

# The STEPS Young Engineers Award

STEP 2	LESSON PLAN	WORKSHEET 2
<b>REFERENCE TEACHERS GUIDE CHAPTER 3 STEP 2</b>	<b>Time Required</b> 30 – 45 mins	<b>Date</b>
<b>Subject</b> Science and Engineering	<b>Class Level</b>	
<b>Strand</b> Materials	<b>Strand Unit</b> Properties and characteristics of materials	
<b>Title</b> DRAW – Final Design		
<b>Objectives</b> Design and draw the plan for the engineering project		
<b>Skills Required</b> Working scientifically: questioning, predicting Designing and making: planning, evaluating		

Learning Objectives	Learning Activities
<p><b>Students will:</b></p> <ul style="list-style-type: none"> <li>Develop planning skills</li> <li>Learn to think logically and practically – think and predict the steps involved in producing a prototype before attempting to construct it physically</li> <li>Learn to consider the wider picture: materials, safety, environment</li> <li>Practice teamwork – teams must work together on the solution</li> </ul>	<p><b>Design and Plan (10mins)</b></p> <p>Engineering teams think through options before deciding on the final design plan.</p> <p><b>Instructions:</b></p> <p>Hand out rough paper. Split teams into two subgroups. Each subgroup discusses the project and comes up with a design plan. To discuss the designs they should use the pens and rough work paper to draw ideas and explain. Help them to think the design through by writing the prompts (below) on the board (or as you wish). After a few minutes the teams reunite.</p> <p><b>Prompts to aid design planning:</b></p> <ul style="list-style-type: none"> <li>- What will it look like? (draw)</li> <li>- What will it do?</li> <li>- How will it do it?</li> <li>- How will you build it?</li> <li>- What will it be made from?</li> <li>- Would it be safe for use in the real world?</li> <li>- Will it affect the environment? How?</li> <li>- How will it affect people's lives? For the better? For the worse? Why?</li> </ul>

	<p><b>Worksheet 2 - Draw (15 – 25mins)</b></p>
<p><b>Students will:</b></p> <ul style="list-style-type: none"> <li>• Develop written communication skills – designs drawings must be clear and informative for all project members</li> <li>• Make informed thought-through decisions as a team</li> </ul>	<p><b>Instructions</b></p> <p>The two subgroups reunite. First, each team nominates a Chairperson and a Drawer. The Chairperson asks each subgroup in turn to explain their designs to the other subgroup on their team. Using the Top Tips for planning below (or otherwise) the team choose the design they will use for the project. It might be helpful if they write a procedure to work out the steps they need to take to build their design before putting pencil to paper.</p> <p>Then, on Worksheet 2 in the Project Book, the Drawer draws the design in the space provided, The sketch should be annotated (labelled) clearly - about 5-10 labels pointing out key features or instructions on how to build it (see Tips on the drawing below).</p> <p><b>Top Tips for planning:</b></p> <p>The Chairperson draws 2 columns on a blank sheet: Advantages and Disadvantages. Taking each idea, in turn the team thinks of the advantages and disadvantages of each. They may use the prompts (above) to aid the discussion. They will then be able to make an informed decision for their project plan.</p> <p><b>Top Tips: The Drawing</b></p> <p>The drawing does not need to be more than a sketch. It is more important that it is annotated clearly, than drawn precisely with rulers and compasses. It is not a piece of art – although the teams are perfectly free to make it both clear and artistic. A real engineering drawing has one function: a skilled worker, or another engineer, should be able to read the drawing and understand what needs to be built.</p> <p><b>Final, Not Final!</b> – The drawing is called ‘Final Design’. However, once the teams start to build their designs, they are very likely, perfectly free and very much encouraged to change the design and to redesign as they go.</p>
	<p><b>Discuss Materials (5 - 10mins)</b></p>
<p><b>Students will:</b></p> <ul style="list-style-type: none"> <li>• Learn about materials and identify characteristics</li> </ul>	<p>Discuss material properties and material choices like an engineer.</p> <p><b>Instructions</b></p> <p>Ask the teams to write a list of all the materials they will use to build the prototype of their design. Write the list in the space provided on Worksheet 2.</p> <p><b>Option: Discuss and investigate</b></p> <p>Ask the students to think about one of the materials they listed, and to answer the questions below. Students pair up and compare materials. Discuss the materials as a class.</p>

	<p>- Can you describe the material? (use words like hard/soft/flexible/light/strong/sticky/solid/liquid...)</p> <p>- Why did you choose this material?</p> <p>- Is it easy to obtain? Where will you get it?</p> <p>- Will it be easy to work with?</p> <p>- If you could choose any material in the world instead, what would you choose?</p> <p>- Why?</p> <p><b>Explain to the students</b> You have just experienced a real engineering process. Engineers need to know about materials so they can select the right one for the purpose. They need to know the physical properties (hard/soft/strong/light etc.), and need to know the practicalities (is it easy to get? is it expensive? is it easy to work with? etc.)</p> <p><b>More Options</b></p> <ol style="list-style-type: none"> <li>1. Investigate materials further. <a href="#">Click here for ideas.</a></li> <li>2. Homework: Ask the class to pick an object at home (ideally an engineering example). Imagine they are the engineers. Answer the questions above about one of the materials the object is made from. (for example - glass in a TV screen)</li> </ol>
<p><b>Want more fun engineering?</b> Linked Thought Experiment</p>	<p>Who will win? Superhero vs Super-villain</p> <p>See Teachers Guide</p>
<p><b>Resources</b></p>	<p>Pencils, pens &amp; paper</p> <p>Project Book per team</p>
<p><b>Integration</b></p> <p>English – procedural writing for how they plan to design and build their idea</p> <p>English oral language – verbalising ideas, solutions and methods as a team</p> <p>Geography - Human environment</p>	