TeachEngineering

STEM Curriculum for K-12

Phase 1: Design to Deliver: Optimizing Craft Production for Efficiency, Profit, and Purpose

Objective for Phase 1

Students will design and implement a vehicle production system that integrates principles associated with craft manufacturing concepts and engineering roles.

Porsche, one of the most iconic names in luxury performance vehicles, is ready to trust a brand-new startup to handcraft their next **Dream Porsche**. That startup could be yours, if you can defeat your competitors.

Porsche isn't just looking for pretty designs. They will select, from among you and your competitors, the group that can deliver the maximum number of high quality vehicles within their allotted time frame while also earning the highest profit.

This is your **audition** to show Porsche that your team has what it takes to deliver excellence under pressure. The clock is ticking. The competition is fierce. The reward? A massive contract and your company's name forever tied to an automotive legend.

Will you rise to the challenge—and become part of Porsche's legacy?

Watch the Video

Porsche has delivered this video for your team to watch so you may gain some insight into their process.

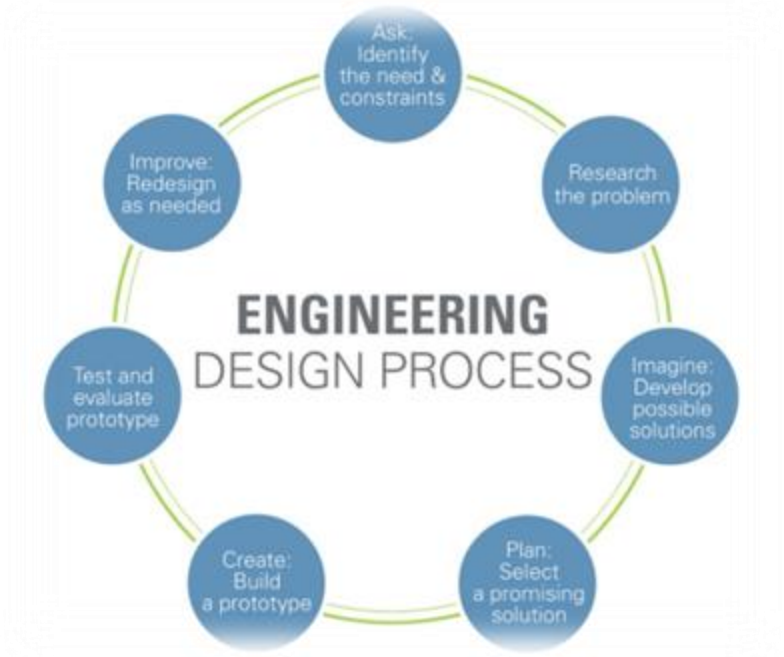
What Did You Notice? What Do You Wonder?

- About the way the different cars were assembled?
- About the roles people played in each assembly?
- About the speed of assembly in each video?
- About how quality is checked in each car production method?
- About the equipment or tools used in each process?
- About how cost and efficiency are impacted by these different processes?
- About how each system impacts the overall quality and durability of the cars produced?
- About the advantages and disadvantages of each assembly style?
- About how easy or difficult it would be to fix mistakes in each type of assembly process?

The video represents an example of **craft manufacturing**.

The main idea of craft manufacturing is that a highly skilled person, or a group of skilled people, produces a unique item, one at a time, according to a customer's directions.

Engineering Design Process



Common Engineering Roles in Manufacturing

There are many more, but here are a few to think about:

- A **design engineer** designs and often makes plans to improve systems and products based on available materials and requirements.
- A **sourcing engineer** is responsible for finding and purchasing product components and making sure they will meet the needs of the product.
- A **manufacturing engineer** is often responsible for the process of constructing the product and making sure it goes as efficiently as possible.
- A **quality engineer** is responsible for making sure the product is designed and built to meet all requirements.

Activity Instructions

Your team will **design FOUR different Porsche vehicles**.

1. **A Porsche executive, Mr. Otto Mobile, will provide your team with the specifications for four car models Porsche intends to make.**
2. **Your company should make a prototype for each of the four models.**
3. **Although there is a lot of freedom in design choices, state and federal safety and environmental laws, as well as marketing research, dictate some requirements for each model that can't be changed.**

Example: Weight

Car Option A
(a) Vehicle must have four tires (with axles), wind shield, steering wheel, and roof.
(b) All tires must be medium soft.
(c) Vehicle base width and length are 4 dots and 8 dots, respectively.
(d) Vehicle weight between 30 and 40 grams.
(e) Vehicle height must fit a sitting driver.
(f) Maximum different colors of the car is 6 (including color of tires and steering).
(g) Car price is $10.

Activity Instructions

Your team will **design FOUR different Porsche vehicles**.

4. Use the Bill of Materials sheet for the cost and weight of each car part.

5. Verify that each constructed prototype meets the weight guidelines and that the total cost of parts is not above the sale price.

Type	Size	Weight	Price	Quantity	Total Price
Brick 	1x1	0.45	$0.07		
	1x2	0.8	$0.11		

It’s time to design your company’s four prototypes!

Though you have a lot of freedom in your design, don’t forget to follow the design specifications & constraints.

DOCUMENTATION REQUIRED

1. Insert photos of your team's completed designs and Bill of Materials forms into a document. You will need this information for the next activity.

2. Once all documentation is finalized, DISASSEMBLE the vehicle prototypes and place all parts back into the plastic brick supply kit. Follow placement of parts with the labels inside the kit.

Reflect on this activity

In this activity, you took on the role of two different types of engineers.

- Which two do you believe them to be?
- What step(s) in the engineering design process did you apply during this activity?
- How do you know?