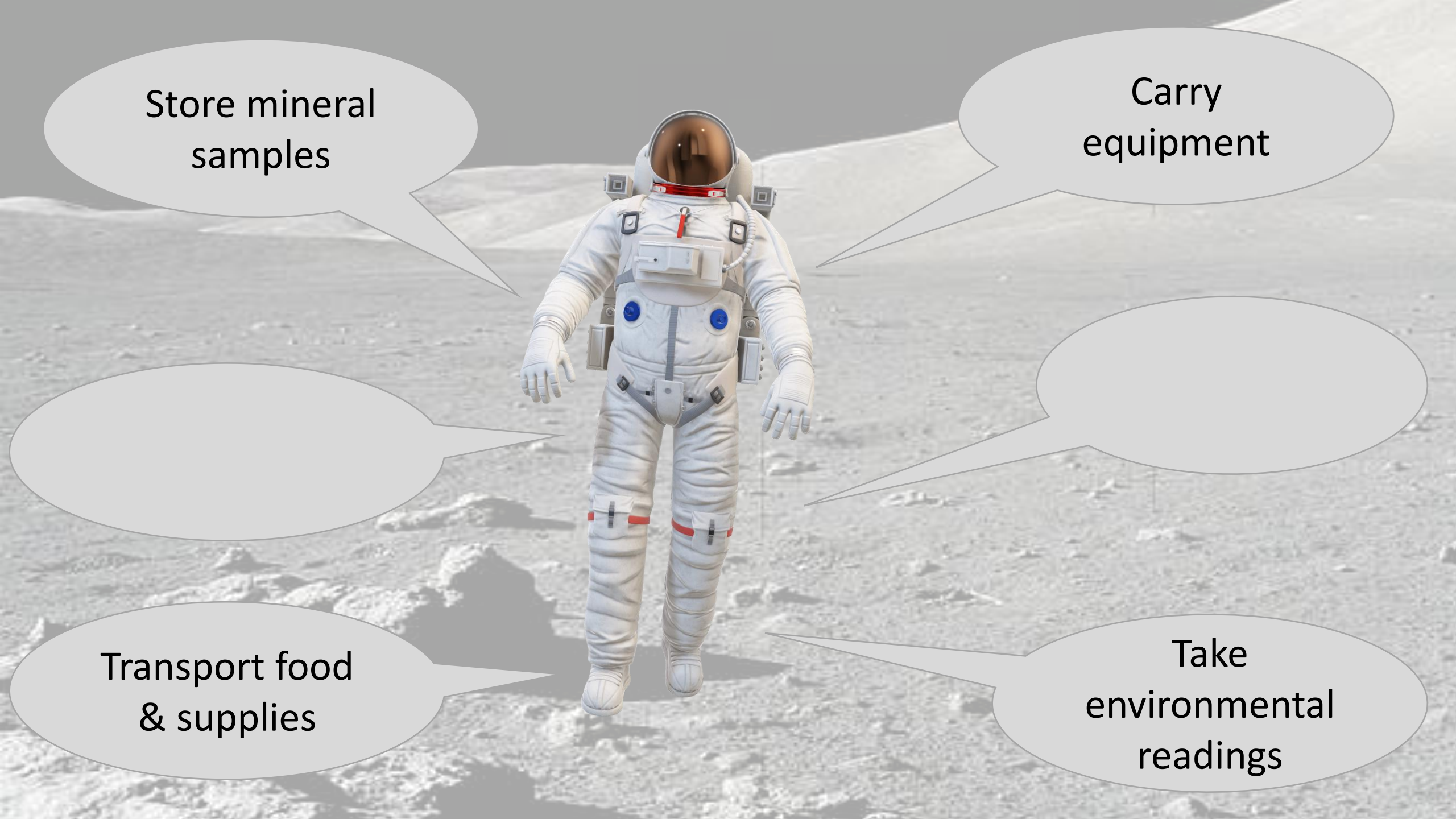

Space Travel
Mars Rover
Space Helmet
Rocket Probe
Satellite
Lunar Home/Lab

Coffee Break Design Challenge

Design Challenge

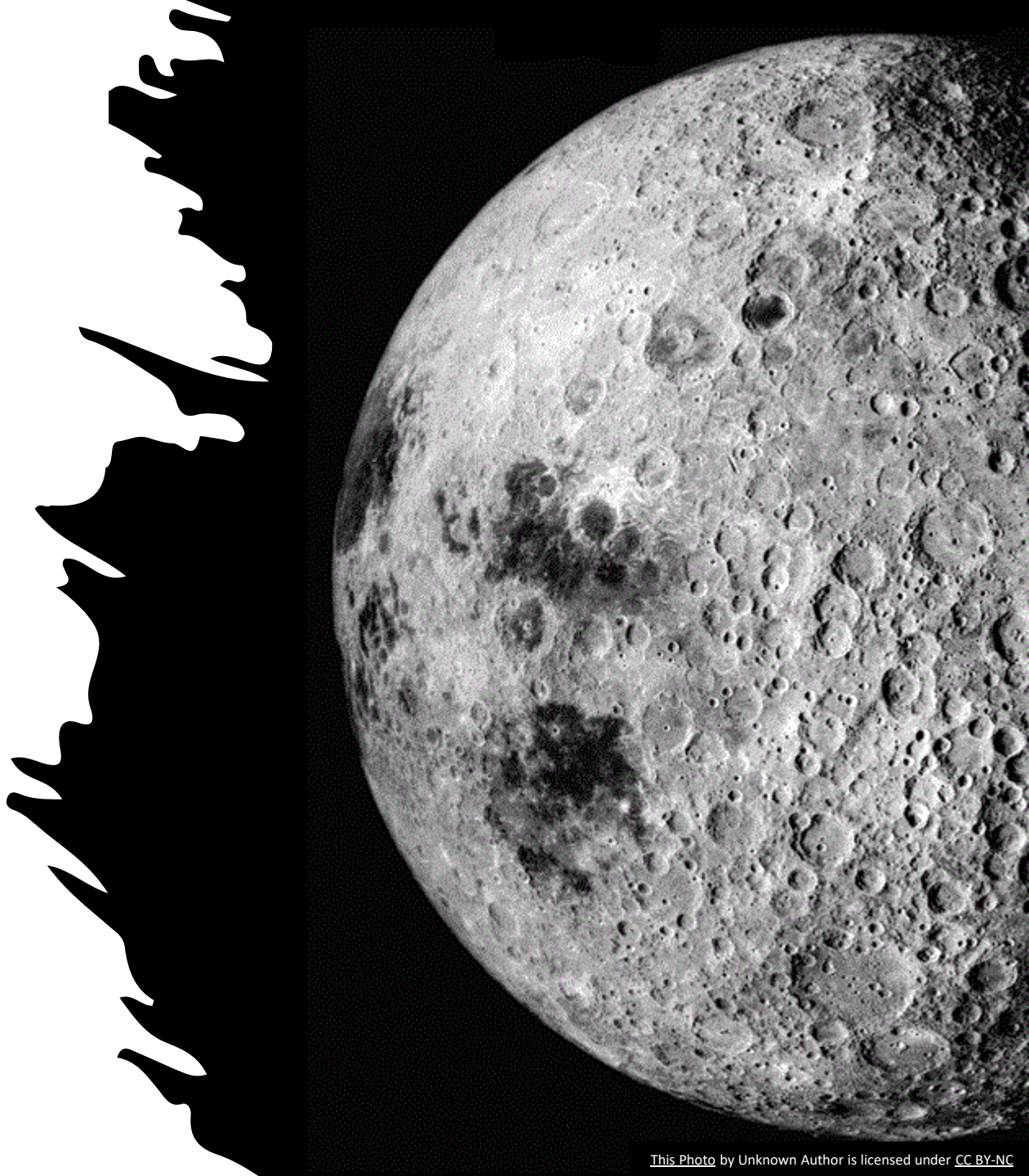
As astronauts prepare for missions to other planets, consider how robots could assist initial exploration and the work of these scientists and engineers




