BEAT THE FLOOD

Teacher's guide

CREST AWARDS

THE GLOBAL GOALS For Sustainable Development

practicalaction.org/schools/beat-the-flood

Practical ACTION

Beat the flood is an exciting hands-on challenge for 8-14 years. It enables pupils to consider the global impact of flooding caused by climate change, then design and build a model of a home on the fictitious island of Watu.

To see how Beat the Flood is used in both a primary and secondary setting, and hear feedback from a secondary head of science you might like to watch this video youtu.be/4E5CbLDYhMo

The video clip whose url is below shows Beat the Flood being used as the basis of an extra-curricular day supporting International Women in Engineering week. youtu.be/JguVC8xEvKk.

The challenge can be used to deliver parts of the science, design and technology and maths curriculum in regular lessons, as an enrichment day, in a STEM/science club or part of a primary-secondary transition activity. Pupils can also gain a CREST Discovery Award or use the challenge as a starting point for a Bronze, Silver or Gold Award.

Contents

Learning objectives

Pupils have the opportunity to:

- gain practical experience to reinforce learning on testing materials for tensile strength and absorbency
- develop problem solving, team working and presentation skills
- discover how STEM can help solve global issues and achieve the UN Sustainable Development Goals

Curriculum links

STEM subjects provide great opportunities for teachers to include authentic global contexts and global learning. To see where Beat the flood supports the delivery of the formal science curriculum for England, Northern Ireland, Scotland and Wales please go to: practicalaction.org/schools/science-curriculum.

Within the D&T curriculum pupils will gain technical skills and knowledge.

Overview of Beat the flood

Outline	Teaching material	Timing (min)
Introduction to the context	**PPT slides 2-5** **Pupil activity sheets (one set per group)** - *Where in the world pictures* - *World map (print size A3)*	10 min
Starter activities		
a. The Sustainable Development Goals	**PPT slides 6-7** **Pupil activity sheets** - *Sustainable Development Goals (one per pair)* - *Global Goals display materials (one set per class)* *practicalaction.org/ schools/ global-goals-display-materials* **PowerPoint** - *Sustainable Development Goals Quiz*	20-30 min
b. Structures	**Pupil activity sheets (one per group)** - *Frame and shell pictures* - *Frame or shell?* - *Structures template 1* - *Structures template 2*	30 min
c. Testing for absorbency	**Pupil activity sheet (one per group)** - *Testing materials for absorbency - results table*	20 min
d. Testing for strength	**Pupil activity sheet (one per group)** - *Testing materials for strength - results table*	20 min
Main activity – Making a model flood-proof house	**PPT slides 8-12** **Pupil activity sheets (one per group)** - *Watu island map* - *Watu island community cards* - *Design specification* - *Design ideas* - *Materials cards and summary of costs* - *Costing our flood-proof house*	60-120 min
Feedback	**Pupil activity sheet (one per pupil)** - *Team feedback*	30 min
Solutions in Bangladesh	**PPT slide 13**	5 min
Celebrating success	**PPT slides 14-15**	5 min

Introduction to the context

Divide the class into small groups and hand out the Where in the world pictures and World map (N.B. this needs to be printed on A3).

Use PowerPoint (PPT) slides 2-5 to introduce and sum up the activity. Ask pupils to match the photos to countries. Use the time to discuss that flooding is a problem faced across the world, including the UK.

Prompt questions

- Have you ever had any experience of dealing with flooding?
- Do you think some countries experience more flooding than others?
- Do you know what might cause flooding, or make it worse?
- Are there any problems that would make the impact of flooding on people worse in some parts of the world?

Resources

Pupil activity sheet (one per group)
- *Where in the world pictures*
- *World map (print size A3)*

Starter activities

We recommend you run the following starter activities to help pupils:

- understand the context of the challenge, particularly in relation to the Sustainable Development Goals

- gain knowledge related to structure and materials that they can include in their decision making around the design of their models.

a. The Sustainable Development Goals

Use PPT slides 6-7 to introduce the Sustainable Development Goals (SDGs) also known as the Global Goals. Do this by explaining that in 2015 the United Nations identified a number of problems faced by people and communities around the world. They then came up came up with 17 SDGs which they agreed to work towards to help solve world poverty by 2030.

