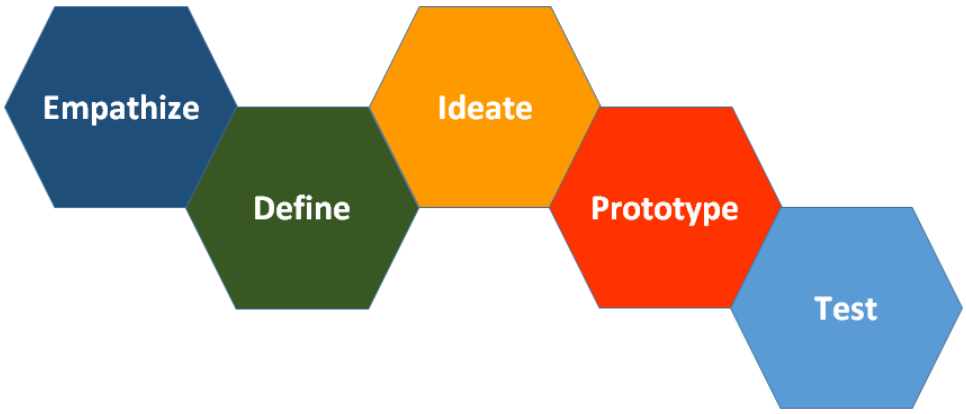
WOMEN IN ENGINEERING 2021
ENGINEERING & INTERNATIONAL ACTIVITY
Buoyancy Challenge

Lifeboats

This session will introduce you to the international drowning problem and how design and engineering could be used to help.

The learning outcomes for this session are:

- Understand how to think like a designer - Using the Stanford School model below



Empathize

- Understand the international drowning problem and how buoyancy can help a specific user group
- Understand the concept of buoyancy

Define (Specification)

- Be able to calculate buoyancy for a specific situation

Ideate

- Be able to create ideas around creating buoyancy using plastic bottles

Prototype

- Test the buoyancy of a plastic bottle
- Create concepts for a buoyancy device for a specific user group

Test

- Evaluate and test the principles of your design

Please read the safety information sheet before starting here

What you will need:

An empty plastic bottle

A container of water larger than the bottle, this could be a sink, bath or even a bucket (An adult should be present)

Some paper and pens or digital design software for drawing designs

Method:

Empathise

Please watch video 1 for an overview to the international drowning problem by RNLI International lifesaving manager John Powell. (Link to international video)

Please watch video 2 for an overview of Buoyancy engineering fundamentals by RNLI Engineer Helen Bunce (Link to engineering video)

Define

Calculate the buoyancy of an empty plastic bottle that you have at home. This could be any type of plastic bottle.

Around 120N of buoyancy is required to keep 2 x fishers afloat. Calculate how many of those bottles would be needed. You can use the basic buoyancy calculation sheet (Link to buoyancy calculation sheet)

Think about:

How would the fishers store the device on their boat?

What materials could be used to make the device? What properties would the materials need to have. (Hint... Think about the hot and humid environment)

How much would the device cost?

How and where could the device be manufactured?

Ideate

Create some concept ideas for a design that holds the required number of bottles together and would be easy for 2 fishers to hold on to if their boat capsized. You could draw these by hand or use some computer software to create. (You could use TinkerCAD or Sketchup or MS Powerpoint)

Please share your designs so we can display on our web site by sending in to womeninengineering@rnli.org.uk
Please share your designs only and ensure that there are no people in the pictures.

Prototype (Optional)

Prove the buoyancy of a bottle you have using practical work. Using a container of water, push your chosen bottle under the surface, can you feel the upwards force exerted on the bottle by the water?

If you have enough empty bottles you could create a prototype of your design using basic materials such as sticky tape and string. Do not attempt to test any prototype in water where there is a risk of drowning. Please share photos of your prototype so we can display on our web site by sending in to womeninengineering@rnli.org.uk Please share your prototypes only and ensure that there are no people in the pictures.

The next steps…….

Find out more about buoyancy here:

https://www.bbc.co.uk/bitesize/topics/zc89k7h

https://www.britannica.com/video/181395/Discussion-forces-bodies-water

Buoyancy: What Makes Something Float or Sink?

https://www.bbc.co.uk/bitesize/guides/z9ykmsg/revision/4

Find out more about International drowning reduction here:

https://rnli.org/what-we-do/international

Find out more about design thinking and Human Centred Design here:

https://www.ideo.org/tools

https://web.stanford.edu/~mshanks/MichaelShanks/files/509554.pdf

How this links to the RNLI:

The RNLI is working with partners globally and in countries where drowning is a significant problem to elevate the issue onto the global agenda, widen the research base, grow skills, and identify cost effective and practical solutions to save more lives. In 2019, this included projects in Bangladesh and Tanzania.

Buoyancy is a critical factor in the design of lifeboats and rescue equipment that are used by RNLI volunteers and staff.

We would love to see how you got on with the challenge so please send any photos you don't mind us sharing on our webpage to womeninengineering@rnli.org.uk (please note that we will require consent to share these photos and an automated email will be sent requesting consent).