Store mineral samples
Carry equipment
Transport food & supplies
Take environmental readings

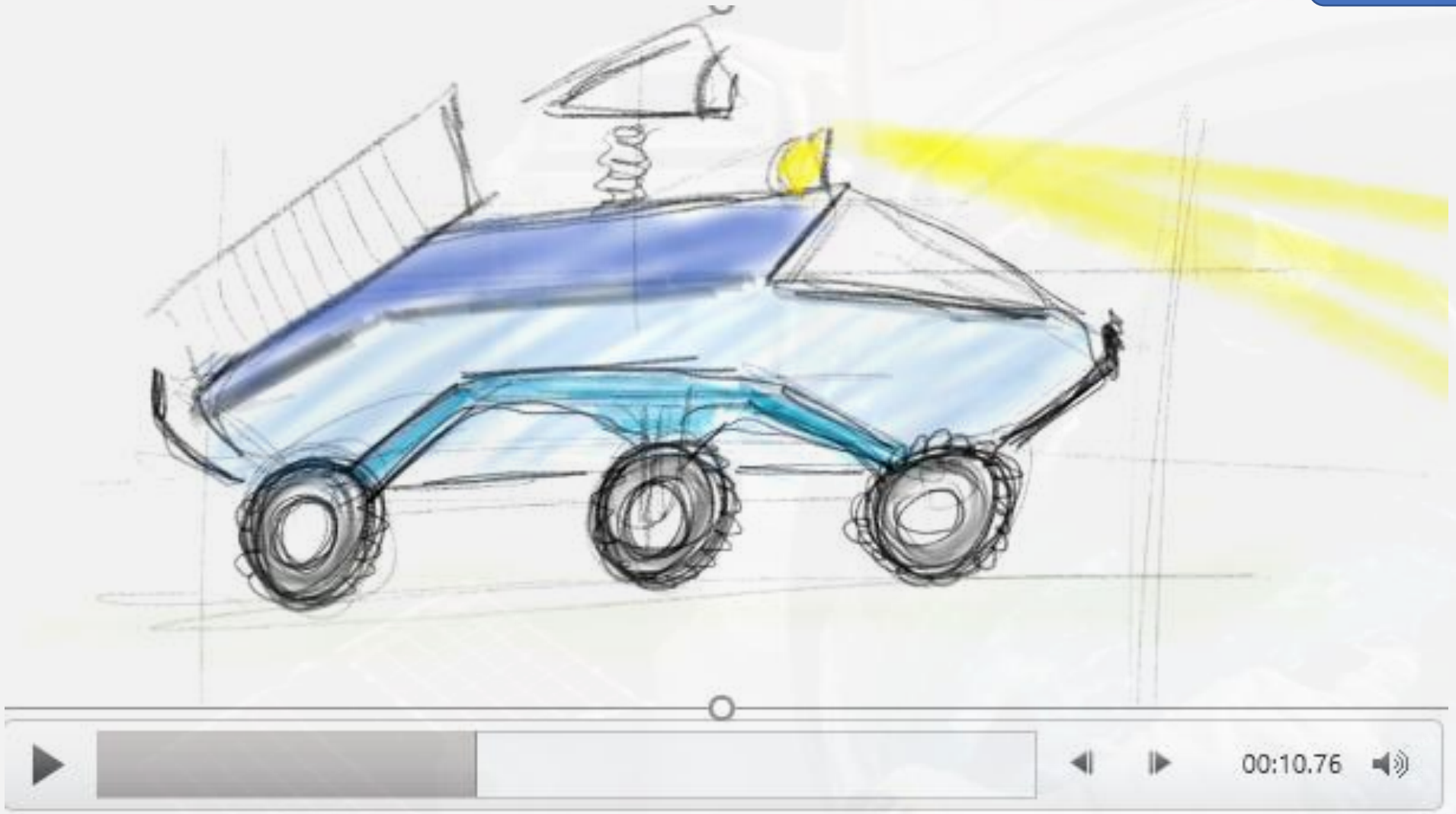
Design Challenge

Design an assistance robot to help astronauts in this harsh environment




BostonDynamics

Design Sketching



Sketch a design for an assistance robot

Coffee Break Design Challenge

Take a photo of your sketch and email the picture of your robot design and I will return a PowerPoint gallery of the design work to the group

Technology & Engineering

The Computational Thinker: Concepts & Approaches

Concepts

- **Logic** predicting & analysing
- **Algorithms** making steps & rules
- **Decomposition** breaking down into parts
- **Patterns** spotting & using similarities
- **Abstraction** removing unnecessary detail
- **Evaluation** making judgement

Approaches

- **Tinkering** experimenting & playing
- **Creating** designing & making
- **Debugging** finding & fixing errors
- **Persevering** keeping going
- **Collaborating** working together

Robotics

Robotics can address computational thinking which involves children developing and using a number of concepts and processes including:

