

# Imagine & Plan – Creative Problem Solving

Coming up with design ideas and  
evaluating their effectiveness



**Download the full report:**

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Progressing to be an Engineer –  
The Approach. Royal Academy of  
Engineering.

**Informed by work from Kingsmead Primary School,  
Wales High School & Worthing High School**

# The Progressing to be an Engineer Cycle



# Overview

**Imagine & Plan – Creative Problem Solving** – most tasks involve some creative problem solving. It is a way of using your creativity to develop new ideas to solve problems. It often involves working collaboratively with a team of people. There are a variety of different methods that can be used to stimulate the imagination and generate innovative solutions.



ILOs	Key learning	Possible activities
<p><b>What do we want pupils to understand about Imagine &amp; Plan – Creative Problem Solving?</b></p>	<p>Creative problem solving is at the heart of the Engineering Design Process. It is a simple process that involves breaking down a problem to understand it; generating ideas to solve the problem and evaluating those ideas to find the most effective solutions.</p> <p>The first step in creative problem solving is to conjure up a range of ideas as a team. At this point, every idea is considered and nothing is thrown out. Next, ideas are individually evaluated and discussed and then decisions made to move forward with those you think might work.</p>	<p><b>Generating ideas:</b></p> <p>Teaching creative problem solving can be achieved by using random design brief generators: <a href="https://theideamachine.org/">https://theideamachine.org/</a></p> <p>Sometimes it's useful to try different ways of generating ideas.</p> <p><b>Activities:</b></p> <ol style="list-style-type: none"> <li>1. <a href="#">Crazy 8</a></li> <li>2. <a href="#">4 x 4</a></li> </ol>
<p><b>How do we want them to apply their knowledge?</b></p>	<p>Pupils should generate ideas and solutions by applying different techniques, being resourceful, critiquing, giving and receiving feedback and seeing engineering as a 'team sport'.</p> <p>Pupils are successful creative problem solvers when they can generate multiple ideas and effectively communicate why some ideas are better than others.</p>	<p><b>Tooth decay in children</b></p> <p>Looking at the problem of oral health in children under five, identifying reasons and generating potential solutions.</p> <p><b>Activities:</b></p> <ol style="list-style-type: none"> <li>3. <a href="#">Exploring problems</a></li> <li>4. <a href="#">Developing solutions</a></li> </ol>





	From	To	Towards
	<b>Suggested 5–7 years</b>	<b>Suggested 7–11 years</b>	<b>Suggested 11–14 years</b>
<b>Pupils should be taught to:</b>	Come up with and describe how different ideas can solve a problem.	Generate multiple ideas, effectively communicating their fitness for purpose and why certain ideas are better than others.	Use research and experience to come up with designs to solve a problem, justifying choices by applying scientific knowledge and evidence.
<b>Success was demonstrated when pupils:</b>	<ul style="list-style-type: none"><li>■ were able to suggest some simple ideas to solve a specific problem.</li></ul>	<ul style="list-style-type: none"><li>■ generated more than one idea that fit the brief, communicated these effectively through sketching and annotations acknowledging pros and cons of each option.</li></ul>	<ul style="list-style-type: none"><li>■ able to add an increasing complexity to designs and make reasoned choices based on level of benefit to the target audience.</li></ul>

