IF YOU WERE an ENGINEER WHAT WOULD YOU DO?®

Handbook

Competition Tasks and Guide

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This booklet is a guide to using the 'If you were, an engineer what would you do?" Leaders Award Competition to raise the awareness of engineering and engineers, developing creative problem-solving skills in pupils between the ages of 3 and 19.

The competition is open to **all schools and learners** and entries will be judged purely on how good a solution to a problem a learner has identified is. Engineers are involved throughout the programme to be interviewed, they also read the entries and form part of the judging panels.

All pupils entering the competition receive a named and graded certificate. Shortlisted entries will be judged by the panel and in each of the (22) regions across the UK two ideas are chosen from each year group. Public exhibitions celebrate the joy of this competition and display the shortlisted entries and where possible Distinction entries also.

Each year our partner universities review the shortlisted entries to Proto Type there is **no guarantee** that a winning design will be chosen to be Proto Typed this is completely at the discretion of the Universities teams.

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What is the 'If you were an engineer, what would you do?' Competition?

Primary Engineer launched this programme in 2012 to explain to primary and secondary pupils what it is to be an engineer. The idea was a simple one, look at what engineers do, interview a few of them, then look around and find a problem to solve. Draw your solution and annotate it. That way their imagination can take flight especially without technical or financial limits. With the addition of a letter addressed to an engineer they can explain their idea in more detail highlighting why they should choose their design to build the competition was complete.

Every year our offices in Burnley receive the tens of thousands of entries from schools across the UK. They are taken around the UK where engineers come together to read and grade each one. Shortlisted entries are then taken to judging panels, one in each of the regions to choose the two best ideas in each age group. We hold awards ceremonies and public exhibitions in each of the regions.

Many of our university partners have been so inspired by the ideas they have chosen to build some of the incredible solutions, as you can see below.











Above top the Shopping Trolley for the elderly.
Left to right: The Water Sucking Bicycle, the Phone Charging Trampoline and the Magnetic Fastening Shirt.

The programme:

The project, interviewing engineers, ideas generation, creative problem solving, annotating drawings, and letter writing.

The competition, entries are read by engineers and given grades, individual certificates are returned to the schools, shortlisted entries are judged by a panel of engineers and winners by year group in each of the regions across the UK are selected. Regional awards and exhibitions take place and on occasion our university partners choose a design to Proto Type from the Shortlisted entries.

Key Information:

- The age range for the competition is between 3 and 19.
- The resources page on the www.leadesraward.com website hosts teaching resources and, and examples of previous winners work.
- Online interviews take place from mid-September to mid-March to book see the website for more information. The Primary Engineer YouTube Channel hosts all the previously recorded interviews.
- If you would like an engineer for your school contact the Leaders Award team for more information info@leadersaward.com

The Project Outline:

- Interview engineers, watch the recordings, research engineering.
- Encourage pupils to generate ideas over a period of time, choose the best idea and annotate the drawing and add a letter explaining to an engineer why it should be built.
- Send the registration spreadsheet to info@leadersaward.com add the labels to identify the entries and post to Primary Engineer Floor 2 AMS Office Tower AMS Technology Park, Billington Road Burney Lancashire BB11 5UB.

The Competition:

- Engineers will be invited to grade all the entries at grading days around the UK, each entry will be given a grade.
- Individual certificates will be created with grades and returned to the school.
- Shortlisted entries will be taken to judging panels and the best chosen for awards. Two of the best ideas will be chosen per year group per region.
- Awards and exhibition dates will be advertised via our website, social media and newsletters.

ENGINEERING?

Task 1: Discovering Engineering

Lesson Objective: To Identify Different Types of Engineers.

Lesson Content: The first part of the project is to find out as much as you can about the different types of engineers; Civil, Mechanical, Aeronautical. The knowledge that is learned can then be used to prepare for the interview with your allocated engineer. On the **Primary Engineer YouTube Channel** you will find many recordings of different types of engineers answering questions about their work.