- predicting and analysing
- devising steps and rules
- breaking down a problem into parts
- patterns and generalisations
- removing unnecessary detail
- evaluation

https://community.computingatschool.org.uk/files/8221/original.pdf

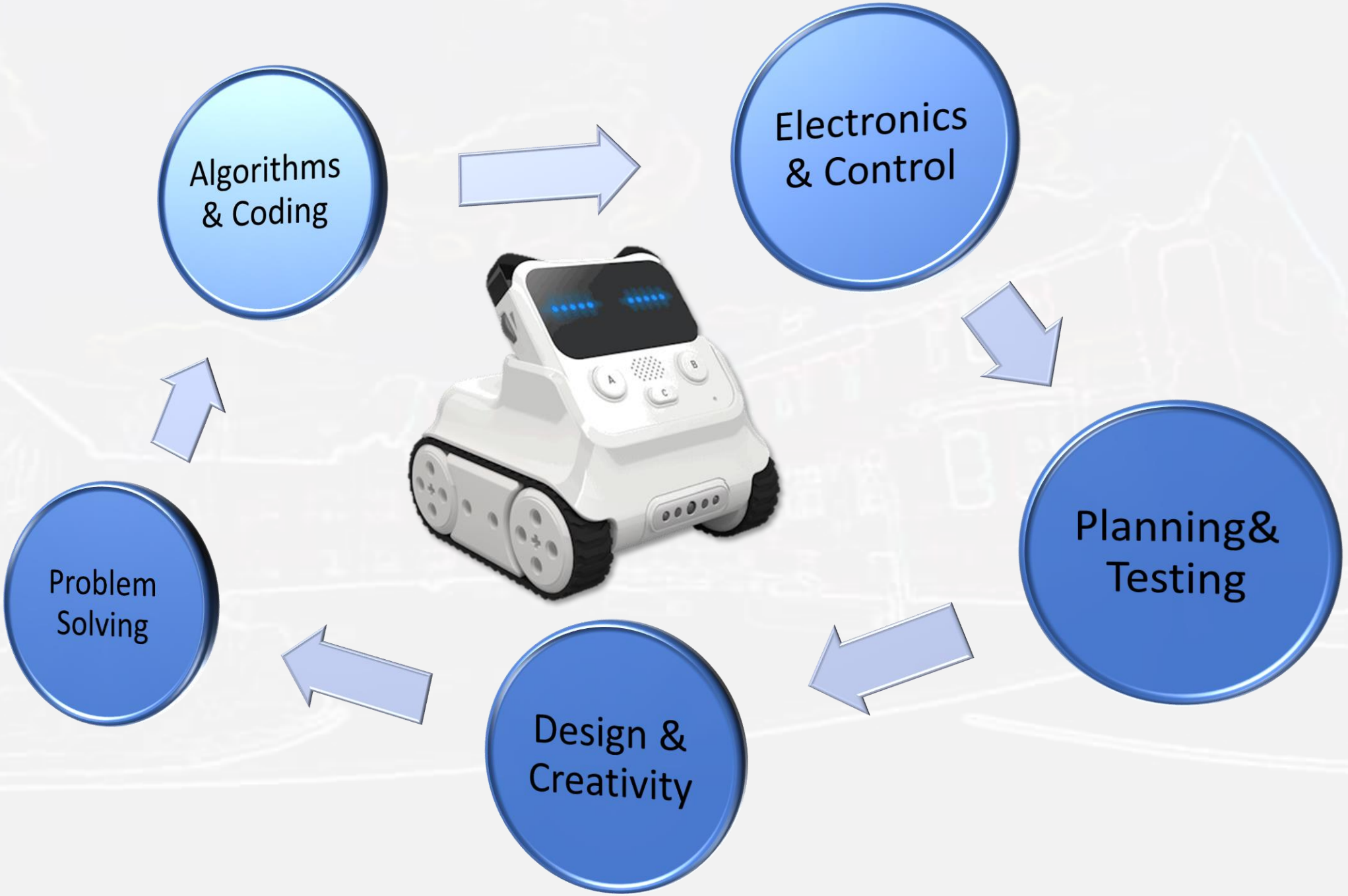
Robotics and STEM Activities

- The goal is to integrate STEM activities in a meaningful way
- Address problems and understand the technological world around them
- Allows learners to engage in worthwhile problem solving
- Offers a bridge between maths, engineering, science and technology
- The approach promotes collaborative learning through experiential learning

Coding Robots

- Developed approach
- Hardware updated
- Bluetooth communication
- Tablet based programming
- Rugged & Rechargeable
- Utilise Blockly coding which is Open Source ,scalable and expandable

https://www.makeblock.com/steam-kits/codey-rocky


Algorithms & Coding
Electronics & Control
Planning& Testing
Design & Creativity
Problem Solving

Activity Two: Following a Path

Design a path and Algorithm to:

- **Respond to a Button Press**
- **Move forward a for a short distance**
- **Change direction**
- **Move forward a for a short distance**

