

Engineering design is all around us [!www.engineeringlens.org](http://www.engineeringlens.org)

My Objectives: To show students that engineering design was used to make most things. By looking at similar existing products we will see that a need was satisfied and there are special requirements that define the products. This shows that two important question in designing a product are the following:

- What was the need for the new product?
- What were some of the requirements for that product?

I will do the area of "Engineering is everywhere" and feed it back to you for comments. I will use the format that my previous slides were in with additional elements of what my goals are for the student and teacher for each slide. I will try to be as complete as possible and try to build in the concept of the student setting expectations and then verifying them.

Goal for the students: to see that engineering design is in most items they see and use on a daily basis.

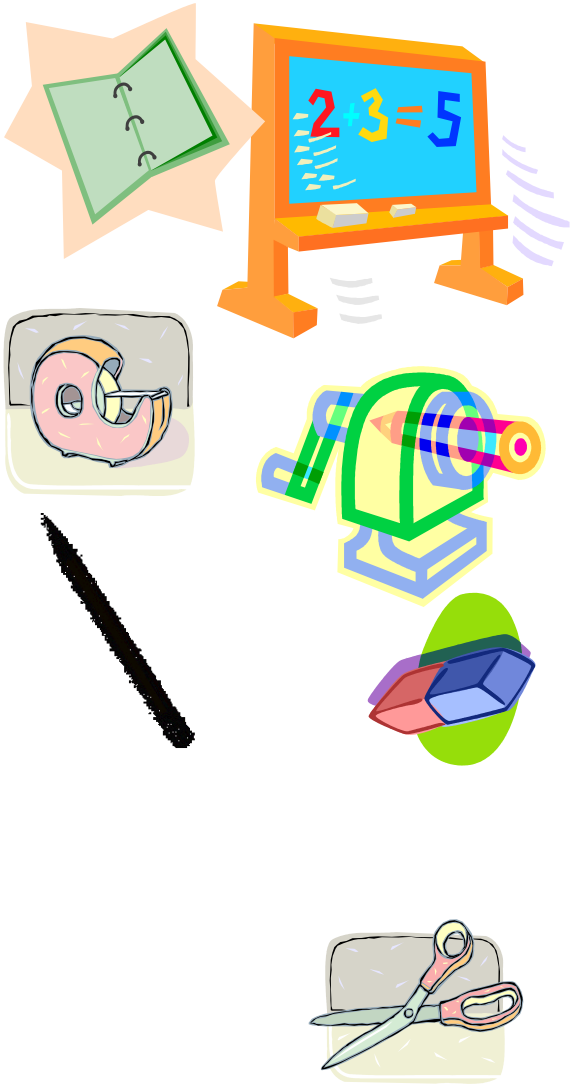
Prior knowledge: Understand what engineering is about and its application to things.

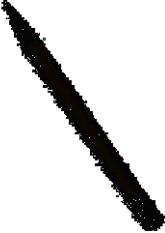
Goal for the teacher: Ability to bring in learning goals of new vocabulary and the concepts of the following:

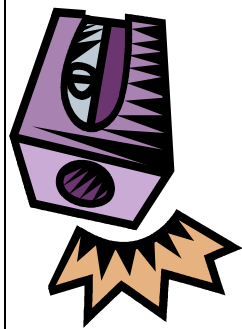
- Sorting items
- Decision process
- Developing categories

<div style="text-align: center; background-color: #e1eef6; padding: 5px; margin-bottom: 10px;"> <h2 style="margin: 0;">Class project</h2> </div> <p>Action Items:</p> <div style="border: 1px solid #4f81bd; padding: 5px; margin-bottom: 10px;"> <p>Look at the items in your box. How would you evaluate them? What categories would you create to compare and contrast them?</p> <ul style="list-style-type: none"> •Tell the class what you liked and didn't like about each object. •Also consider value and innovation. •Discuss how science and math are used to design them. </div> <p>Create a table to describe and pick the one the group likes</p> <table border="1" style="width: 100%; border-collapse: collapse; text-align: center;"> <thead> <tr style="background-color: #4f81bd; color: white;"> <th style="padding: 5px;">Categories</th> <th style="padding: 5px;">Importance</th> <th style="padding: 5px;">Item 1</th> <th style="padding: 5px;">Item 2</th> <th style="padding: 5px;">Item 3</th> </tr> </thead> <tbody> <tr> <td style="height: 20px;"></td> <td></td> <td style="background-color: #f4a460;"></td> <td></td> <td style="background-color: #e377c2;"></td> </tr> <tr> <td style="height: 20px;"></td> <td></td> <td></td> <td style="background-color: #9ecae1;"></td> <td style="background-color: #7fcdbb;"></td> </tr> <tr> <td style="height: 20px;"></td> <td></td> <td></td> <td></td> <td></td> </tr> </tbody> </table> <p>Possible Design categories (choose no more than 5) Function, Style, Esthetics (look & feel), Cost, Quality, Manufacturability, Safety, Environment, Features, etc ...</p>	Categories	Importance	Item 1	Item 2	Item 3																<p>Engineering is all around us;</p> <p>Use Pencils, Erasers, Crayons, folders as possible examples</p>
Categories	Importance	Item 1	Item 2	Item 3																	

