

Teaching notes – running STEM Challenges

- Use the Engineering Design Process to design, build, test and improve
- Let children make mistakes and learn from them
- Don't give children ideas, let children think for themselves and ask them questions if they get really stuck
- Set clear times for planning, then building
- Allow plenty of time for evaluation and reflection - as always, children should evaluate their own designs and other teams' designs (in a Learning Loop) to learn from each other and feed this learning into the next project
- You can use STEM Challenge projects to develop key transferable skills (see Learning Intentions) – children can self-assess these

Teaching notes – Marble ramp project

- This project is all about prior learning – before children start to design, get them to reflect on what worked well and what didn't in the previous attempt. There are two sections to the Marble ramp project, for First and Second Levels.
- The challenge is to get the marble to take as long as possible to travel down the ramp so this brings in lots of Maths and Science concepts – time (you could use timers if available), distance (make measurements), speed (measure using an app, video in slow motion), angles, gradients, steep vs shallow slopes, height, length (they could use string to measure the length of unusually shaped ramps eg U shape), 2D shapes, 3D objects, forces, gravity, friction, materials...
- Materials are limited so children will have to plan carefully so they don't waste materials
- Children could investigate steep vs shallow slopes using ramps and cars before starting this project, or create a simple marble ramp and investigate different angles created by different heights of the starting point
- Children can investigate adding speed bumps, flaps etc to their designs
- They need to engineer a strong and stable structure – how will they support the ramp so that the marble travels down as slowly as possible, and the structure is not wobbly?
- Technical drawing – children could plan a bird's eye view and side view(s) to show how the structure will be supported
- This project is a starting point but as children start to wonder what else might slow the marble down, they could experiment with different materials, try their own designs...
- This project can be differentiated easily – allow an extra sheet of paper or use card for younger classes and give them more time for having second attempts at the same challenge, use budgets or add additional rules (eg a minimum length for the ramp or a minimum time the marble must take) for older classes, children could work on their own if they really struggle with teamwork, children can be grouped strategically for support from other children, or to support other children, children can give advice to others and become “experts” who could create marble ramp guidance materials to help others, learners could create slow motion videos of their marble runs...

STEM Challenge Project

Marble ramps



Learning Intentions

- To build up our **skills**:
 - Teamwork
 - Communication
 - Creativity
 - Critical Thinking
 - Resilience

- To use the **engineering design process** to solve a problem

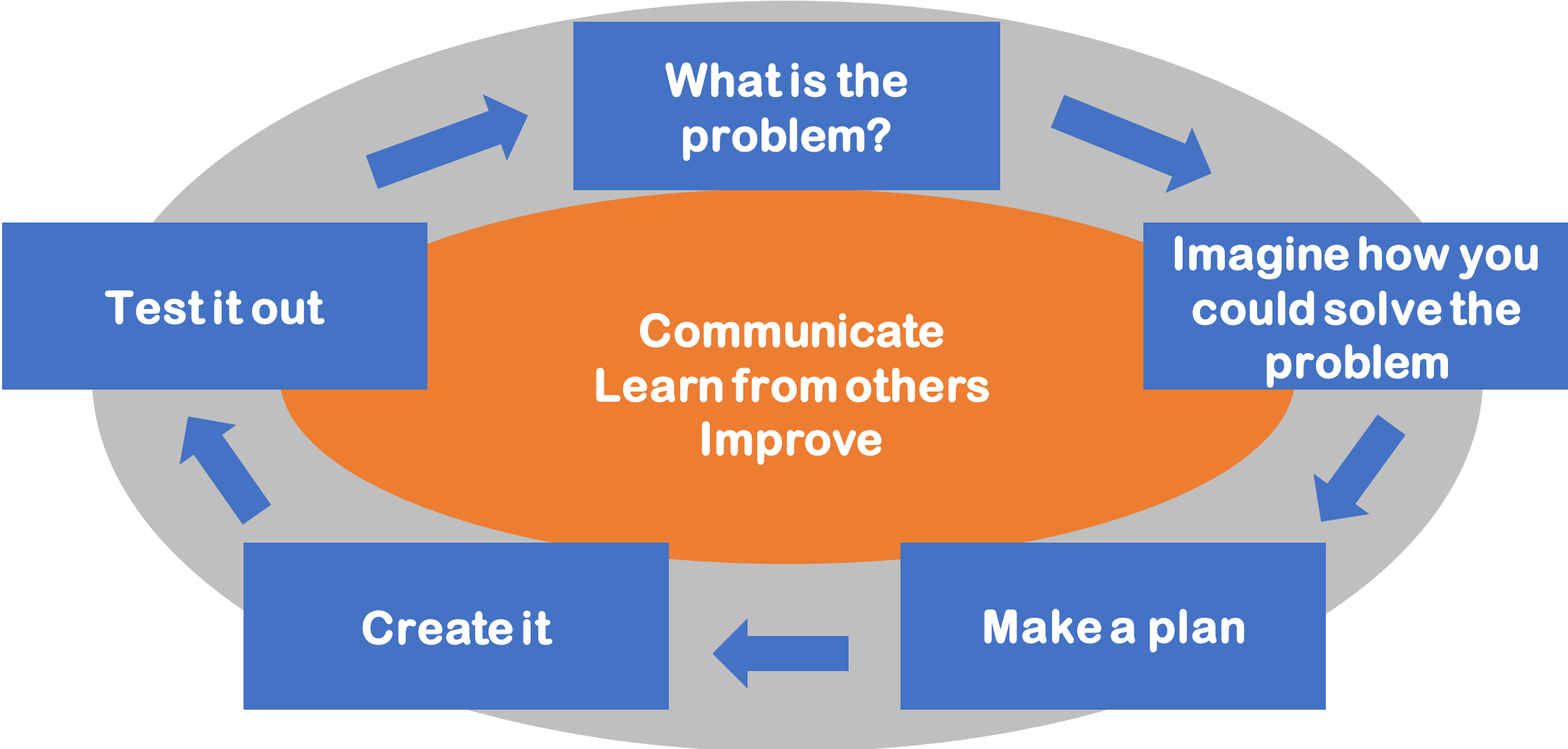


What are your success criteria for this project?