Sketch simple Path below and use MBlock command to create program

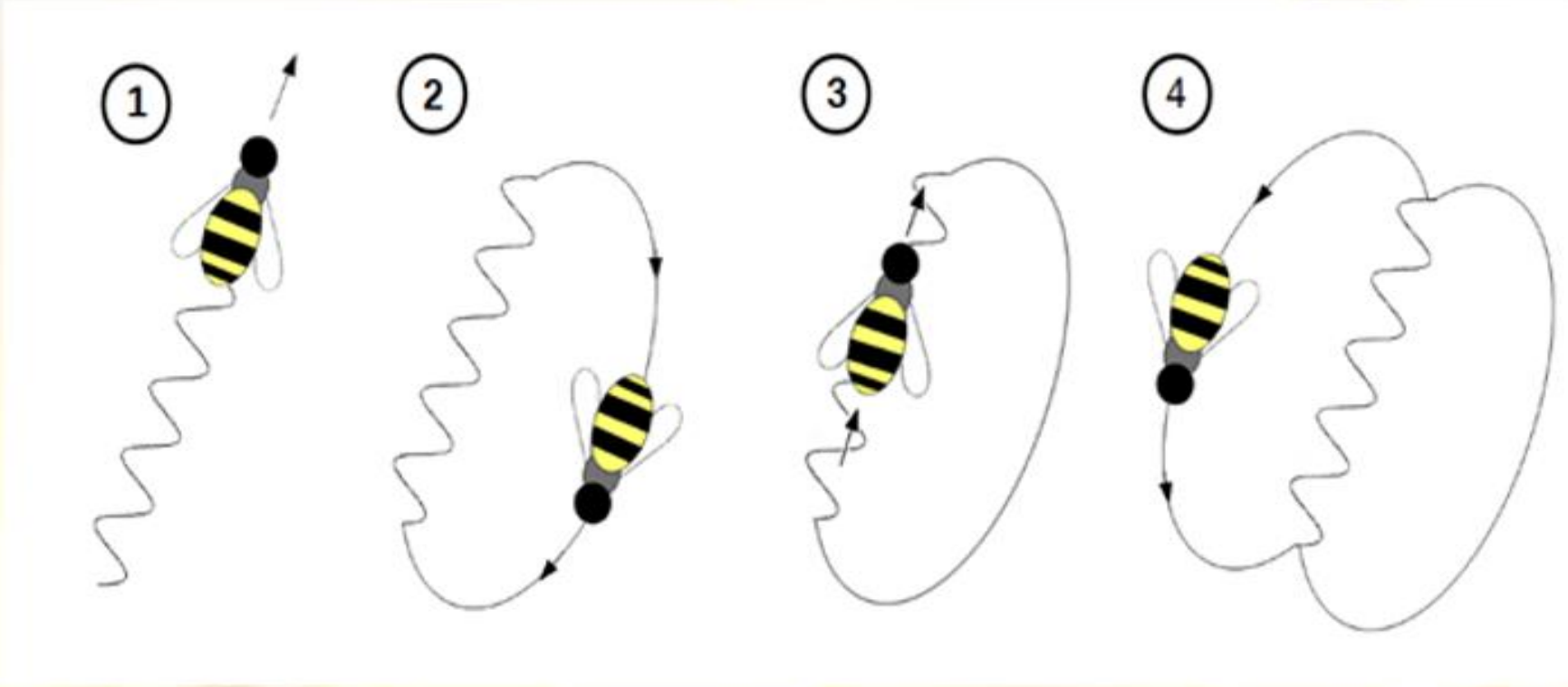
Rotate Right

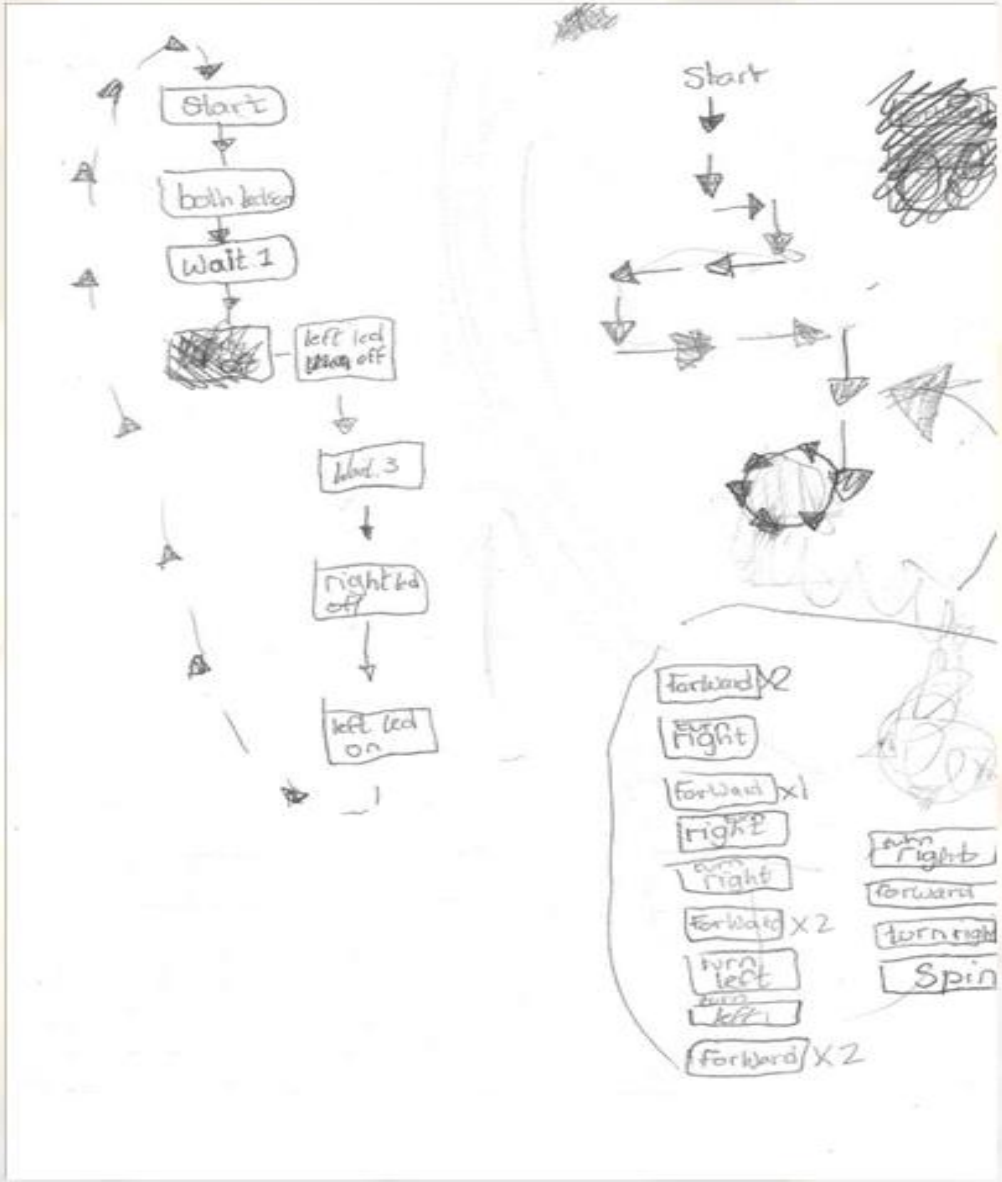
Rotate Right

Forward
Slow x 2

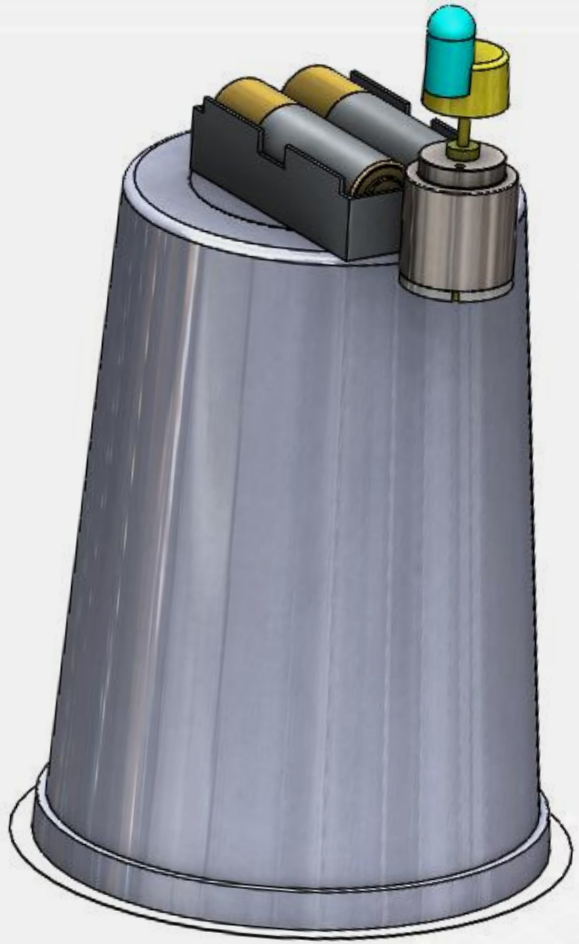
Forward
Slow

