

SDG 9 Future of Space

MM7: Problem to Pitch Space Design



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Phase 3 Implementation

Lesson 6 Design Thinking Stage 4 Prototype

Subject Areas: Art and Design, CPSE, Climate Action and Sustainable Development, Engineering, Technology, SPHE

8 DECENT WORK AND ECONOMIC GROWTH



12 RESPONSIBLE CONSUMPTION AND PRODUCTION



16 PEACE, JUSTICE AND STRONG INSTITUTIONS



17 PARTNERSHIPS FOR THE GOALS



Lesson Title and Summary: Design Thinking Stage 4 Prototype

In this lesson, learners will begin to consider their ideas for prototyping, develop a concept statement and look at ways to prototype their ideas depending on their users / audience.

The lesson emphasises prototyping for space challenges encouraging students to apply design thinking principles to space-specific challenges. Whether through an open-ended design task, focusing on real-world space issues they've identified in previous lessons or by selecting an SDG challenge .

Vocabulary: Concept Statement, Enterprise, Innovation

In this lesson, the learner will:

- explore how to evolve ideas
- iterate their ideas
- develop a concept statement
- explore prototyping methods
- develop prototyping skills

Materials:

- Worksheet: Rapid Response Prototyping
- Teacher's Guide Ready Set Design
- Paper
- Pens, Pencils
- Modelling material e.g. plasticene, clay, Fimo
- Ready Set Design (RSD) materials' bags
 - A fastener e.g. pipe cleaner, pin, paper clip
 - A surface e.g. material, tin foil, card
 - A structure e.g. sticks, straws, box,

MM7: Problem to Pitch Space Design

L6: Design Thinking Stage 4 Prototype



Activity Instructions

Activity 1 Prototyping – Rapid Response (10 mins)

1. Watch the video 'What is a prototype'
2. Briefly, Discuss the benefits of prototyping from the video or use the examples below
 - Encourages Creativity: It allows experimentation and exploration of different design possibilities without fear of failure, promoting creative problem-solving.
 - Turns Ideas into Reality: Abstract concepts are transformed into physical or visual models, helping ideas come to life provides a way to test ideas quickly, helping identify what works and what doesn't early on, making it easier and cheaper to find solution.
 - Immediate Feedback: Learners can quickly see what works and what doesn't, providing opportunities for rapid iteration and improvement.

Activity 2 Developing your Prototype – Rapid Response (40 mins)

Option A: Space-Focused Prototype

Learners are tasked with creating a space item or accessory that addresses an open-ended problem and develop a concept statement based on defining the problem, create a Space vision board showcasing design inspiration, materials, technologies, and user / client needs, and build a 3D prototype model of their space solution based on insights from the activities in Lesson 2 - user profiles and empathy map. This could be problems like space debris, ethical production, or earth-centric challenges like disaster relief, telecommunications or weather observation. Learners can select one of the Space 4 Sustainable Development Goals (SDGs) and global challenges to help them focus their prototype towards a real-world challenge - see MM7 Space Design Challenge Briefs.

Option B: Space Design Challenge

If learners have not selected a specific space problem, use the Ready Set Design, a quick 3D design challenge that incorporates prototyping. Learners could consider equipment for life in space e.g. innovative spacesuit solutions and functional tools using the three items they have to use in the bag - a structural item, joining item and a surface item e.g. material, paper or other materials provided.

REFLECTIVE EXERCISE: 3-2-1

- Three things they feel they have learnt from the tasks
- Two things they found most interesting and would like to explore more
- One – their opinion they have about the tasks

Use Post-its or a mentimeter survey - www.mentimeter.com - to gather reflections

MM7: Problem to Pitch Space Design

L6: Design Thinking Stage 4 Prototype



EXTENSION / REDUCTION ACTIVITIES

Reduction: For a shorter class have the students watch the What is Prototyping video at home and come into class with 3 benefits of prototyping and work on activity 2 spending time selecting and SDG and defining their open ended problem, ready for their space prototyping in a following lesson.

Extension: For a longer class, learners can spend more time considering information from the Space4SDGs website, defining their problem and developing their concept statement to take their initial prototype and move into a phase of iteration and refinement, to encourage deeper critical thinking and improvements to their original ideas based on feedback. The Rapid Response Prototyping support sheet can expand learners skills using simple structural techniques, while learners consider

- How well does this solution meet the needs of the client or situation?
- Are there any practical challenges with the design that could be improved?
- What creative elements could be enhanced or added?

MEDIA BOX: (materials, online video links, extra resources, case studies etc)

What is Prototyping [1:17 mins] https://www.youtube.com/watch?v=_1bOaNSy5XY
Rapid Prototyping [7:31 mins] <https://www.youtube.com/watch?v=JMjozqJS44M>
Design Thinking Prototype [4:53 mins] <https://youtu.be/Q4MzT2MEDHA>

Local Trip / Expertise / Additional Work and Assessments

Learners can present their final prototype and concept statement to the class, for peer review and consideration of their

- Inspiration: What motivated their design choices?
- Key Features: What are the most important or innovative aspects of their design?
 - What aspects of the design are particularly creative or effective?
 - What suggestions would you make for further development?
- Solution-Focus: How does the prototype meet the problem area
- Client / User Needs: How does the prototype address the needs identified in their empathy map or user research?