The concept of the curriculum vitae can also be introduced, prior to the lesson. The allocated engineer could send a child friendly CV depending on the age range of pupils. Another good link to what engineers do can be found at This is Engineering

Starter Activity: Draw an engineer, describe an engineer

Plenary: Identify different specialisms of engineers.

Write: three or more questions for the interview.

Key Words: Engineer, invent, create, problems mechanical, structural, curriculum vitae.

Task 2 – Interview an Engineer

Lesson Objective: To construct a list of questions to ask the engineer during the interview.

Lesson Content: It is worth enquiring if any pupils have a friend or family member that is an engineering professional who would be happy to be interviewed.

If you able to conduct an interview face-to-face or online, encourage pupils to have their questions ready and take notes of the answers.

To access the live online engineer interviews, check the home page www.leadersaward.com and follow the link to ONLINE INTERVIEWS, from here you will be able to see the schedule and how to 'book a seat'!

Plenary: Have pupils changed their mind about what an engineer does? Review the drawings done in previous lesson, would they make any changes? Has this activity given them any ideas for what they will invent?

Key words: Interview, reflection, career, industry.

Task 3 – Let's get creative!

Lesson Objective: To examine existing solutions and identify problems.

Lesson Content: Everything will involve engineering in some way. Something as simple as a toothbrush for example, there are different kinds of toothbrushes, manual, electric, hard, soft. The toothbrush overtime has been adapted and improved to cater for different needs.

Pupils ages will potentially factor the depth of analysis. Older pupils could pick some items from around the home and evaluate them under Function, Safety, Aesthetics, Ergonomics, Durability, Cost, Materials, Environment. The Pupil Logbooks have guidance for pupils evaluating the functionality of object.

Consider past entries on the www.leadersaward.com Galleries pages

Task pupils, considering what they have seen identify least 2 new problems that they think need to be solved. Focus on the **purpose** of the solution, e.g. to help others, health benefits, environment etc. The **technology(ies)** that could be used e.g. transport, internet, entertainment, medical etc. The **engineering discipline** used, for example, structural, mechanical, chemical etc. The additional benefit of this task is to make pupils aware of the broad range of technologies and disciplines available.

Task4-Ideas

Lesson Objective: To use notes and drawings to explore ideas.

Lesson Content: Prompt pupils to write down some of the ideas that they might be considering. It might be via the whole class or group work. A starting point might be different subject areas or hobbies that the pupils have. At this stage of the process small changes to their ideas like size, length and colour can have big implications.

Depending on age, pupils could be challenged about their ideas and the practicalities of them. Encourage them to understand if the solution would in fact solve their problem and ask them questions such as:

- What else could you do to help this idea solve the problem?
- Could you change this part of it to make it more suitable?

Plenary: Review and reflect, what two things could be changed on your design that would make it better, it could be as simple as colour, or size, material, functionality?

Key Words: Creativity, ideas, communication, annotation, functionality

Task 5 - Time to Shine!

Lesson Objective: To plan and draw/annotate the final design on A4 or A3 paper.

Lesson Content: Annotating the final drawings and discussing them with their peers or other year groups

Annotating ideas: Annotating means adding purposeful notes and labels to add detailed explanation to the drawing. The annotations on a drawing are a crucial part of the entry process for the competition as it can give key details that may not be seen clearly in the drawing. Annotation would explain how the materials will be joined together, what they will be made of, what the parts will do, how they will respond to different uses, how they will move – the more annotated detail the better!

The Leaders Award participants range from 3 to 19 years of age. As pupils drawing skills range across the board and it must be noted that the pupils are not judged on their ability to draw, spell, or their handwriting this is purely about a creative solution to a problem the engineer can understand. It will be graded on the idea and concept. It is accepted that some pupils will require the support of a Scribe.