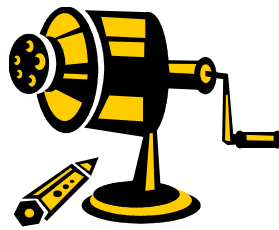
<p>Basic definition: Engineering designs creates useful products and process for society based on all disciplines but mainly math and science.</p>	<p>Goal: <i>Remind students of what engineering design is about.</i></p>
<p>How are we going to measure our success in doing this project? Students build a rubric about this lesson plan What things can I do after the learning?</p> <ul style="list-style-type: none"> • I/we will be able to do this without help • When we reach a road block, we will be able to decide an new path. • We will understand the new words we learn • We will work together and not get personally angry at 	<p>Goal: <i>Students take ownership of their project and their measurement.</i></p>

<p>each other.</p> <ul style="list-style-type: none">• We will learn from our errors.•	
<p>What science attributes are used in this product to make it do the design functions. As an example, the material used provides certain characteristics, the movement may be based on certain simple machines (levers, cams, gears, etc)</p>	<p>Goal: to see the connection between science and engineering.</p>
	<p>Goal of this slide: Students get the concept that all products they touch have been designed by an engineer.</p> <p>Questions to discuss:</p> <p>Can we name these?</p> <p>What function do they do? How do they work?</p> <p>What material would be used to build them?</p> <p>What would the engineering design in these products?</p> <p>Is there some science used in designing some of these items?</p> <ul style="list-style-type: none">• Seizers using a pivot• Simple machines in a pencil sharpener• Spinning of a baseball

	<ul style="list-style-type: none"> • Friction of the chalk on a blackboard. <p>What math was involved with the design of these products?</p>
<p>Color, Size, how they feel in our hands, how they operate,</p> <div data-bbox="235 598 1015 892" style="text-align: center;"> <p>What makes one different then another?</p> </div> <p>What are some of the differences you can think about?</p> <p>Make a list of attributes (Categories) to judge the items</p>	<p>Goal: Show students that there are ways to describe these items (Attributes)</p> <p>Can we have more types of the same products?</p> <ol style="list-style-type: none"> 1. Different types of erasers 2. Pencils
<p>How was describing or  science or math used in defining the design?</p> <p>Math: to have a sharpen point, we need to understand the math of a cone. Science can apply to the chemistry of the paint of the pencil, the forming of the metal hold the eraser, creating and producing the writing material (carbon, graphite)</p>	<p>Goal: Show students that science and math are used in creating products.</p>



Innovation: Taking a product and making it better or different to satisfy a need.