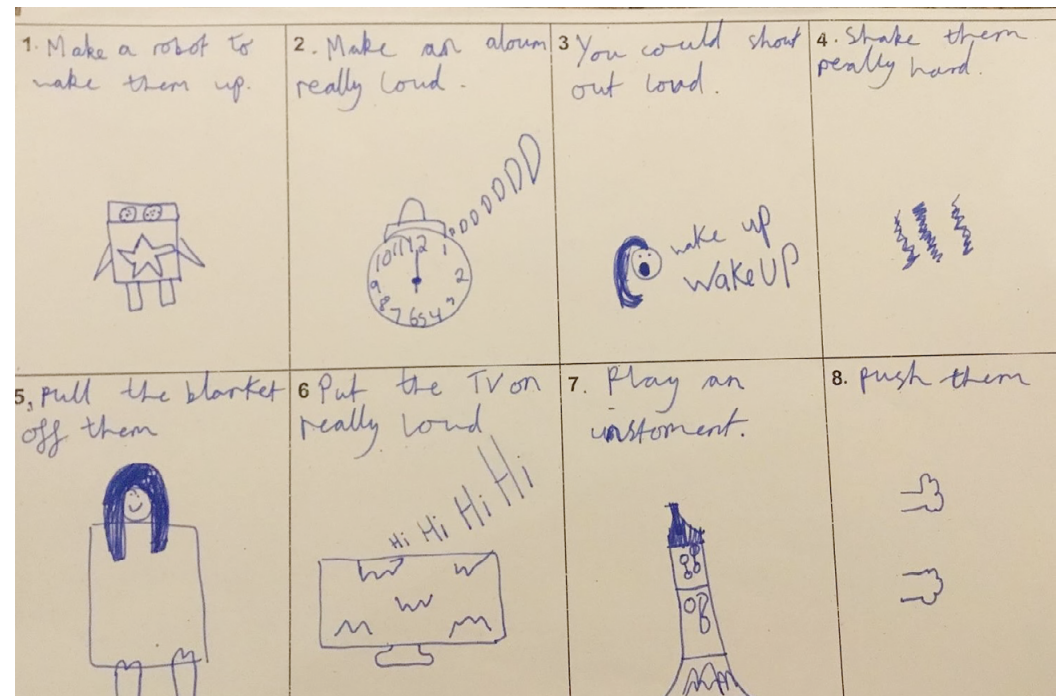
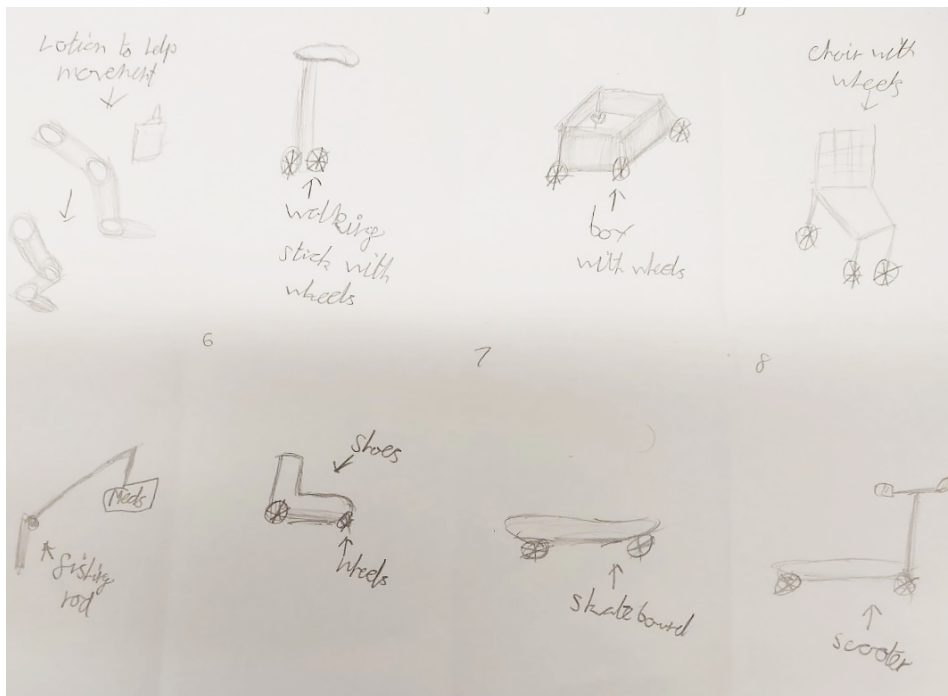


# Generic task

## Initial learning activity - eliciting and developing understanding

### Activity 1 - Crazy 8

Pupils were each given a blank sheet of paper which they were asked to fold in half 3 times to generate 8 equal boxes. The teacher then posed a simple design problem - crossing the road safely, waking up a heavy sleeper. A timer was set for 8 minutes and the pupils were challenged to generate 8 different ideas. At 60 seconds per idea, the focus was on quantity rather than quality.



'The crazy 8 activity worked really well at getting the students to think more creatively and worry less about presentation and what other people would think. The ideas machine made this task really easy from a teacher perspective. The fast pace meant that everyone was engaged and the students were pushed out of their comfort zones.'