When the drawings and annotations are complete pupils can discuss the range of ideas they have identified with their peers or other year groups

Suggested questions:

- What are the main advantages of your design?
- How do you think your design solves your initial problem?
- Does your design meet the requirements of your target audience?
- How do you think this could be made in real life?
- What materials are used for your product? Is there a better material that could be used?
- Have you considered the impact your product or the making of your product could have on the environment?
- What are the limitations of your design?
- What do you think you could put in place to make your design better?
- How did you come up with this solution?
- Do you feel confident enough to propose your solution to someone else?

Plenary: After pupils have drawn their final design they should consider the following:

Is it clear and easy to understand? Key parts are labelled? What it will do, who would use it and why? Materials and different angles of the design?

Task 6 - The Engineer's Letter

Objective: To be able to reflect on your work and explain your idea in written form.

Lesson Content: Pupils should reflect on their work from the previous lesson and provide an opportunity to modify their design. This could come from peer assessment or by using the questions from the previous lesson to ensure the design is clear, and well annotated.

Pupils can now write their letter to the engineer as their idea will be well formed. This is limited to one side of A4 and will be included with the design at the exhibition (if chosen). It should explain what the idea is, what problem it solves and who would use it. This is the pupil's opportunity to explain; why their design is important, their thoughts behind their design choices, justification of their aim, materials, look, mechanisms, how suitable it is in solving the initial problem identified, and maybe most importantly, why their problem is one that needs to be solved!

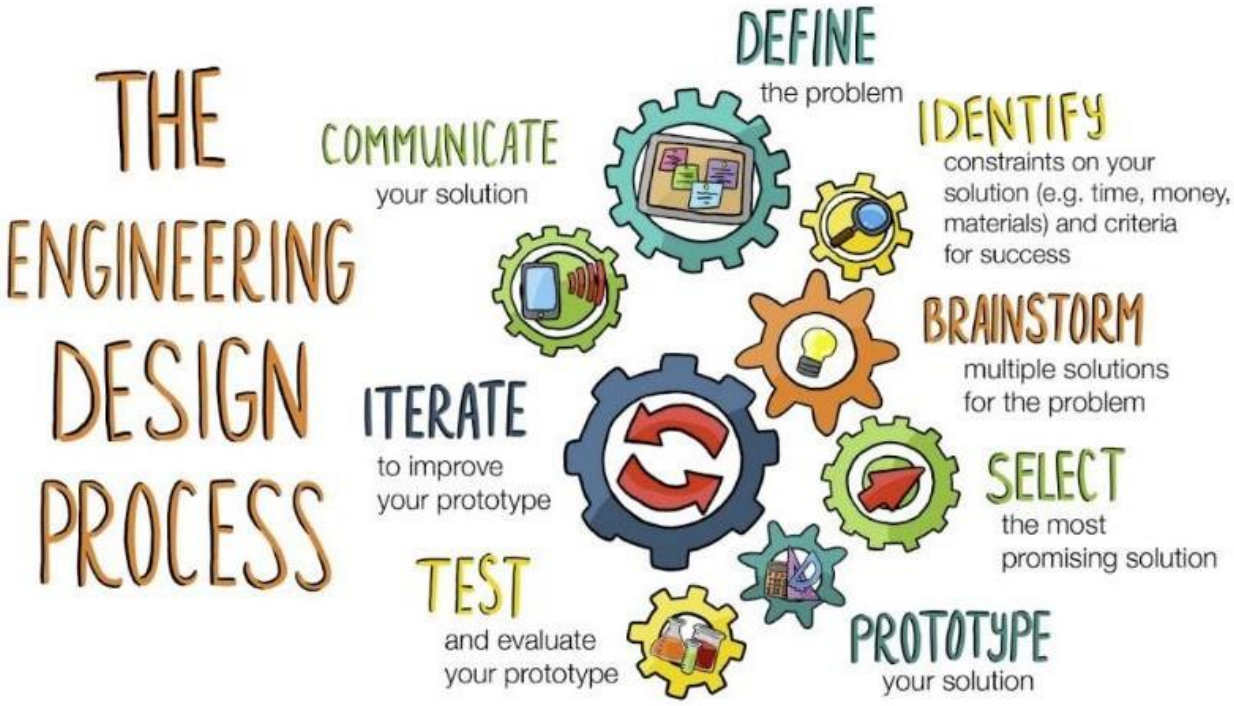
- What problem does the idea solve?
- Why did they think it is a problem?
- How does the solution work?
- Who or what benefits from the invention?
- Why should their invention be built as a prototype?
- Why is their solution special?
- Who or what was their inspiration to invent this solution?
- Did interviewing an engineer help them to think of the solution?
- What would they like to be when they leave school?