- I would like to get better at
 - teamwork
 - communication
 - creativity
 - critical thinking
 - resilience
- How can you get better at this? Write down some strategies for yourself.
- As you progress through the project, you will decide if you have been successful at developing this skill.



The Engineering Design Process



Marble ramp challenge

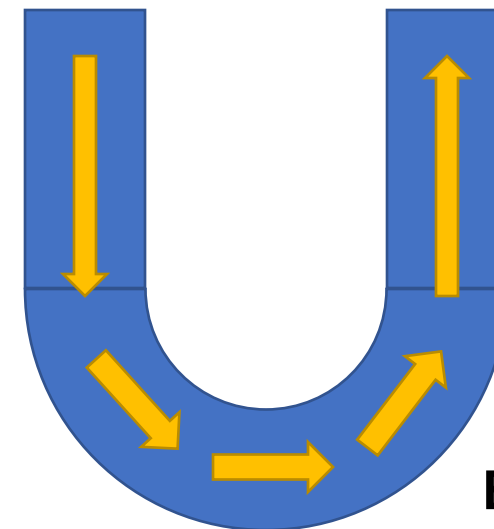


- Design and build a **U-shaped marble ramp** on your desk
- You must include a **marble catcher** at the end to stop the marble rolling away
- The challenge is to make the marble take **as much time as possible** to travel from the start to the marble catcher
- The top of the marble ramp must be **less than 10 cm** above the desk
- You **cannot stick anything to the desk**
- **No tubes**, only ramps – you must be able to see the marble as it travels down

- You will be given the following materials:

- **1 x A4 paper**
- **1 x A4 card**
- **Half a paper plate**
- **Sellotape**
- **Marble in a pot (you cannot use the pot)**

- **Test** your marble ramp and try to **improve** it



Bird's eye view

Marble ramp challenge

- What are the problems with this task?
- What can you predict being difficult?
- Imagine how you could solve each problem.
- What have you already learned that might help you?



Evaluation



- On a pink post-it, write down what you are **Tickled Pink** about – what is good about your design?
- On a green post-it, write down what is **Green For Growth** – what needs to be improved about your design?
- Or you could use pink and green highlighters to draw straight on to your design!





What can you learn from others?

- **Learning loop** – look at other people’s work.
- How did other groups tackle the STEM challenge?
- Which ideas did you see that were successful?
- What did you see that hadn’t worked, or that you wouldn’t use?
- **Feed back to your group**

Marble ramp challenge



- Design and build a **complex marble ramp** on your desk
- The ramp must include at least **three straight ramps** and **two curved sections**
- You must include a **marble catcher** at the end to stop the marble rolling away
- The challenge is to make the marble take **as much time as possible** to travel from the start to the marble catcher
- The top of the marble ramp must be **less than 10 cm** above the desk
- You **cannot stick anything to the desk**
- **No tubes**, only ramps – you must be able to see the marble as it travels down

- You will be given the following materials:
 - **1 x A4 paper**
 - **2 x A4 card**
 - **Paper plate**
 - **Sellotape**
 - **Marble in a pot (you cannot use the pot)**

- **Test** your marble ramp and try to **improve** it

Marble ramp challenge

- What are the problems with this task?
- What can you predict being difficult?
- Imagine how you could solve each problem.
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Evaluation



- On a pink post-it, write down what you are **Tickled Pink** about – what is good about your design?
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- **Learning loop** – look at other people’s work.
- How did other groups tackle the STEM challenge?
- Which ideas did you see that were successful?
- What did you see that hadn’t worked, or that you wouldn’t use?
- **Feed back to your group**

Marble ramp challenge



- Design and build a **complex marble ramp of your own design** on your desk
- You must include a **marble catcher** at the end to stop the marble rolling away
- The challenge is to make the marble take **as much time as possible** to travel from the start to the marble catcher
- The top of the marble ramp must be **less than 10 cm** above the desk
- You **cannot stick anything to the desk**
- **No tubes**, only ramps – you must be able to see the marble as it travels down
- You will be given the following materials:
 - **1 x A4 paper**
 - **2 x A4 card**
 - **Paper plate**
 - **Other materials**
 - **Sellotape**
 - **Marble in a pot (you cannot use the pot)**
- **Test** your marble ramp and try to **improve** it

Marble ramp challenge

- What are the problems with this task?
- What can you predict being difficult?
- Imagine how you could solve each problem.
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Evaluation

- Discuss how your team approached the STEM challenges in this project
 - What did you learn?
 - Which skills did you develop?
- How could you improve your designs?
- Can you think of another similar STEM challenge you could set yourself to try at home?

Self-assessment at end of project

- We have been developing our skills by doing STEM challenges:
 - Collaboration
 - Communication
 - Critical thinking
 - Creativity
 - Resilience
- Have you followed your strategies?
- Have you been successful in developing your chosen skill?
- Have you developed other skills during this project?