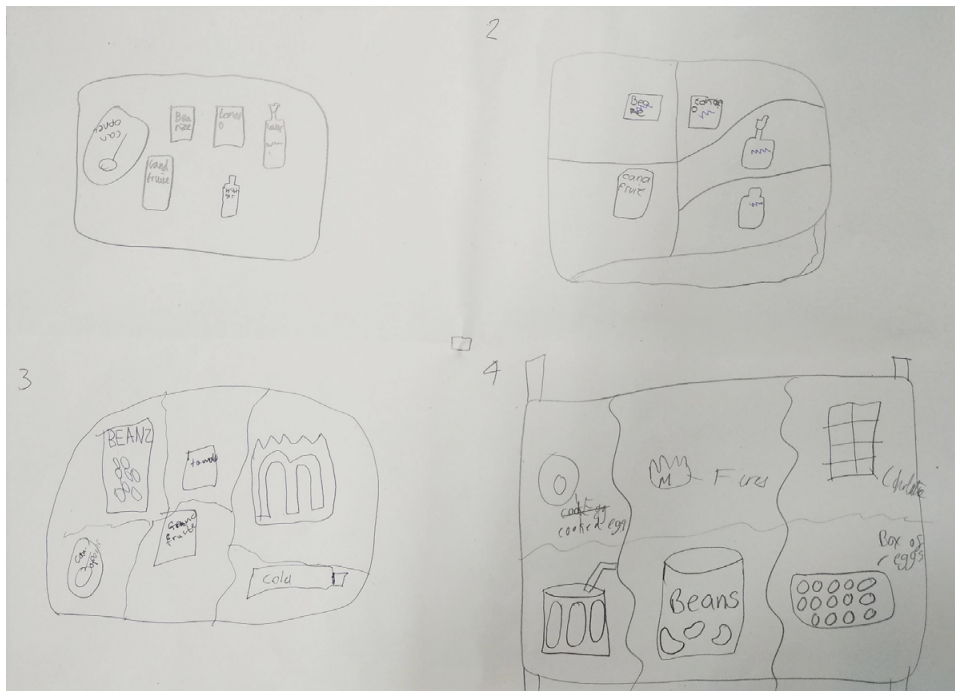


# Generic task

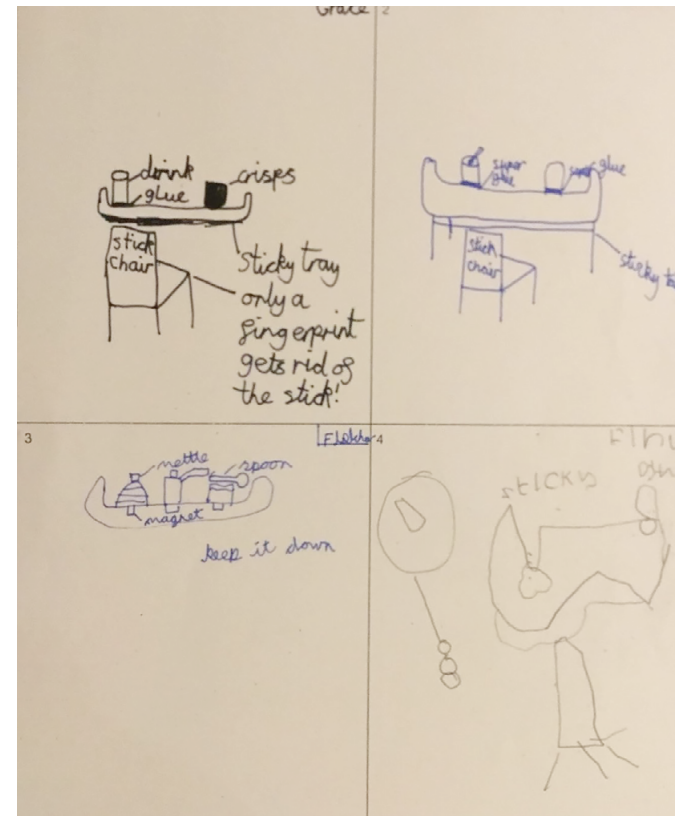
## Initial learning activity - eliciting and developing understanding using a generic task (continued)

### Activity 2 - 4x4

Pupils were then challenged to respond to a problem as a team. Each team had 2 minutes to sketch a quick idea on the first part of the sheet, then pass to the next team, who were required to alter ONE aspect of the design in the next box. The sheets were rotated until the problem arrived back with original team, with 4 iterations. Problems were generated with a Random Brief Generator from the ideas machine.



'The iterative design task worked well and allowed the students to develop their teamwork and time management skills. Again the ideas machine was a big help here.'