Learners can explain any improvements made and how their prototype better meets the challenge, sharing any new ideas or next steps for future development. This also allows learners to further develop their communication and presentation skills while receiving valuable feedback.

Ready Set Fashion Design – is a quick, fun, and creative introduction to Fashion Design Thinking and related skills such as teamwork, innovation, and creativity. This strategy can be applied across different fashion-focused lessons using readily available recycled materials.

Ready:

1. Start by sharing fashion challenge cards—these are open-ended prompts that set the learners' design challenge. Depending on the age group or learning objectives, you can adjust the complexity of the challenge.

Space Challenge Card:

Using only the materials provided in front of you, create a fashion item that...

Helps promote sustainability in Space.

Could be part of a zero-waste approach.

Is adaptable for different space conditions or environments

Learners have 5 minutes to plan with their team and 15 minutes to build their prototype

Set:

2. Either have Learners select from a range of materials or give them three materials from each of the following types
 - a. A fastener - e.g. paper clip, string, elastic band, safety pin, pipe cleaner
 - b. A surface - e.g. paper, card, material, tin foil
 - c. A structure - e.g. empty bottle, box, paper cup, plate, stick

Design:

3. Learners have 20 minutes to design.

Students have 20 minutes to work together and design their fashion item or accessory. They will use the provided materials to develop an innovative solution related to the challenge, such as designing an eco-friendly bag, an upcycled accessory, or a multi-functional garment.



Debrief:

4. Once completed, ask each group to present their prototype and share their thought process:

- What was their design idea?
- How did they approach the fashion challenge?
- What materials did they use, and why?

Encourage other groups to provide constructive feedback:

- How would they improve or add to the design?
- What might be the next stage if this was developed further?
- What fashion-related issues should be considered (e.g., user needs, market research, sustainability)?
- Is there anyone local they could talk to if this were a real fashion project (e.g., local designers, eco-friendly fabric suppliers)?

This activity encourages students to think creatively within the context of sustainable fashion, applying Design Thinking to solve real-world problems while using limited resources.

For the extension activities: Learners can consider the following questions to iterate and improve their prototypes.

1. Refine their Prototype:

- Using the feedback they receive, students will revise their prototypes. This may involve tweaking the design for functionality, experimenting with new materials, or adding features to better address user needs. Encourage students to think about:
 - Materials: Could they use more sustainable, durable, or functional materials?
 - Usability: Is the prototype easy to use or wear? Can it be improved for comfort or efficiency?
 - Aesthetics: How does the design look? Could the visual appeal be enhanced?

2. Documentation:

- As students refine their prototypes, ask them to document the changes they make. They should reflect on:
 - What feedback they received and how they incorporated it?
 - What specific changes were made to improve the prototype.
 - What remaining challenges or questions they have for future iterations.

3. Final Presentation and Reflection:

- See linked learning box in the lesson plan. MM7 Media Communication modules 1 - 4 can also be used to support final presentations in a number of ways e.g. video, research poster, presentation or audio e.g. podcast or interview.



INTRODUCTION

Watch the following video: 'What is Design Thinking?'

<https://www.youtube.com/watch?v=a7sEoEvT8l8>

Answer the questions below. You can re-watch the video as many times as you need to.

a) What or who does design thinking help you focus on?

b) How do design thinkers learn?

c) What do simple prototypes do?

d) What do rapid prototypes do?

e) If you ideate, prototype and test too early - what are three mistakes that can be made?

f) Write down the two reasons for using design thinking.

g) What are the five stages of design thinking?

Watch the video: 'How to make a cardboard prototype'

https://www.youtube.com/watch?v=k_9Q-KDSb9o Write down as many tips as you can.



READY, STEADY, BUILD: KNOWLEDGE GATHERING

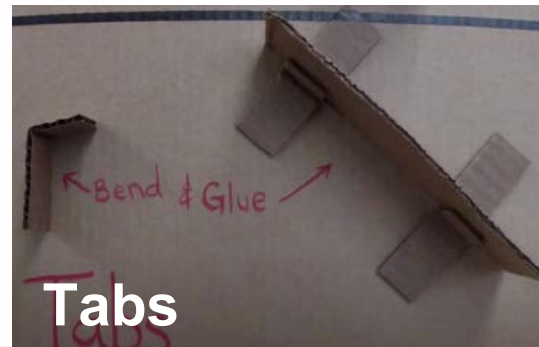
Today we are going to experiment with rapid prototyping with materials that we have to hand. You will explore three basic elements - useful for rapid prototyping:

