



Curriculum aims and objectives

Aimed at KS2, adaptable for Y3, 4, 5, 6.

National Curriculum Links to developing spoken language (collaborative conversations, exploring ideas, discussions), DT (research, design, construction, evaluation), Science (properties of materials, forces and mechanisms, evolution and inheritance, plants, living things and their habitats), working scientifically.

Head

Pupils will develop real life skills through the engineering design process; ask, imagine and plan, create and improve. Pupils will gain a wider understanding of what engineering is.

Heart

Pupils will learn more about levers and linkages/3D structures, through observation and testing a variety of designs. They will look closely at plants/birds in the habitats where they live in the Bay area. They will use their findings to inspire ideas and visualise their own designs for an extendable grabber/vertical growing system. They will identify some of the unique structures and functions found in nature that have inspired engineers to create problem-solving designs.

Pupils will use their curiosity to look closely, discover more about their local nature, (additionally use research and stories), developing a sense of connection and value.

Hands

Pupils will apply their observations, knowledge learnt and creativity to design and build a prototype solution to the engineering challenge (either a grabber or a vertical growth structure). They will reflect on how well their design meets the purpose.

Adaptations to extend impact

Additional design criteria include:

- Challenge how to water and harvest the food. This could introduce the simple machine, the pulley, as a mechanism to lower and raise the growing containers for watering and harvesting.
- Challenge could introduce the use of simple coding to indicate when the plants require water by using a moisture sensor combined with a BBC Microbit computer.



For the teaching resources mentioned, designed by Lancaster University's School of Engineering, sign up as an MBC Member and access the MBC Moodle'

These activities can be linked to the United Nation Sustainable Development goals, an ambitious, urgent set of 17 goals aimed at changing the world for the better. Threading the UN SDGs through the curriculum helps to build agency, empathy, knowledge and skills that contribute to achieving these inter-connected goals, linking local actions with global impacts. Engineering skills have a major role to play in achieving these goals.

worldslargestlesson.globalgoals.org/resource/introducing-the-global-goals



Creative problem solving, inspired by the nature of the Bay

KS2 Science and Design and Technology

Dr Irene Wise

Lancaster University

Engineering Challenges: Grab it! and Grow up!

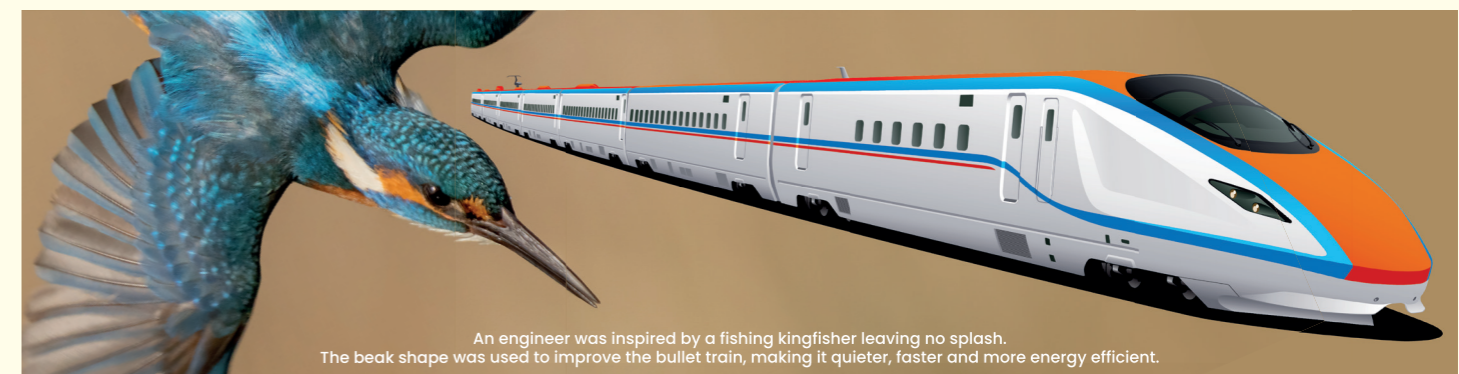
These 2 activities, Grab It and Grow Up, link the engineering design process with exploration and observation of the biodiversity of plants and birds found in the habitats of Morecambe Bay. Biomimicry is an exciting way to inspire pupils to observe the natural world, instilling curiosity and wonder, to develop a creative approach to problem-solving by looking at nature for sustainable solutions. Biomimicry is about valuing nature for what we can learn, not what we can extract, harvest or domesticate. In the process we learn about ourselves, our purpose and our connection to each other and our home on earth, on Morecambe Bay.