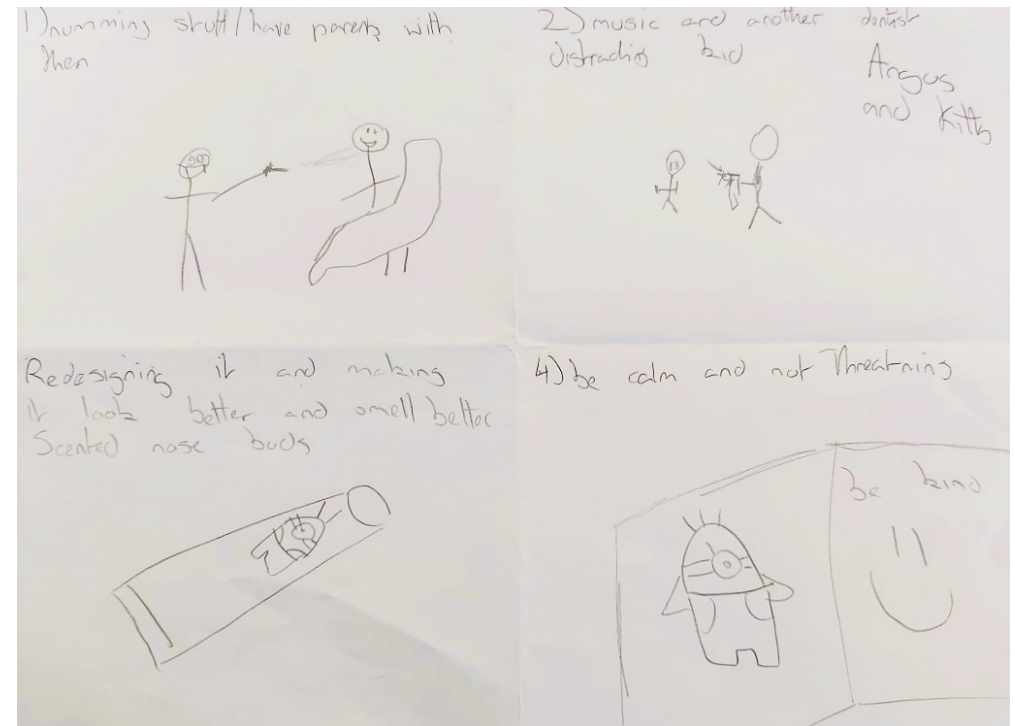
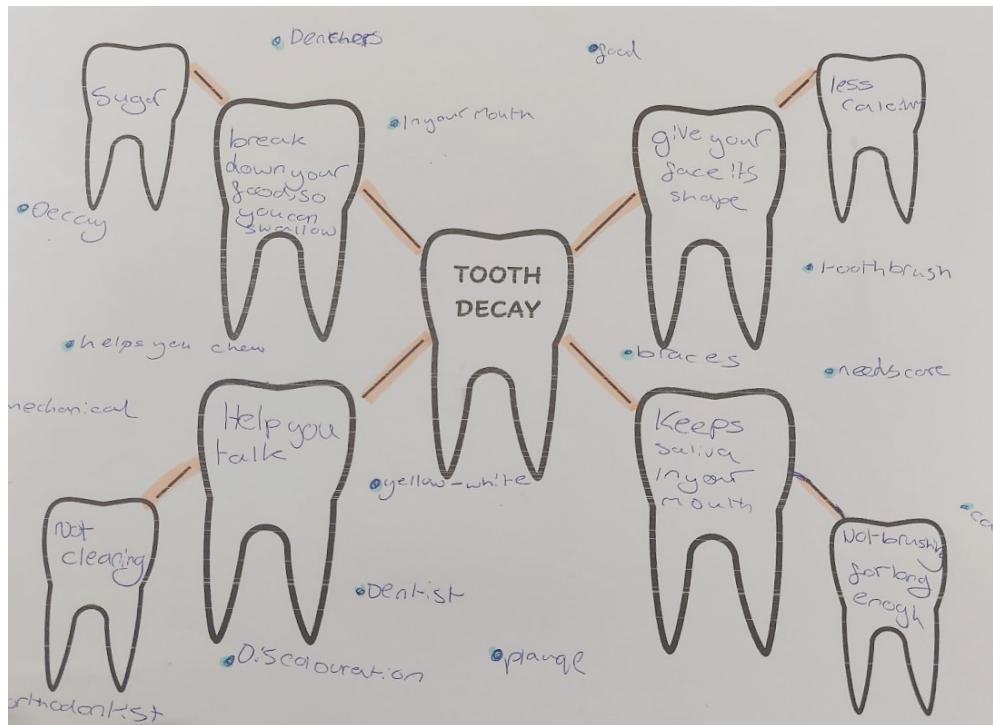