SDG 11 Sustainable cities and communities is the Goal mostly closely linked to this challenge. The activities below aid understanding and engagement with the SDGs.

i. Interdependence of the Sustainable Development Goals

Hand out copies of the *Sustainable Development Goals* sheet to help aid understanding of what the Global Goals are. Ask pupils which ones might be linked to some of the problems faced by people around the world who suffer from the impact of flooding.

Now carry out our Global Goals string activity. This helps pupils see the interconnections between the goals.

1. Hand out all the symbols to start with, then enough of the images for each pupil to have something to hold. For younger pupils, or to simplify the activity, you may wish to cut the targets off the bottom of the symbols.

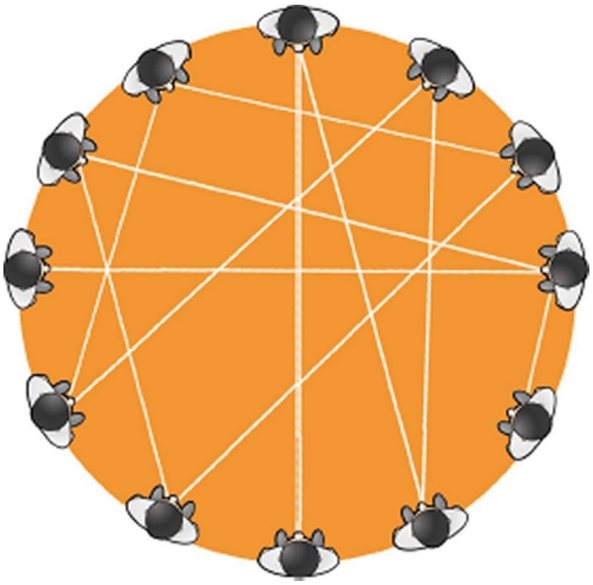
2. Ask the pupils holding images to 'pair up' with the correct Global Goal.

3. Ask pupils to stand in a circle facing inwards and showing their Global Goal symbols and images.

4. Hand one end of the string to the pupil holding Global Goal 2 and ask the pair which of the other goals they think 'Zero hunger' may link to, and why. An example may be a link to health and well-being because people who don't have enough to eat cannot be healthy. Ask them to keep hold of the end and pass (or throw!) the ball of string to the pupils holding that Global Goal and image.

5. Ask the same question of this pair of pupils, and again ask them to keep hold of the string but pass the ball to the pair who have a Global Goal they think links to theirs, and explain why.

6. Continue until you have a spider web effect.



7. Ask the pupil holding SDG 11 Sustainable cities and communities to pull on their string. When other pupils find their string moves explain that this is because everything is interconnected; when you make progress on one Global Goal it affects the others.

Resources

Pupil activity sheets
- *Sustainable Development Goals (one per pair)*
- *Global Goals display materials (one set per class)* *practicalaction.org/schools/global-goals-display-materials*

Equipment
- *String*

ii. The Sustainable Development Goals Quiz

A short quiz on some facts related to the SDGs.

Click on the SDG icon on PPT slide 2 to go to the relevant question, then the SDG symbol to return to PPT slide 2 ready for the next question. You may like pupils to choose which question they want next.

Answers and additional information is given in the notes section of the PPT and in the notes document, which is designed to can be printed for easy reference.

Resources

Teacher resources
- *Sustainable Development Goals Quiz*
- *Sustainable Development Goals Quiz - notes*
- *practicalaction.org/schools/sdgs-quiz*

b. Structures

This activity enables pupils to learn about, evaluate, and model shell and frame structures for their suitability as structures for a home in a flood-prone area.

Divide the class into small groups and hand out the *Frame and shell pictures* and *Frame or shell?* activity sheets to each group. After the activity discuss how their understanding of structures could help in designing a flood-proof home.

