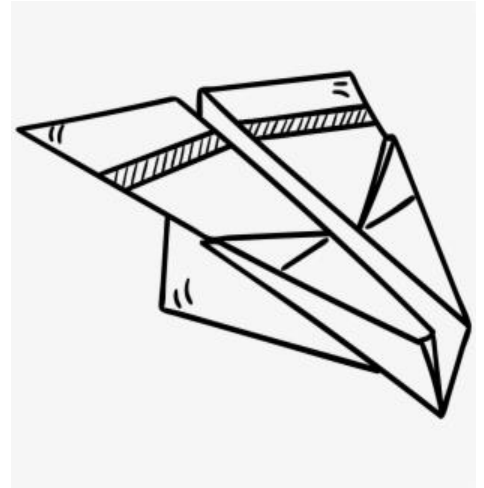


### **Part 1: Design Phase**

- 1) Everyone will get split into 3 groups and each group will be assigned a type of paper airplane to fold.
- 2) Each student will make a paper airplane in their group so that we have all the types of planes made up of all the types of paper (printer paper, cardstock paper, colored paper, tissue paper).



### **Part 2: Testing Phase**

- 1) Each student will throw their paper airplane 3 times, recording how many times out of the three times it is thrown the airplane hits the target.

### **Part 3: Reflecting Phase**

- 1) Everyone will meet together with the students in their group to discuss how well their plane did. Each group then will see what material worked best for their type of plane, and discuss why this was the best. Was it the material? The type of throw? Did others bend?
- 2) Lastly, every group will get together to discuss and choose the overall best paper airplane that could be made from our design and material constraints.

What airplane was the best? How many different factors impacted your results? Did human error impact your results from this process?

The goal of this is to make the best paper airplane that can hit the target, while following the design and material constraints. Industrial Engineers do this every day!

### **Why is this important?**

This activity emphasizes the importance of experimentation, data recording, step-by-step instructions, reflecting upon a process, and drawing data-backed solutions. Additionally, it allows you to explore ideas to find an optimal solution given design constraints.

In the real world, you are faced with problems to solve every day - whether it is what to eat for dinner, in what order to do homework, or what the best ice cream flavor is! Using Industrial Engineering you are able to make the most out of your problems to find the best solution from what options you have!

Imagine you just walked into your local grocery store and you have a long list of items you have to buy, but you look at the time and oh no! You only have a couple minutes before your bus home leaves! You will need to run around the store and locate all the items on your list before time runs out. It won't be easy though because it is one of the busiest times of the day and the store is packed full of customers that you will have to maneuver around while you bend, squat, and reach to grab your items. Is there a best order in which to grab all these items and leave the store the fastest?

**It is the job of Industrial Engineers to always find the optimal solution!**

### What to Do in Activity:

1. Divide the group into 3 flights of shoppers (number in each flight will vary depending on group size)
2. Place the groceries at varying locations and heights (from floor level to just above eye level) and spread them out as much as the space allows
3. Make and distribute to participants a grocery list, with each list (3 possible options) containing a different specific order that participants must grab their items in
4. Line the participants up at the starting table with their lists, remind each group they **MUST** grab the items in the order it appears on their team's list, send them all off at the same time and start the timer
5. Participant team times will be recorded on the board in their specific list color
6. Which color team did it the fastest? The slowest? Is there a pattern? What was frustrating?
7. Let participants see all 3 lists and come up with reasons why they think certain lists are more efficient than others

### Why is this important?

When it comes to industry: Time is Money! Just as in real life, every minute you spend doing one activity is a minute you can't be doing another. For example: You have to do your homework before you can go hangout with your friends, which means every extra minute you spend working on your homework is one less minute you have to do fun things with your friends. Industrial Engineers recognize this and that's why they work hard to come up with the most efficient way to perform tasks because we like to work smarter, not harder!

This activity demonstrates that by working smarter and planning the order in which you grab groceries, you can save yourself a ton of time and energy from not having to go back and forth between aisles.



What is the fastest way to get something done, doing it all by yourself or splitting a task up with teammates? Imagine you work at the LEGO factory and you are in charge of assembling 100 cars a day by yourself! Do you think you could do it? Now imagine you had 10 workers who were helping you assembling 100 cars. Now that would be much easier wouldn't it? Let's explore the effects of working together to assemble a few LEGO cars in an assembly line!

### What to Do in Activity:

1. Try timing yourself assembling the green LEGO Cruiser by yourself
2. Multiply this time by 100 to find the time it would take you to assemble 100 cars
3. Brainstorm ways to make the assembly go faster
4. With 3-4 others, assume assembly positions around the assembly line
5. Assign everyone a part to assemble
6. You will time your process from the first car out to the last car in
7. Each person will assemble a part of the LEGO Racer, moving the car down the line as you finish your part
8. Multiplying your lines time by 20 to find the time it would take to assemble 100 cars
9. Brainstorm ways you could improve your speed even more!
- 10.

Industrial engineering is all about finding the fastest, easiest, most efficient way to get a process done.

### Why?

We use an assembly line system because when mass-producing goods because it is usually the quickest and most efficient way to build products. Assembly lines allow the building process to be run smoothly. They can be used for simple products like personal pizzas and for very complex products like cars and electronic equipment. The food industry also uses the assembly line to manufacture or process foods and then package them to be distributed and sold.



Imagine one day you're feeling hungry, so you walk into the kitchen to make yourself a sandwich. But then, poof! Suddenly you're working at Subway as a sub maker. The customer in line wants a ham and swiss sandwich with mayo, mustard and lettuce, pronto! Your job is to craft a sandwich that the impatient customer is asking for in a timely, efficient, and waste-less manner.

**Industrial Engineers tackle issues of efficiency all the time!**

### What to do in Activity:

- 1) Gather around a table in groups of 2-4
- 2) Once in a group, decide who will be the sandwich maker. This person will step away for a couple of minutes.
- 3) The rest of the group: Discuss and write down the step-by-step instructions on how to make the *perfect* ham and swiss sandwich with mayo, mustard and lettuce in the least amount of steps possible. Remember, the customer won't be happy if the sandwich takes forever to make!
- 4) Once the directions have been written down, decide who will give the directions to the sandwich maker. This person will be the "customer."
- 5) Have the sandwich maker come back, but don't let her see the directions! Have her put on a blindfold and get ready to make the sandwich.
- 6) The customer can now tell the sandwich maker each step using the directions that the team has made. Have someone else time how long it takes.
- 7) How did the team do? Were there steps that needed clarification, or steps that didn't need to be included at all? In what ways could you have improved this process?

The goal of this is to make the most accurate product in the least amount of time and with the smallest number of steps. Industrial Engineers do this every day!

### **Why is this important?**

This activity will emphasize the importance of communication, step-by-step instructions, and having a process. Additionally, the activity will make clear what steps are wasteful and how to eliminate those steps to make the process more effective. By eliminating wasteful steps you can finish the job quicker, and, in many cases, save money.

In the real world, when you are creating steps for people to follow in the workplace, you want to make sure they are clear so your product is manufactured appropriately and to the right specifications.