Step-by-Step Creative Problem Solving

1. Define a problem – WHO needs WHAT and WHY?
   - What problems do you or someone you know have ?
   - What have others done to solve or try to solve those problems?
   - What are the limits of other solutions?
   - Is it important to solve?
   - What will your solution do?
   - How will you know if it will do what you want?
   - What would keep it from making it do that?
   - How would you test your solution?
2. Do some background research – Learn from the experience of others, this can help you avoid mistakes that have been made in the past.
   - What existing solutions are already out there?
3. Specify the requirements – one of the best ways to do this is to look at similar solutions and identify their key features.
4. These requirements will identify the important characteristics that the solution needs to be a success.
5. To explain the Engineering Design Process in a simpler form please follow this link and watch the animation (*please check link first before sharing, it was correct at time of publishing*).
6. Storyboard solutions: Engineers explore many solutions to a problem, there are many ways to approach problem solving but once the first idea is formed it can be 'bagged' secure that at least one solution has been identified. This enables a freedom to explore more creative 'off the wall solutions'.
7. Final selection: Look at whether each solution meets the design requirements, some solutions will meet more of the requirements than others and those that don't meet the design requirements should be rejected.
8. Develop the solution: Development involves the refinement and improvement of a solution and is consistent throughout the design process.
9. Annotate clearly how the solution will work e.g. the best materials. A university partner may choose to Proto Type it so the clearer the information the better.

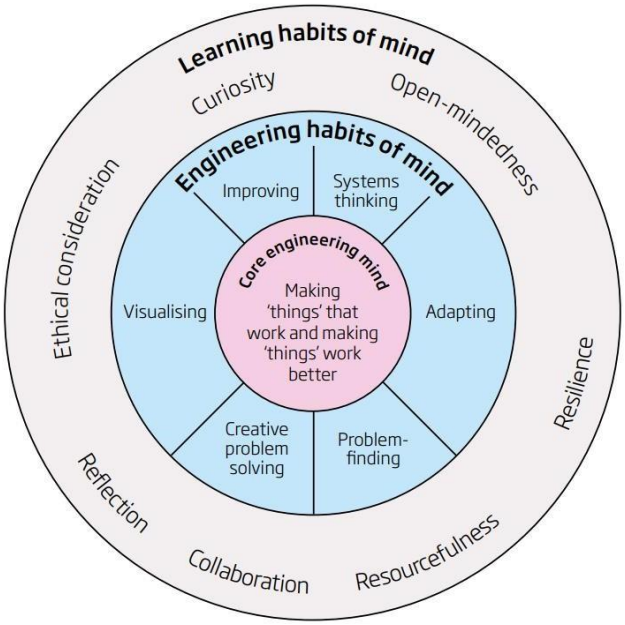
Creative Problem Solving Approaches

Usually teachers that present pupils with a problem to solve. This project asks pupils to not only solve the problem but to define it in the first place. Here are a few strategies to develop creative problem solving.