- Structure
- Fastening / Joining
- Surface

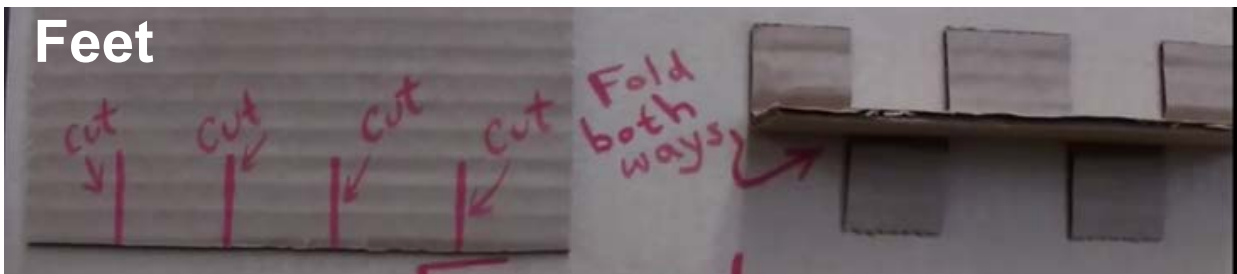
1. Structure - this will provide support and form to your prototype. The structure provides strength by load-bearing if re-enforced or solid, e.g. columns or supports for covering, or other materials, e.g. tent poles. Here's some simple tips for creating structure.



Flange



Tabs



Feet



Watch the short video on structural techniques - all these processes can be scaled up to make bigger models and forms.

Write down the key ideas in the video. Use bullet points.

MM7: L6WS RAPID RESPONSE PROTOTYPING

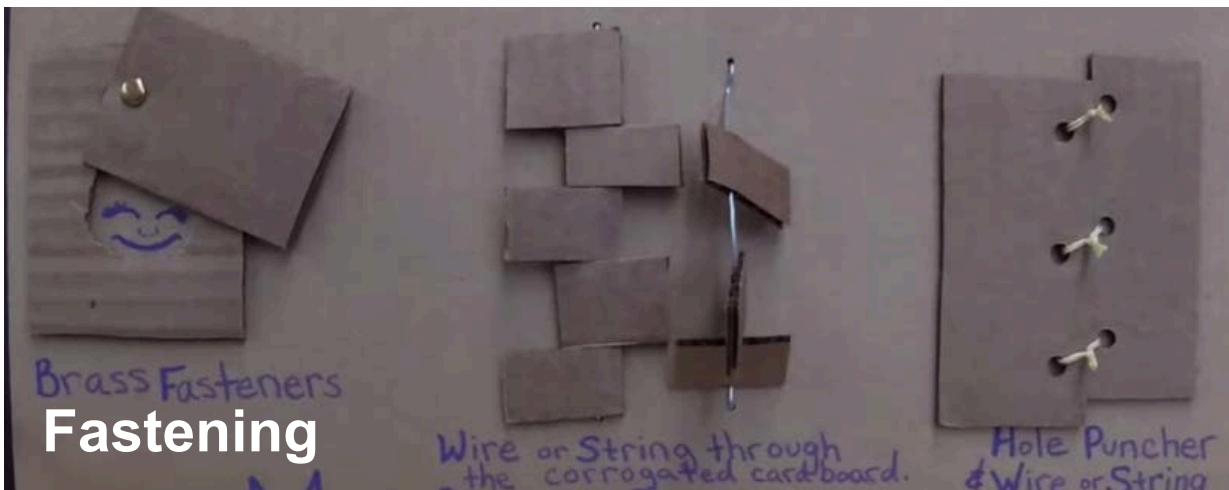
9 INDUSTRY, INNOVATION
AND INFRASTRUCTURE



2. Fastening / joining and attaching - this can be done using structural approaches, such as slots and tabs, or using other materials like pins, paperclips, string tape or glue.



Tabs and Slots



Fastening



Some techniques can be both structural and used to join things together like the slots / tabs here on the left.

What other ways do you know of joining things together? Discuss this in your group and make a list.

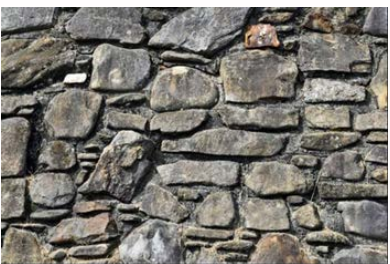
Knots are another useful joining technique- here's a useful website for learning to tie knots <https://www.animatedknots.com/complete-knot-list>



3. A surface - a surface has a number of functions, such as protection, decorative, textural, adhesive, and are made from numerous materials, e.g. plastic, wood, fabric, paper, both natural and synthetic.



Sometimes they can be structural as well as serving other functions. This surface material could provide support and be used as an attachment or joining function as well as offering a decorative purpose.



Natural materials often have other properties such as insulation, waterproofing, protection as well as being structural, making them good for outdoor construction.



Waterproof, or those that are water repellent materials (hydrophobic), are often inspired by nature, whether a rough surface that minimises water contact and absorption or the nanopatterns of insects who fly in the rain undisturbed. You can also treat materials with sprays to make them waterproof.



Safety surfaces can be both decorative and functional. They often use bright colours and recycled materials from other processes. They can be highly durable and so reduce maintenance.



Interior design surfaces, e.g. upholstery, curtains, wallpaper, bedding, worktops, are increasingly synthetic and made from recycled materials, e.g. SeaQual or Econyl from recycled fishing nets. They can be durable, easily cleaned and pleasurable to look at.