Divide the class into small groups, hand out the two structure templates (laminated) , and ask them to develop the following:

1. A pyramid and cube shell structure using the sheets, one with no weight and one with 10g of playdough inside.
2. A range of frame structures using the straws, some without weight and some with 10g of playdough added.
3. A structure that combines a frame structure with straws and laminated shapes.

Allow pupils to test in a tray of shallow water. Agitate the trays to create waves.

The pupil should discover that:

- the structure with no weight will move easily
- the 10g shell structure will have a little resistance to movement
- the 10g frame structure will resist quite a lot of movement
- the 10g frame with shell at the bass will move easily
- the 10g frame with shell part way will resist a lot of movement.

To compare resistance to wind as well as flooding, put the model on a dry surface and use a hair dryer. The shell structures will have the greatest resistance to wind.

Explain how these experiments show how important it is to understand local conditions when designing a home.

Resources

Pupil activity sheets (one per group)
-Frame and shell pictures
- Frame or shell?

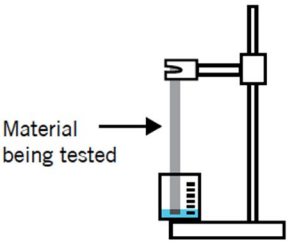
- *Structures template 1 (laminated)*
- *Structures template 2 (laminated)*

Equipment (per group)
- *Drinking straws*
- *Play-dough or blu-tac*
- *Sellotape*
- *Hairdryer*
- *Glue-gun*
- *Scissors*

c. Testing materials for absorbency

Pupils test a range of materials to see which ones would be most suitable for a flood-proof home.

Divide pupils into groups and ask then to set up the stand and clamp as shown. If you do not have these they could just hold the material being tested.



Pupils should cut out equal sizes of materials, where possible 15cm x 2cm in order to ensure a fair test. They should then insert the material into a beaker containing 25 ml of coloured water for 2 minutes (colour water with food dye). After 2 minutes they need to remove from the water and measure the distance the water has gone up the materials.

Results should be recorded on the results table.

Resources

Pupil activity sheet (one per group)
- *Testing materials for absorbency - results table*

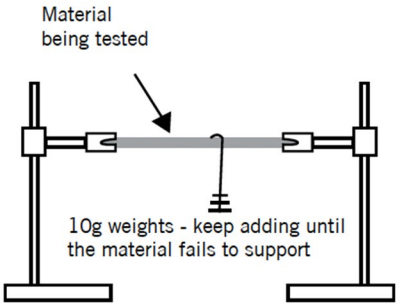
Equipment (one set per group)
- *1 stand and clamp*
- *6 glass beakers*
- *food colouring*
- *ruler*
- *materials for testing e.g j cloth, kitchen towels, aluminium foil, cling film, paper towel, cotton fabric, wooden spills*

d. Testing materials for strength

Pupils test a range of materials to see which ones would be most suitable for a flood-proof home.

Divide pupils into groups and ask then to set up the stands and clamp as shown. Pupils should cut out equal sizes of materials, where possible 15cm x 2cm in order to ensure a fair test. They should attach the material between two clamps and stand as shown in the diagram, then add weights 10g at a time until the material bends or breaks.

Results should be recorded on the results table.



Resources

Pupil activity sheet (one per group)
- *Testing materials for strength - results table*

Equipment (one set per group)
- *2 clamps and stands*
- *Set of 10g weights*
- *Materials for testing e.g j cloth, kitchen towels, aluminium foil, cling film, paper towel, cotton fabric, wooden spills, scissors*

Main activity – Making a model flood-proof house

The main challenge starts on PPT slide 8 where pupils are introduced to challenges faced by islanders on Watu island.

Divide the class into small groups, and allocate each group a different community. Hand out their community cards and an island map. Allow pupils time to read about their community. Help them develop a list of risk factors e.g. closeness to the sea and ages and abilities of people to respond to flooding. If you wish to explore risk to flooding in more detail, carry out our *Who's most at risk?* activity practicalaction.org/schools/who's-most-at-risk

Ask pupils to mark on their maps the area most at risk of flooding, then discuss.