# Embedded task

## Exploring Imagine & Plan - Creative Problem Solving in context

### Activity 3: Exploring problems

Pupils were exposed to the fact that nearly  $\frac{1}{4}$  of all children under 5 have experienced some form of tooth decay and were asked to generate reasons as to why this might happen, using the tooth mind map show below. Ideas included the following: lack of brushing, fear of the dentist, poor diet, too much sugar and ineffective tooth brushing. Pupils were then tasked with choosing one of the problems and imagining a series of potential solutions using one of the techniques practised in the generic task.

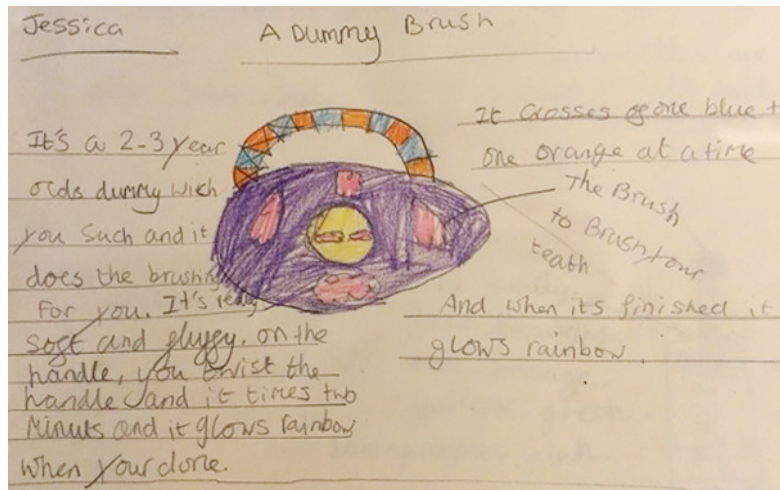


# Embedded task

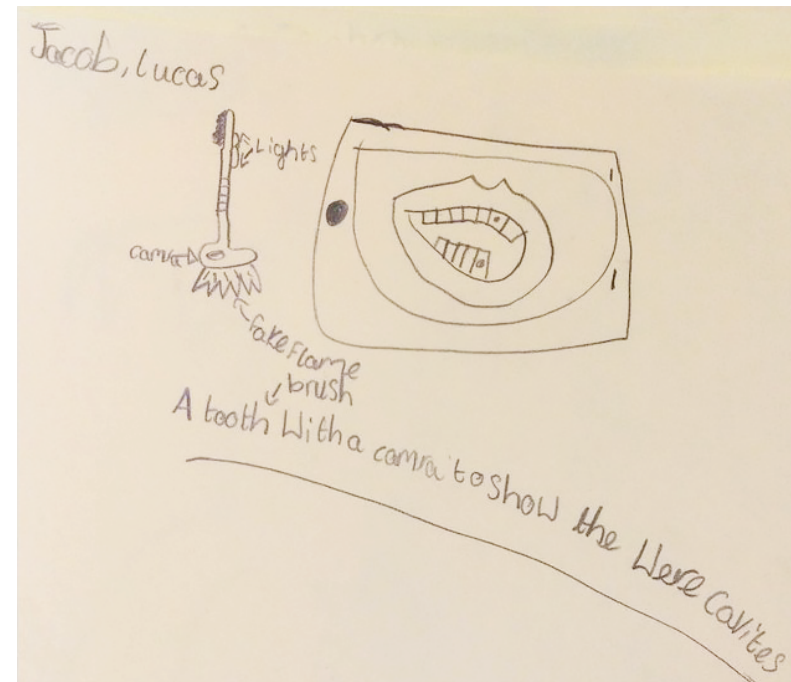
## Exploring the EHoM in context – the embedded task (continued)