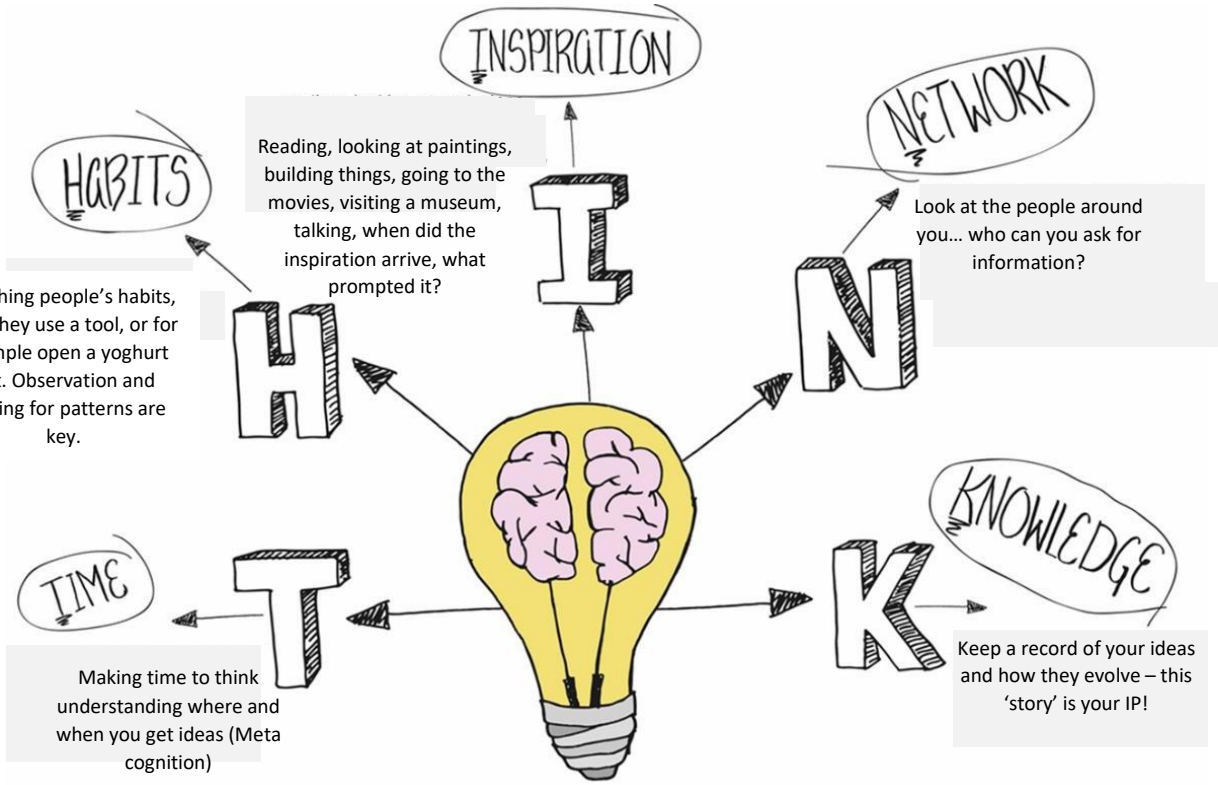
The 'Engineering Design Process' is a series of steps used by engineers to create innovative solutions to problems and new ideas. There are different versions of the engineering design process available, however, they all aim to fundamentally explain the same thing.

Engineering Habits of Mind was developed by University of Winchester's Centre for Real World Learning as part of their Report **Thinking like an Engineer** for the Royal Academy of Engineering. The diagram illustrates these key thinking skills developed by learning to be more reflective, open minded and curious etc.



"If at first the idea is not absurd, then there is no hope for it. "

Albert Einstein (1879 – 1955), Mathematician





Grumpy Grandad: "If necessity is the mother of invention, grumpy grandad could be her closest relative!"

If identifying a problem is proving a challenge, a useful strategy is the 'Grumpy Grandad' approach. This involves thinking about the things that people complain about in their general day-to-day activities.

Such as: how things work, how we travel, how we eat/drink. Most importantly what do people most complain about – the idea is to listen, observe and solve!

What's next?!