The DT curriculum acts as a platform for integrating STEM, creative design and raising the profile of engineering in Primary schools. The activities are designed around the engineering design process, the purpose being to make things that work, or improve them, to work better, using observations of nature to inspire creative solutions. It follows the themes of ask, imagine and plan, create and improve which map the design and technology curriculum, developing real skills including creative problem-solving and finding, adapting and improving.



Progressing to be an Engineer Framework 2023

Bianchi and Wiskow 2023; SEERIH, University of Manchester, Royal Academy of Engineering raeng.org.uk/media/ljbiszod/rae-progressing-engineer-report.pdf



An engineer was inspired by a fishing kingfisher leaving no splash. The beak shape was used to improve the bullet train, making it quieter, faster and more energy efficient.

Grab It! Challenge

Based on solving a reach problem. It might be reaching for something up high, or down low or underneath furniture. The design solution is based on one of the 6 simple machines, a lever, which increases the effort applied, making it easier to move a load. The grabbing part of the design will be inspired by biomimicry, observing natural levers, bird beaks.

The diversity of beak shapes has evolved through various iterations; to enable them to efficiently pick up food found in habitats and survive to produce chicks. Depending on where they live, beaks are the right tool for the available foods, enabling birds to specialise in picking up, probing, prising, cutting or tearing.

Grab It!

Engineering Biomimicry Challenge Resources

PowerPoint to use or adapt illustrating engineering thinking, the challenges.

Activity 1: Exploring a simple machine

Build a lever using lolly sticks and elastic bands to send a pompom into the air.

Activity 2: Right tools for the job

Create a mixture to represent different food types e.g. rice, pasta, elastic bands, dried peas. Choose from a variety of everyday levers e.g. tweezers, clothes pegs, chop sticks, spatula to test for its efficiency to pick up a specific "food" from the mix in 1 minute.

Activity 3: Nature's engineering champions

Sort the images, by matching the living thing with the solution it inspired engineers to create.

Activity 4: The Bay's Natural grabbers

Sort the images of Morecambe Bay's diverse birds. Match their beaks with the type of tool they use to catch and eat their food.

Activity 5: Grab It! Engineering challenge

Design and build an extendable grabber. Combine levers using linkages to create the extendable part of your grabber. Use the inspiration for the Bay's bird beaks to create the grabbing part. Who are you designing it for? How does your design meet the needs of the user?

Additional enrichment opportunities are:

- Bird watching
- Linking to the MBC story "Made by the Moon" by Emily Hennessey



I made a contraption that picks up a remote or keys. I also learnt about nature of Morecambe Bay. I really loved it!
Y5 pupil, Heron Hill Primary, Kendal

Grow Up! Challenge

Based on the need for more creative ways of growing food. Cities are getting bigger, more land is being flooded or becoming infertile and there are more people in the world every day. Can we use less space to grow more food by creating vertical farms?

Strong shapes can be found in nature. For example, bees make honeycombs, hexagonal cylinders made from wax. The Queen bee lays their eggs inside and the worker bees make honey to feed the developing young bees. Plant stems grow tall, slim and flexible. Looking closely at the microscopic structure reveals layers of cylinders. These observations form the basis of the prototype design for a vertical growing farm, designed to provide the plants with light and water.

I loved doing the cress structure and looking at stuff with the microscopes as well as building a spaghetti tower and learning a bit more about engineering, that was super interesting. Y6 pupil, Paul's CE Primary, Barrow



Grow Up! Engineering challenge resources

PowerPoint to use or adapt illustrating the challenges.

Activity: Spaghetti Tower

As a team, design and build the tallest free-standing tower to support an object for 10 seconds, using limited resources (spaghetti, tape, modelling clay, cardboard, string) in 15 minutes. What features of each design are effective? What are the weak points causing failure?

Activity 2: Explore the strength of 3D shapes

Use the templates to make a cuboid, prism and cylinder to test for strength. Which shape supported the most weight?

Activity 3: Nature's engineering champions

Explore biomimicry through a card game, matching the living thing with the solution it inspired engineers to create.

Activity: Engineering Challenge to Design

Build a challenge. Imagine, plan, create a vertical growing structure to support the growth of 4 pots of cress seeds. It must fit within a small footprint and ensure each pot of seeds has the optimum growing conditions. Make the experiment a fair test, compare the cress harvest from each design.