### Activity 4: Developing solutions

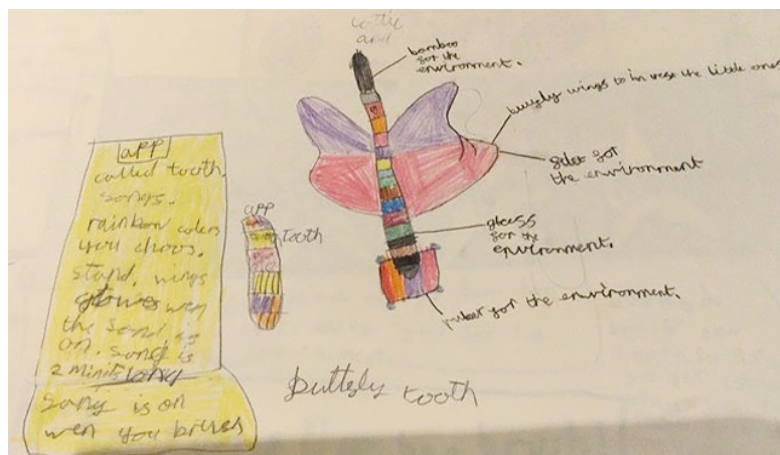
The pupils were asked to choose one of their solutions and develop it further.



"This design targeted very young children who might still be using a dummy. It was a novel idea to get very young children interested in cleaning their teeth."



"I wasn't sure how inventive the children would be in their designs. However, they did come up with a variety of different designs. They were all keen to make their brushes look attractive to young children by considering themes for their brushes. It was good to see that many considered the eco side too."





# Teachers' ideas to extend and support thinking

## Extending

Pupils could design their own Tooth App to improve oral health. They should think about the following questions:

- Who is the app for and why this audience?
- What is the purpose of the app?
- How is it going to work – type, swipe, camera control?
- If you were going to write a brief description for the app store, what would it say?

*Building a timing device.*

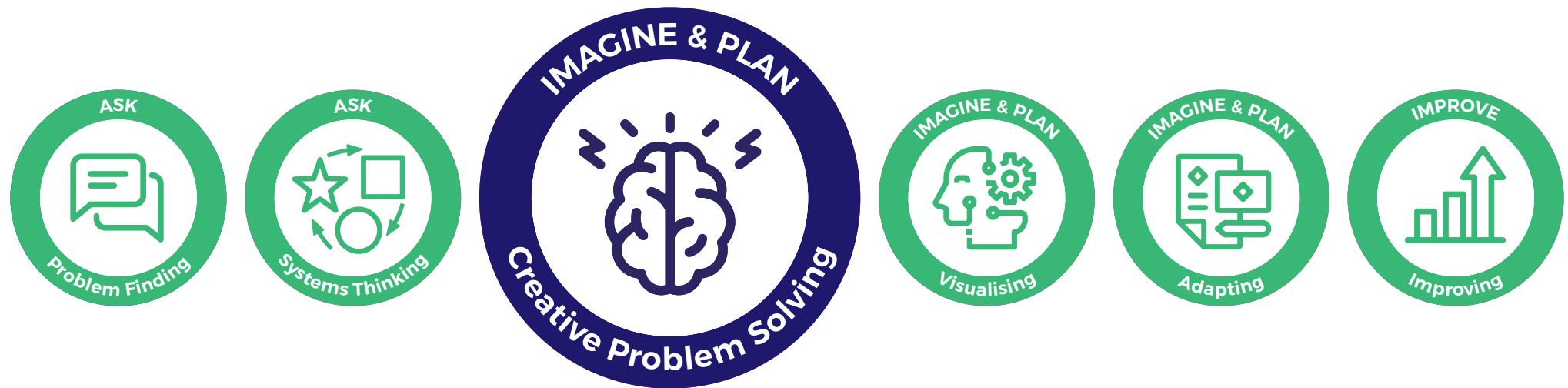
Make your own 2-minute toothbrush timers using Crumble Controllers

<https://redfernelectronics.co.uk/lockdown-learning-a-tooth-brushing-timer/>

## Further support

**Pupils may struggle** because they have limited knowledge of the materials available for making a toothbrush (a few knew that bamboo is now being used for toothbrushes, but many were unsure what the bristles could be made of).

A range of toothbrushes for the pupils to examine might help with this.





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**FROM** – coming up with and describing how different ideas can solve a problem.

**TO** – generating multiple ideas, effectively communicating their fitness for purpose and why certain ideas are better than others.

**TOWARDS** – using research and experience to come up with designs to solve a problem, justifying choices by applying scientific knowledge and evidence.