Intro to Engineering Design: Hospital Gowns
Student Version

In this lab you will be introduced to the Engineering Design Method. Similar to the way the Scientific Method guides scientists as they understand the world around us, the Engineering Design Method guides engineers as they solve everyday problems and create new solutions to those problems.

Key concepts:

- Understanding the five major steps involved in the ***Engineering Design Process,*** and how that process differs from the Scientific Method.
- Identifying problems and sorting them as ***system problems*** or ***design problems***
- Understanding the limitations of current designs and why they were created that way
- Distinguishing ***'must have'*** features of a design from ***'nice to have'*** features
- Using a ***Concept Scoring Matrix*** to evaluate and rank various designs prior to prototyping.

Part I: Ask

The first step in the Engineering Design Method involves identifying a problem to solve. Sometimes engineers are given a problem to solve and other times they find a problem on their own. Today we are going to do a little bit of both.

1. Grab a stack of Post-It notes and write down any problems you can think of in the hospital. Put each problem on its own Post-It note.

   Now that you have identified some of the problems in the hospital, we need to separate the problems based on whether or not they are system problems or design problems. **Design problems** are problems which can be solved by creating or improving a product. They are problems with how something works. Any easy way to identify design problems is to ask, "Can I create or improve a product to fix this problem?" If the answer is yes, it is a design problem. **System problems** relate to the way things are done and often involve actions and people.

2. Share the problems you identified with the class and sort them as either system or design problems.

Part II: Imagine

Now that you have spent some time identifying problems, we are going to give you a problem to solve using the rest of the Engineering Design Method. Almost everyone agrees that hospital gowns are awful. We are going to re-design a hospital gown. Even though engineers often make completely new products. They also spend a lot of time re-designing products to make them better. That is what we are doing today.

1. As a group, discuss the good and bad features of a hospital gown.
2. Make a list of these good and bad features.
3. Why were these features implemented in the way they were?

Table 1: Good and Bad Features of a Hospital Gown

Feature	Good or Bad?	Why was it done this way?

A '**must have**' is a function or feature that your product must fulfill in order to be useful. A '**nice to have**' is a function or feature that would provide value to the user but isn't necessary for proper function of the product.

4. Based on, but not limited to, your feature list, make a list of 'must haves' and 'nice to haves' for a hospital gown. This is also a time that students can be creative and suggest new 'nice to haves' to incorporate novel features.

Table 2: 'Must Haves' and 'Nice to Haves'

'Must Haves'	'Nice to Haves'

Part III: Plan

Now you're ready to start designing a new and improved hospital gown. Before engineers start building their designs, they draw them on paper. We are going to start by planning our designs on paper as well.

1. Grab your Post-It notes and begin drawing solutions to the bad features or completely new features on your own. Make sure to put each solution or new feature on its own Post-It note.
2. Share your ideas for solutions or new features with your group.
3. As a group, categorize all of the features and solutions by their purpose or the problem they address.

4. As a group, come up with three full designs for a new and improved hospital gown.
5. Draw your design on a full sheet for paper using front and back views or close ups of certain areas if necessary.

In order to decide which designs to prototype, engineers often use a **Concept Scoring Matrix** to 'grade' their designs. This looks primarily at functionality and 'must haves' but also considers the cost and other essential factors. You will make a Concept Scoring Matrix to decide which design your group wants to prototype.

6. Use the following Concept Scoring Matrix to choose the design you will prototype. If a design does a great job of meeting a criteria, give it a 2. If it does an okay job of meeting a criteria, give it a 1. If the design does not meet the criteria, give it a 0. The design with the highest total score is the one you will prototype.

Table 3: Concept Scoring Matrix

Criteria	**Design 1 Score**	**Design 2 Score**	**Design 3 Score**
Reasonable Cost of Design			
Feasibility to Build			
Minimizes Environmental Impact			
Must Have #1:			
Must Have #2:			
Must Have #3:			
Must Have #4:			
Must Have #5:			
Total Score (add up all the boxes above)			

Part IV: Create

Once engineers have a design they feel good about on paper, they grab materials and start building a prototype. A **prototype** is a sample of their design that can be used for testing or to identify unanticipated problems. Now you are going to build and test your own prototype.

1. Once you have completed your Concept Scoring Matrix from Part III, ask your teacher for prototyping materials.
2. Use the disposable gown, tape, string, paper clips, and scissors to make a prototype of your new and improved hospital gown. Your prototype should be based on your highest scoring design, but you should feel free to make changes and adjustments as you build.

Part V: Improve

Once engineers have built a prototype, they test it and present the results to many different people: fellow engineers, administration, businessmen, friends, and family.

1. Have someone in your group try on your design. They will be your prototype model when you present your design to the class.
2. Present your design to the class making note of how you addressed the 'must haves' and which 'nice to haves' you included. Don't forget to mention cost and feasibility to make.
3. Listen to other groups present their design and make notes about things you like about their designs.
4. After you are finished with the discussion, answer the following questions about your design.

Engineering Design Concept Questions:

Q1. What worked well in your design?

Q2. What were some flaws in your design?

Q3. What were some cool features from other groups?

Q4. How would your improve your design, so it would be even better next time?

Q5. How does cost factor into your design?

Q6. Can you think of ways to make your design more cost effective?

Q7. Draw a new design in the space below that incorporates things you liked from other teams and fixes any flaws you identified in your design. Score this design using the Concept Scoring Matrix and see how it compares to your previous design.