Button Press

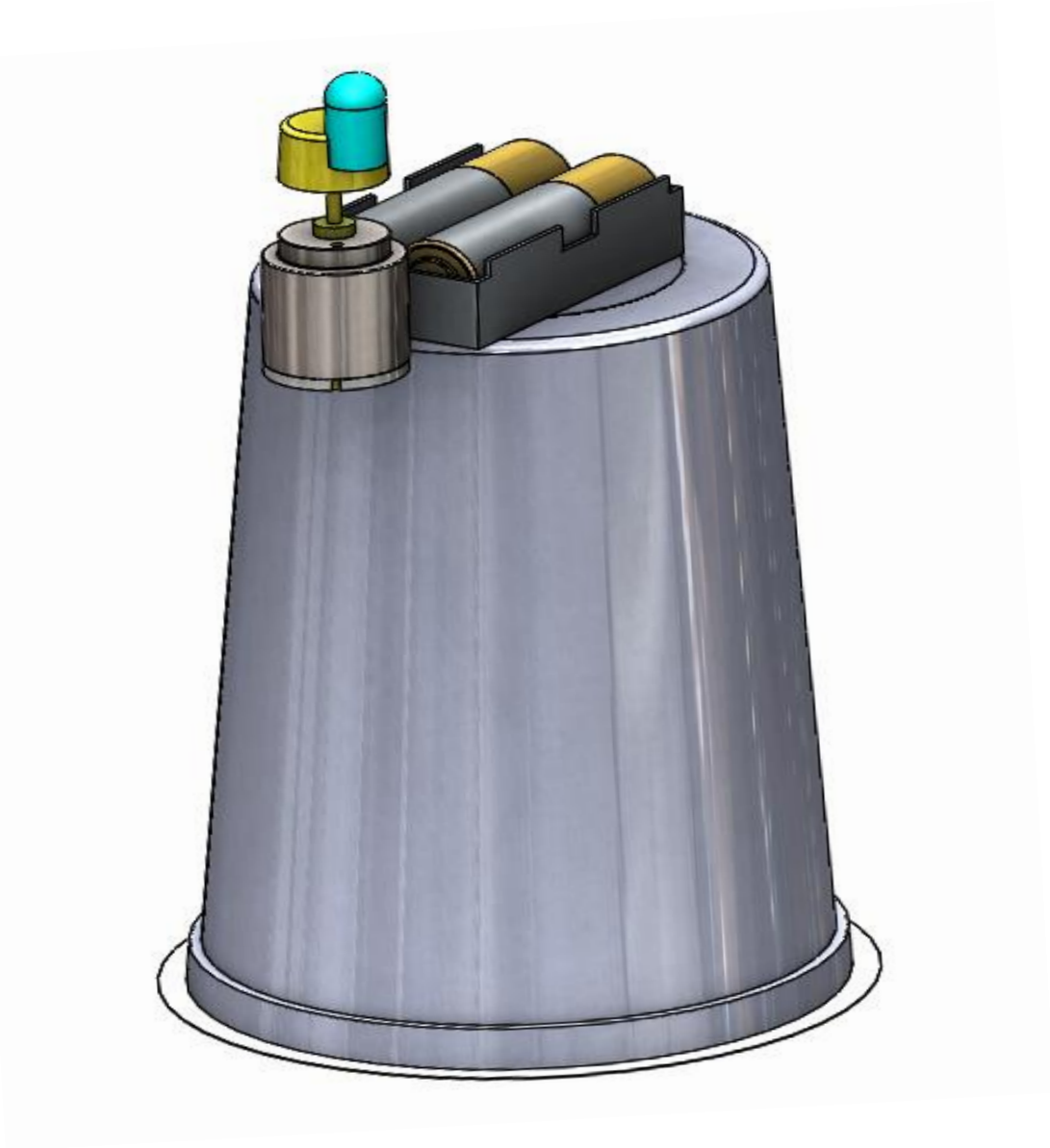

1
2
3
4


Start
both leds
Wait 1
left led off
Wait 3
right led off
left led on
Start
forward x2
right
forward x1
right
turn right
forward x2
turn left
forward x2
turn right
forward
turn right
Spin