Send us the Spreadsheet of names to appear on the Certificates and label the entries with the Primary Engineer Leaders Award Labels so each can be graded.

The deadline can be found on the home page of the website but you can forward your entries as soon as they are complete. Certificates will be issued throughout the year.

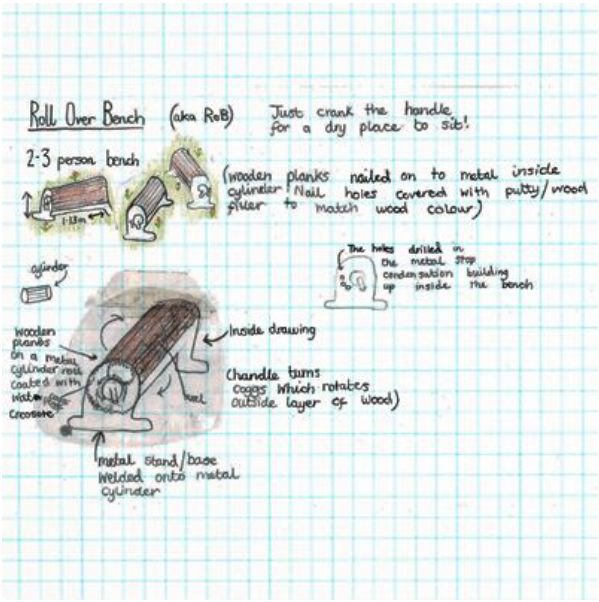
Shortlisted entries will be part of the entries taken to the judging panels in April to May.

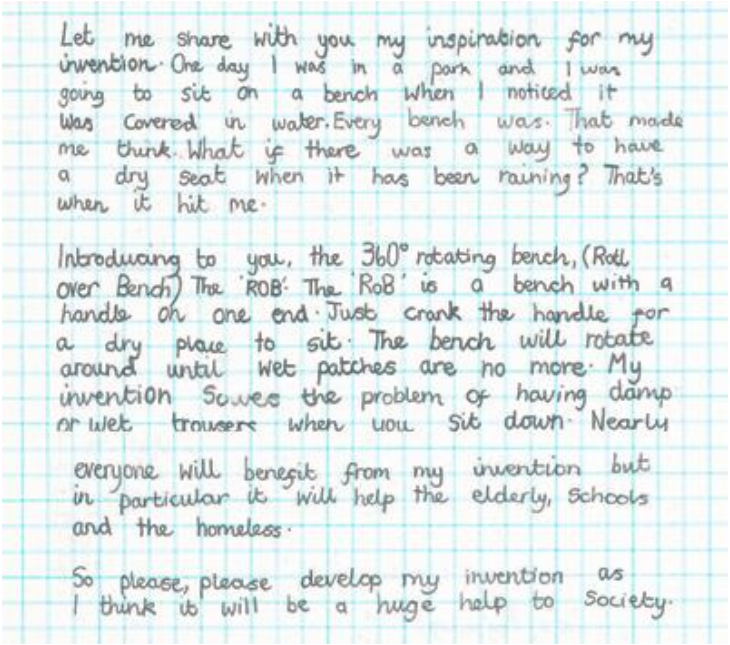
Exhibitions and Awards take place between May and July.

The chosen entries will be placed on public display as they are received.

For more information contact: info@leadersaward.com or phone 01282 417 333

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Let me share with you my inspiration for my invention. One day I was in a park and I was going to sit on a bench when I noticed it was covered in water. Every bench was. That made me think. What if there was a way to have a dry seat when it has been raining? That's when it hit me.

Introducing to you, the 360° rotating bench, (Roll over Bench) The 'ROB'. The 'RoB' is a bench with a handle on one end. Just crank the handle for a dry place to sit. The bench will rotate around until wet patches are no more. My invention solves the problem of having damp or wet trousers when you sit down. Nearly everyone will benefit from my invention but in particular it will help the elderly, schools and the homeless.

So please, please develop my invention as I think it will be a huge help to society.