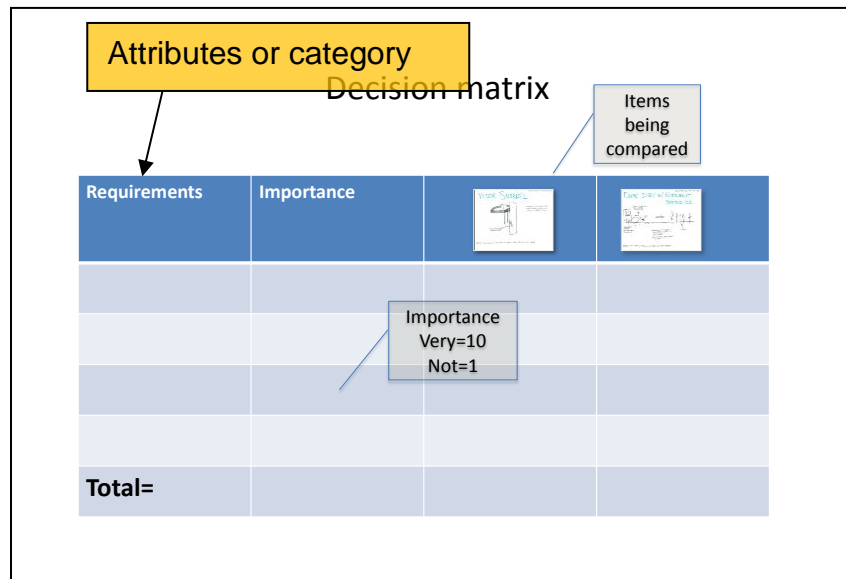


Goal: *Have students understand about innovation in products*

Going from turning one pencil around a fixed blade to having a set of blades turning around a fixed pencil.
Get better point and less breakage.

Lets' look at a few products and do the following:

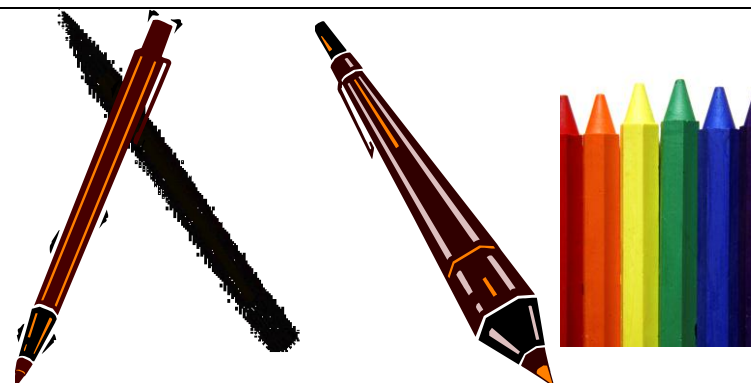
Using the list of categories (Attributes)




Goal: Define a list of requirements that can we used to judge products.

What do you like about each/ dislike about them.

Define the term "Requirement"



Evaluate these different pencils

<p>How would you decide which is the one you would choose? For each requirement, decide how well each of the items you are comparing fit it by giving it a rating of 10 being “Great” and 1 being “not good”</p> <p>What number would we give an product that was just OK in a requirement? = ____</p>	<p>Goal: to build a number value for each of the products we are comparing.</p> <p>Let’s do a little math!</p>																																										
<p>Example:</p>  <table border="1" data-bbox="342 646 818 1129"> <thead> <tr> <th></th> <th>power grip</th> <th>pistol grip</th> <th>combat grip</th> <th>perfect grip</th> <th>8 pattern grip</th> </tr> </thead> <tbody> <tr> <td>Weight (lb) (less is better)</td> <td>8</td> <td>3</td> <td>8</td> <td>2</td> <td>1</td> </tr> <tr> <td>Capacity (rds) (more is better)</td> <td>8</td> <td>3</td> <td>2</td> <td>2</td> <td>4</td> </tr> <tr> <td>Accuracy (inches) (less is better)</td> <td>7</td> <td>8</td> <td>5</td> <td>4</td> <td>7</td> </tr> <tr> <td>Reliability (times) (more is better)</td> <td>5</td> <td>10</td> <td>2</td> <td>8</td> <td>10</td> </tr> <tr> <td>Price (\$) (less is better)</td> <td>3</td> <td>6</td> <td>8</td> <td>10</td> <td>2</td> </tr> <tr> <td>Total Score:</td> <td>172</td> <td>149</td> <td>130</td> <td>145</td> <td>264</td> </tr> </tbody> </table>		power grip	pistol grip	combat grip	perfect grip	8 pattern grip	Weight (lb) (less is better)	8	3	8	2	1	Capacity (rds) (more is better)	8	3	2	2	4	Accuracy (inches) (less is better)	7	8	5	4	7	Reliability (times) (more is better)	5	10	2	8	10	Price (\$) (less is better)	3	6	8	10	2	Total Score:	172	149	130	145	264	<p>This is a completed chart that you can see how somebody else did a comparison.</p>
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<ul style="list-style-type: none"> • What did we learn about making a decision? • What are other examples of artifacts (things) that show engineering, science and math? • How would you explain this to your parents? • Can we write a short paragraph about engineering is everywhere? • Could you make a list of categories to use to judge “tasting cookies”? 	<p>Reflection:</p>																																										