Making Activity

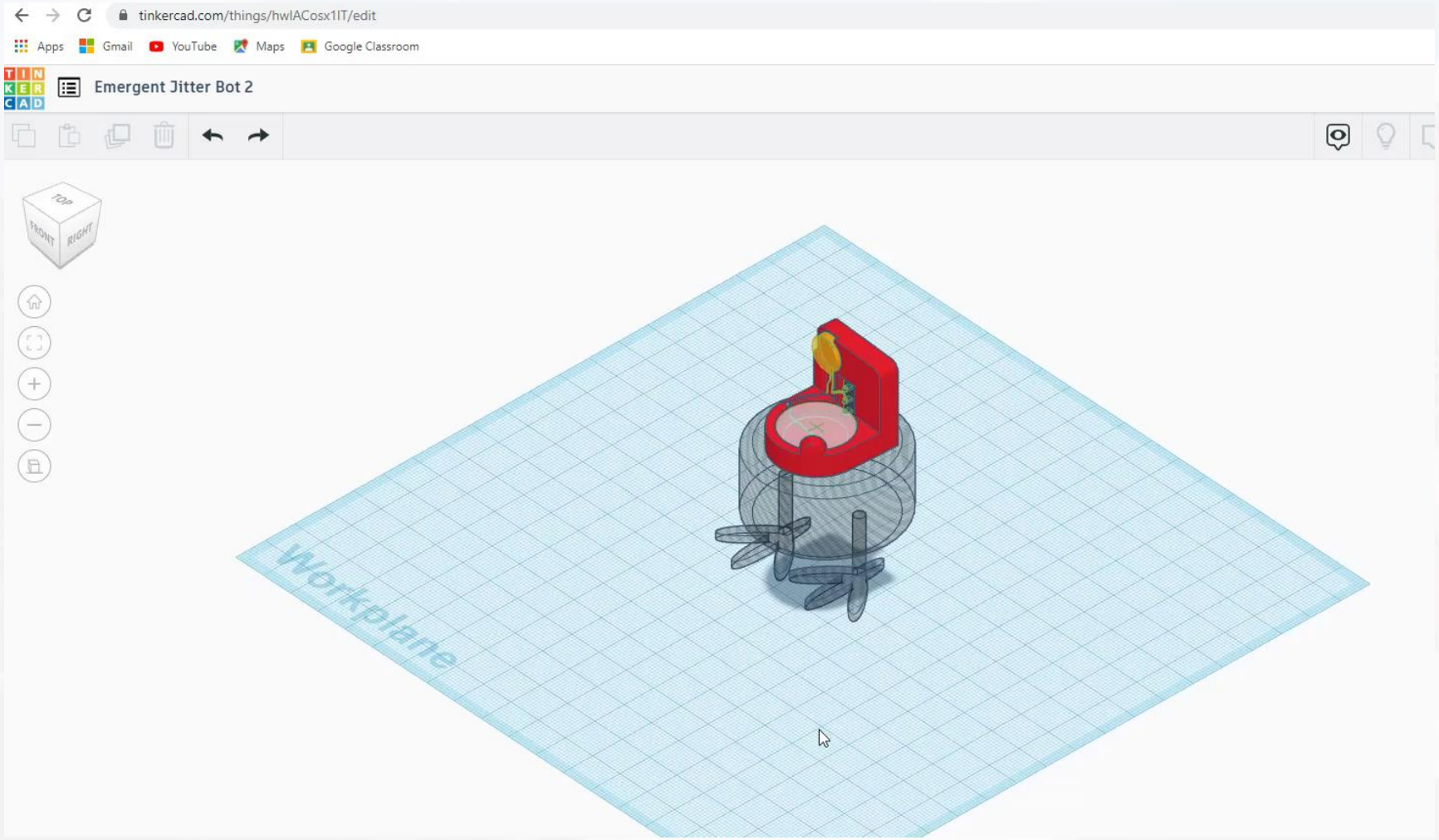


JitterBot Design Post Primary Technology & Engineering




GREENCELL
00:03.75

Computer Aided Design

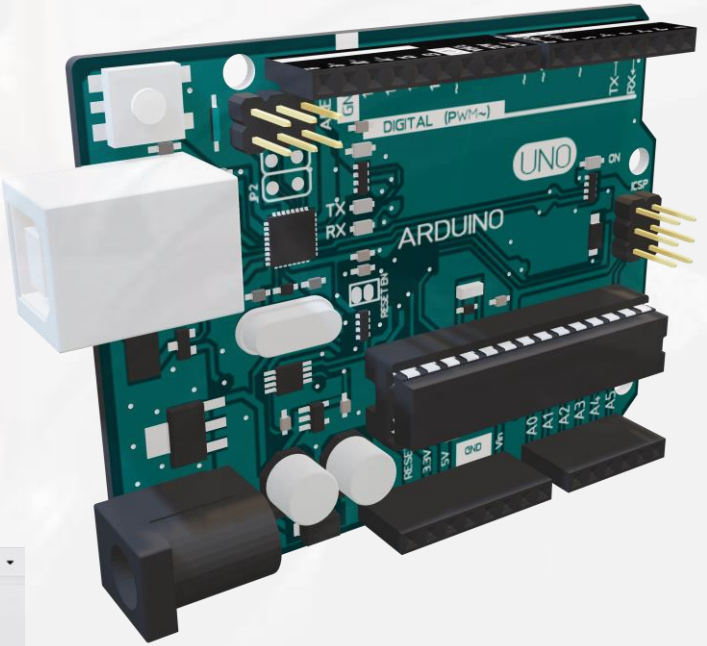


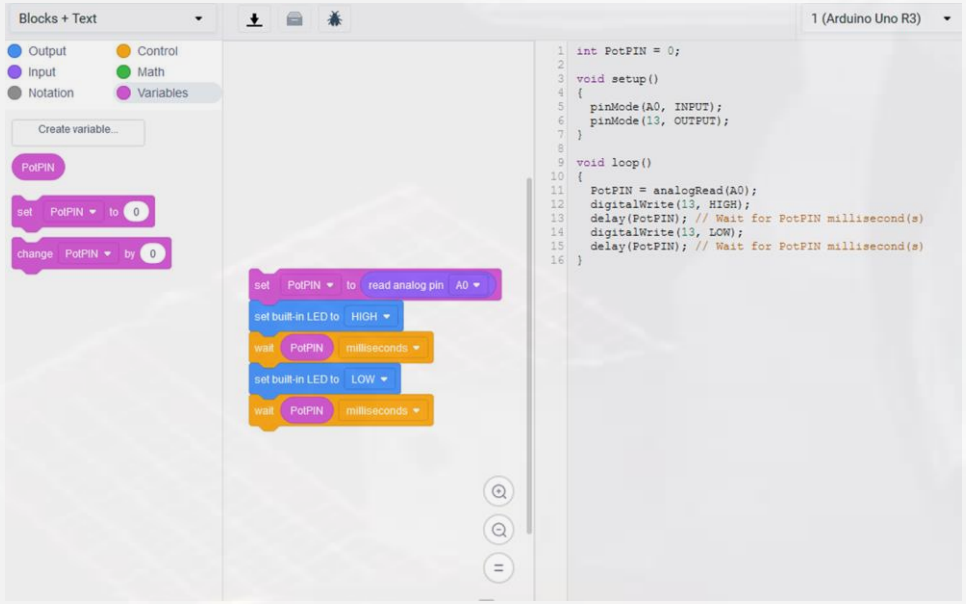
https://www.tinkercad.com/

Tinkercad Super Guide by Bitfab - Bitfab