Homework/extension activity

Before pupils start designing their model they could carry out independent research on flood resistant homes to help them develop their ideas. This could include looking at Practical Action's technical briefs on flood resistant housing practicalaction.org/schools/technical-briefs-construction

Hand out one set per group of the *Design specification, Design ideas, Material cards and summary of costs, and Costing our flood-proof house.*

The aim of the challenge is for pupils to appreciate the design process of flood-resistant housing, and work together to build a model of a flood-proof house.

Encourage pupils to work though their ideas and the specifications before building their model. Show them the video from Practical Action and Ortis Deley from Bangladesh bit.ly/pasbtf.

When pupils start to develop their ideas encourage them to look at the materials information cards, to see how modelling materials represent 'real-life' materials. For example, lolly sticks represent planks of wood, aluminum foil on card represents corrugated iron. We suggest you give a maximum budget of £500. You could encourage older or more able pupils to look at a wider range of technologies used by communities in flood-prone area such as early warning systems and evacuation procedures.

Pupils should keep track of the cost of their model too, reducing cost where possible by using locally available materials. You could also introduce a sustainability element.

Prompt questions

- Are there any other, cheaper modeling materials you could whose properties are just as good?
- How could you make the model more stable?
- Have you considered what will happen to the base of the model house when it is immersed in water?

Testing models is a highlight of the challenge! Models can be put in 5cm of water in a washing up bowl/sink or tray, then squirted with a hosepipe or have water poured onto them from a watering can. You could also include blasting with a hair dryer!

Resources

Pupil activity sheets (one per group)
- *Watu island map*
- *Watu island community cards*
- *Design specification*
- *Design ideas*
- *Materials cards and summary of costs*
- *Costing our flood-proof house*

Modeling materials, e.g.
Bamboo, cling film, aluminium foil, cardboard, straws, plasticine, lolly sticks, mud, leaves, grass, spills, lego bricks, K'NEX, balsa wood, corks

Joining and cutting equipment, e.g.
String, sellotape, masking tape, elastic bands, metal fastenings, glue gun, glue, blu-tac, scissors, craft knives

Testing equipment, e.g.
Washing up bowl, trays, sink, hosepipe, watering can, hair dryer

Feedback

We suggest that pupils present their model to the rest of the class reflecting on how well they worked together, problems they solved, etc. (this will be necessary if you are planning for your pupils to gain a CREST Discovery award).

Resources

Pupil activity sheet (one per pupil)
- *Team feedback*

Solutions in Bangladesh

PPT slide 13 is a short case study of how Practical Action helped a 14 year old girl feel safe after she lost her home due to flooding.

Celebrating success

CREST Awards

Taking part in the Beat the flood is a great way for pupils to gain a CREST Award. The challenge is aligned to the Discovery Award, but can be used towards achieving a Superstar Award or as the starting point for a Bronze, Silver or Gold Award.

The CREST Discovery Award is generally undertaken by 9–14 year olds. It can be acheived in 3–5 hours. CREST Bronze, Silver and Gold Awards are designed for pupils aged 11–18.

For more information on CREST Awards go to: crestawards.org

For further ideas for Bronze, Silver and Gold projects linked to global issues go to: practicalaction.org/schools/global-project-ideas

Big Bang Competition

Pupils aged 11–18 and in full time education/ training who have taken part in a STEM challenge can enter their work into the National Big Bang Competition.

Prizes include industry/scientific site visits, and a chance to represent the UK at international contests. Being a part of the competition is an inspiring and valuable experience for all young people involved.

To find out more go to: competition.thebigbangfair.co.uk

Great Science Share for Schools

Having taken part in the challenge, pupils are encouraged to join in the annual Great Science Share for Schools campaign. It's their chance to share their project with new audiences in or beyond their own schools. To find out more and register your school to take part visit: greatscienceshare.org

British Science Week

The Solar challenge would be a great activity for your class or year group to do during British Science week in March each year. To find out more go to: britishscienceweek.org.

To find out if your school is eligible for a grant go to: britishscienceweek.org/about-us/grants