JitterBot Design Post Primary Technology & Engineering

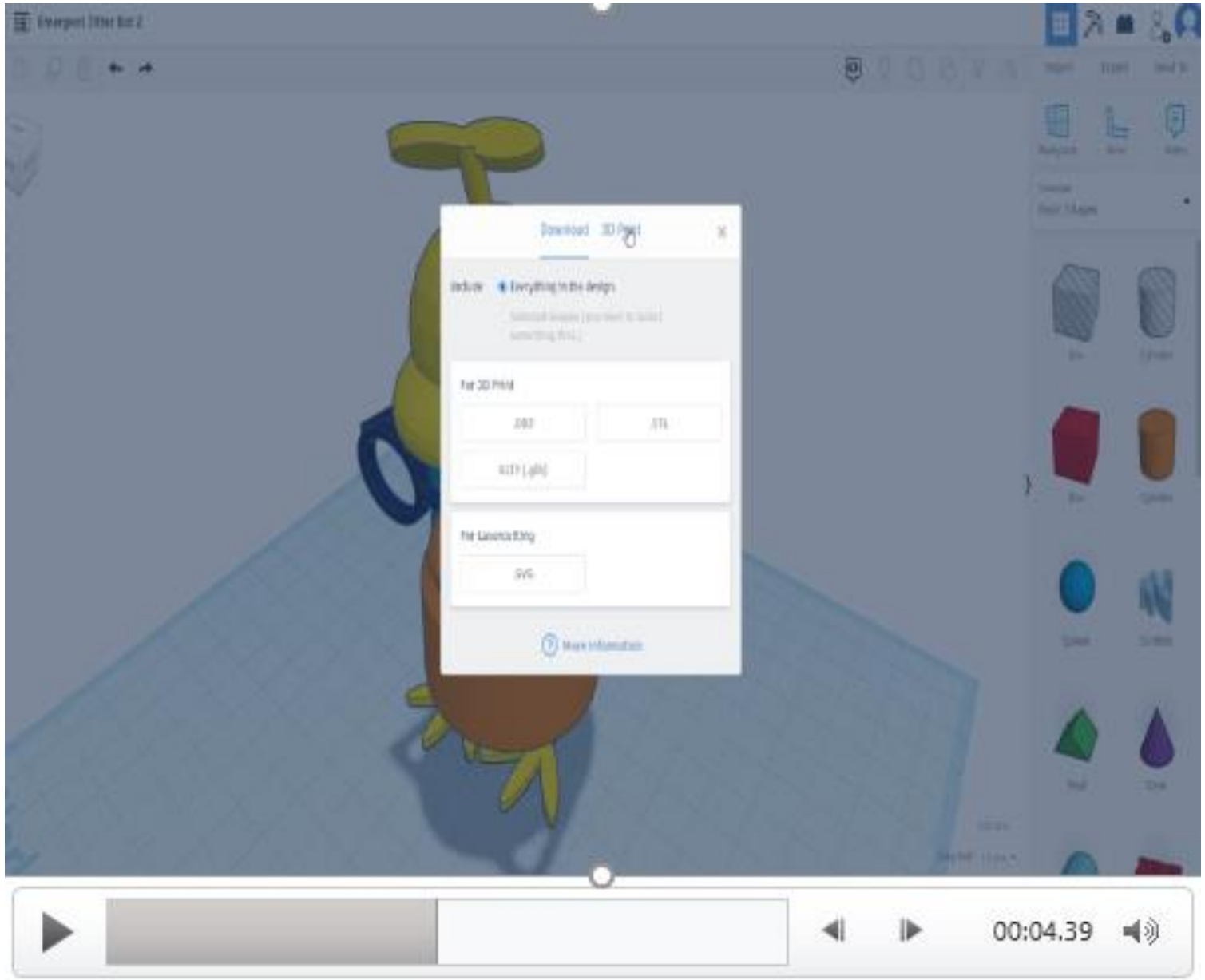
Electronics & Coding

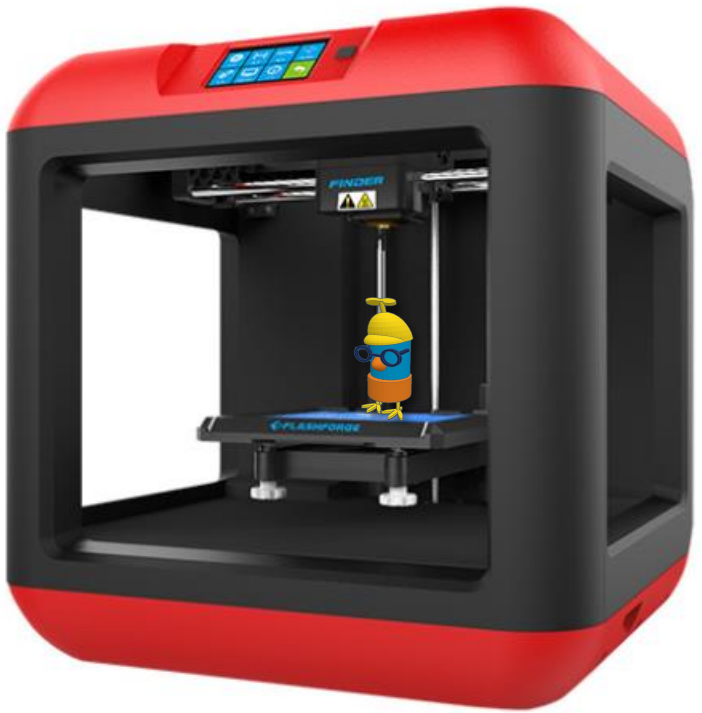




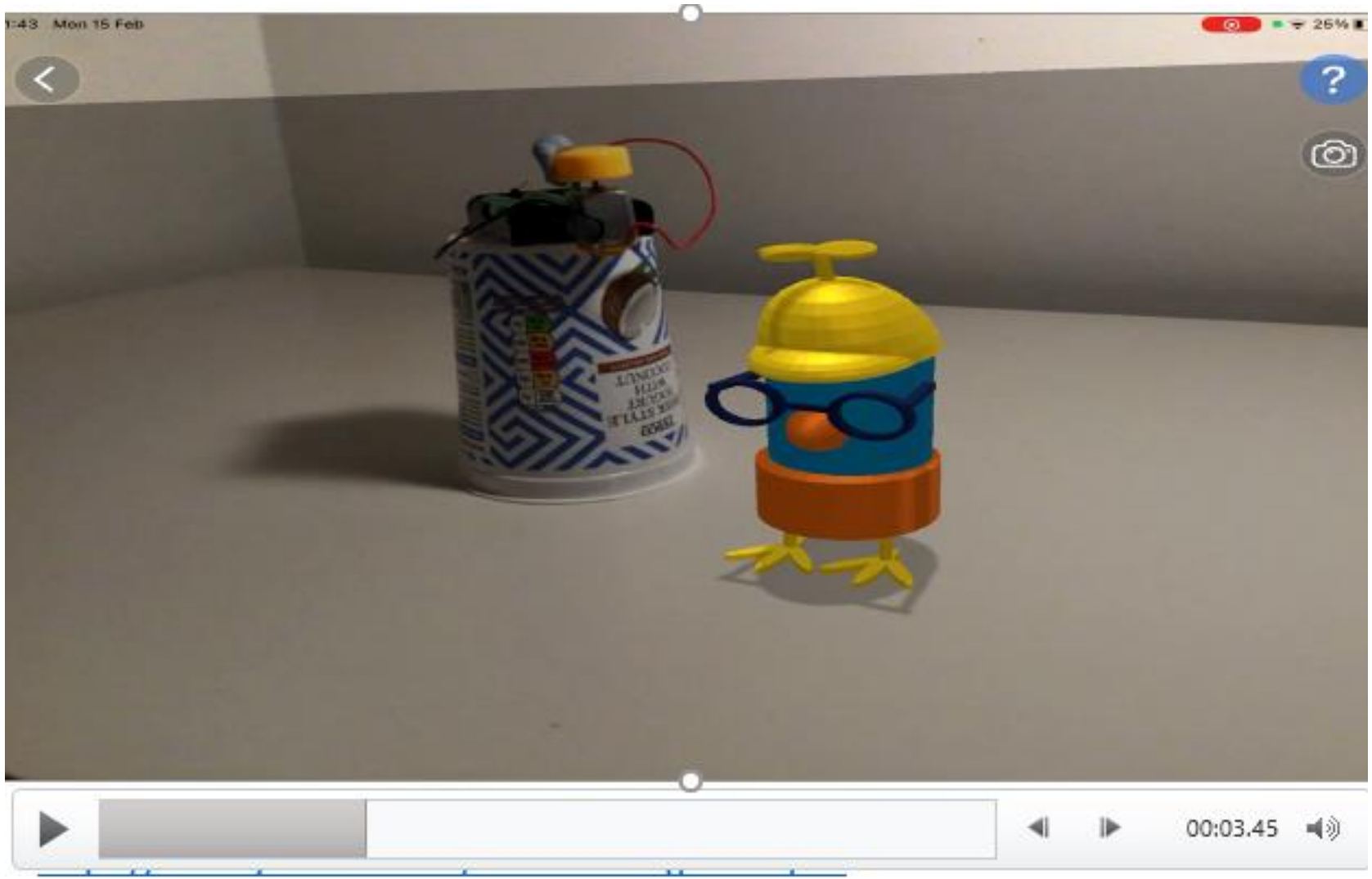
TINKERCAD

3D Printing





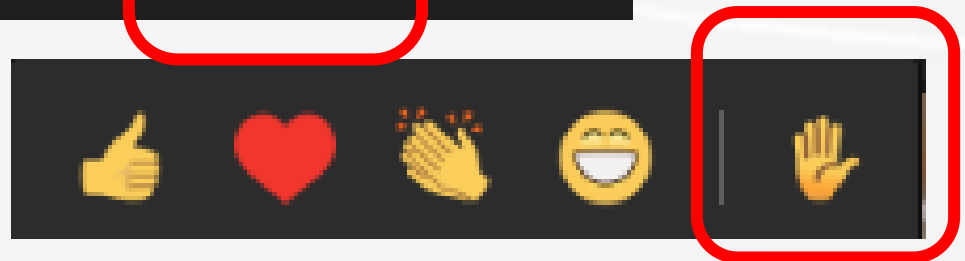
Augmented Reality

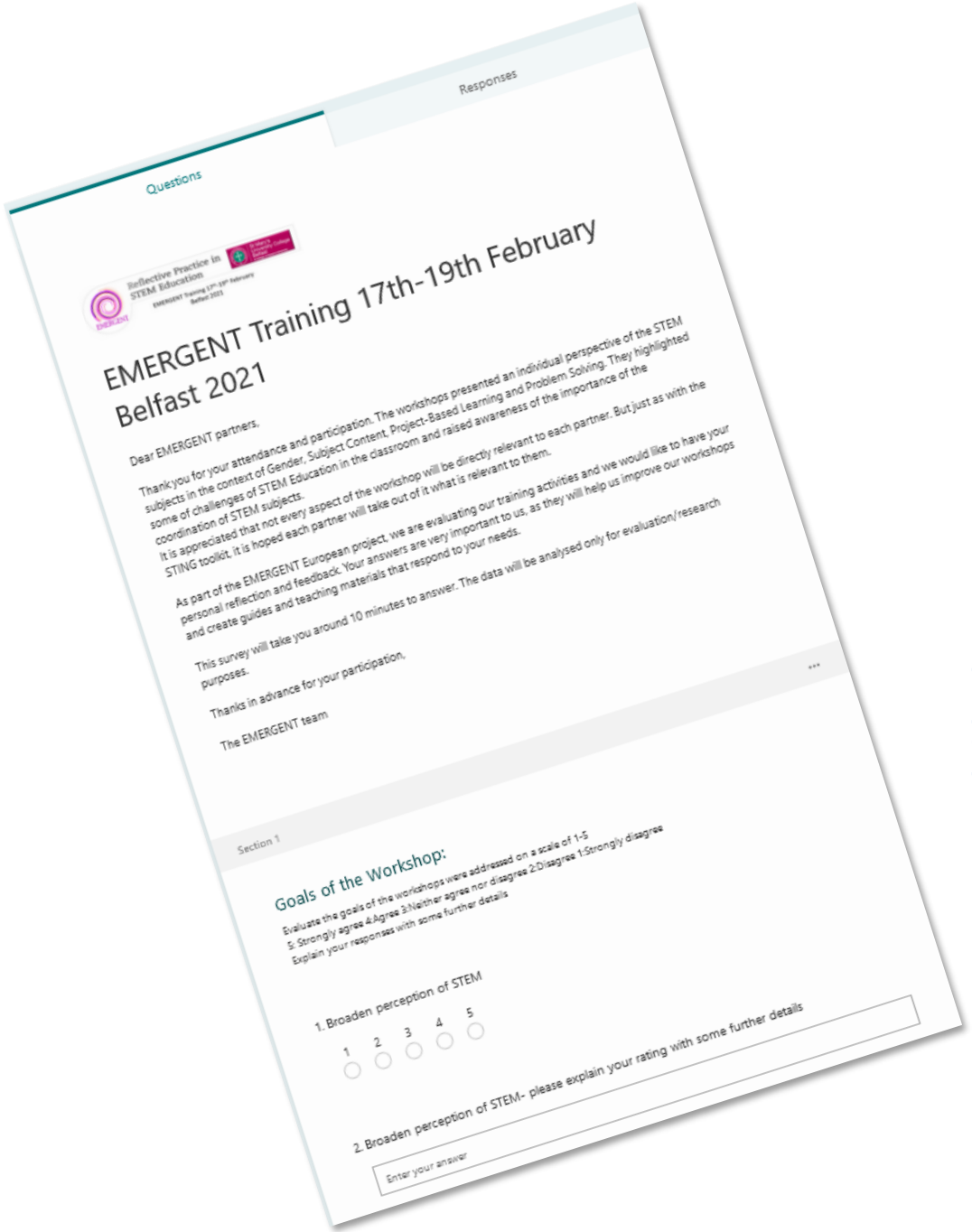


https://www.youtube.com/watch?v=8xgbimBhjMc

??!!

Any Thoughts ,
Questions……





https://forms.office.com/Pages/ResponsePage.aspx?id=eW3pbvz9zUmruJhAv1i6oD83GvUr9dZImw250ll6JNRUNVpSNDhIUE8wTktJSEUyUUY1N1NVWDZPWi4u

EMERGENT

St Mary's University College Belfast
A College of Queen's University

Thank You for Listening and Contributing