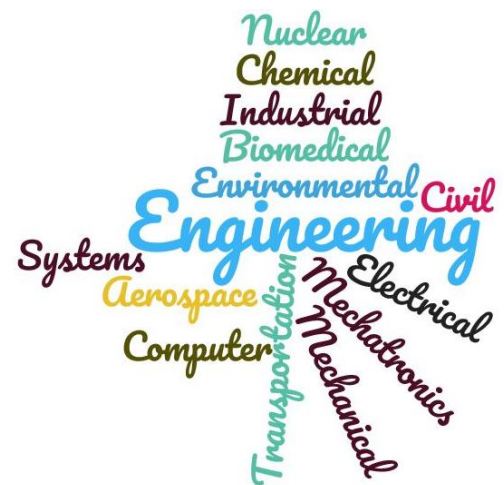


## Introduction to Engineering Disciplines

### Introduction

This week we will be discussing the wide variety of work that engineers do. In last week's newsletter, we learned that engineers use the engineering design process to solve all sorts of problems. From ensuring that everyone has access to clean water to designing artificial heart valves to building rockets to explore outer space, engineers tackle the challenges that affect our lives the most. When students train to be engineers, they all must learn the fundamentals such as advanced mathematics and science; however, engineers would have to be in school for a very long time if they were to become experts in every category of engineering. As such, as engineers advance in their studies and training, they narrow their focus on a certain subject matter so that they become experts at solving specific types of problems. For example, *electrical engineers* learn the physics and science behind electricity and magnetism so they can design circuits and systems ranging from smartphones to satellites. On the other hand, *industrial engineers* learn how different parts of designed systems, such as a factory or a business, interact with each other so they can make them more efficient (more effective at accomplishing their end goal).

When engineering students graduate college, they will generally graduate with a Bachelors of Science or Bachelor of Engineering Degree in one (or sometimes more if they're really ambitious!) types of engineering. They will then either find a job related to their work or pursue their education even further and get a graduate degree in the same or a different, but relevant, subject. It is often said that the further someone progresses in their education, the more they learn about less. This means instead of learning a little bit about a large variety of different subjects as you would in elementary through high school, you learn a lot about one very specific subject.



To learn more about each specific type of engineering, visit our prezi:

<https://prezi.com/upsadsrh6l7h/types-of-engineering/>

## Northeastern Connection

At Northeastern University, freshmen (1st year) engineering students have almost a year to decide which type of engineering they want to get their degree in. Each student begins by taking calculus, chemistry, and physics courses to learn the basics. In addition, they take a full year “Engineering Cornerstone” course, which lets them explore many of the different types of engineering so they can figure out what they’re passionate about! In this course, students learn a number of skills ranging from computer programming, to 3D printing, to [engineering ethics](#).



On Northeastern’s campus, students work in a laboratory space called the First Year Engineering Learning Center to design and build projects for this class. There they have access to academic resources, such as tutors and professors, and tools they need in order to build their final projects, such as 3D printers, laser cutters, saws, and a variety of hand tools. One class task students with creating an interactive exhibit to be displayed at the Boston Children’s Museum each year!

## Do Now

### Learn

First, to get a summary of all of the different types of engineering, review our prezi: <https://prezi.com/upsadsrh6l7h/types-of-engineering/>

**(See the end of this newsletter for a types of engineering word search!)**

### Do

What do you think an engineer looks like? With a partner (you can also do this by yourself if you can't find one), identify one type of engineer, find a blank piece of paper and spend roughly 10 minutes drawing what *you* think this type of engineer looks like! While drawing, do not discuss your ideas with your partner or show them your drawing before finishing.

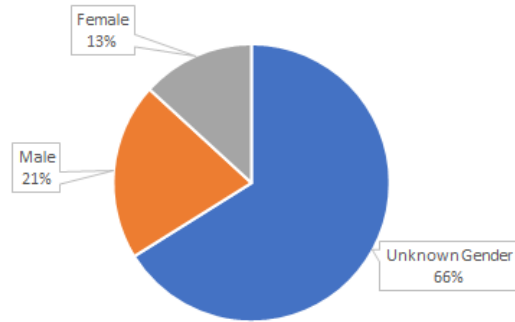
### Discuss

Once you've completed your drawings, discuss the following:

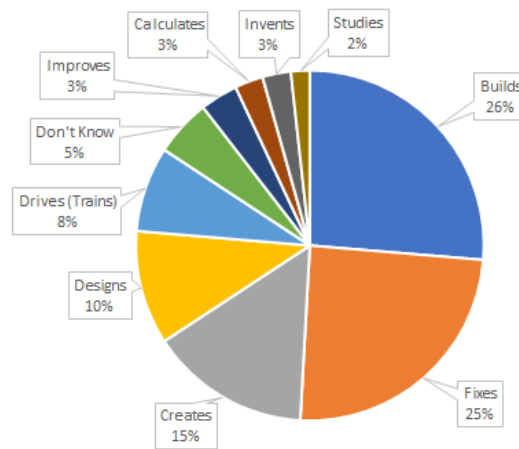
1. Did you draw the engineer with a specific gender in mind? If so, what gender?
2. Did you draw the engineer with a specific age or ethnicity in mind? If so, what age/ethnicity?
3. Is the engineer holding anything? If so, what are they holding and why?
4. What is the engineer wearing? Are they wearing any personal protective equipment (PPE) (ex. Lab coat, safety glasses, gloves, dust mask, etc.)? Why did you draw them in this outfit?
5. What is the engineer doing in the drawing? Why did you draw them this way?
6. If you found a partner for this activity, how are your drawings different? How are they similar?
7. Do you think all engineers are generally similar to one another or different from one another?
8. How does having engineers that are *different* from each other benefit us?

Tufts University and the [Boston Museum of Science](#) partnered to conduct a study using an activity similar to the one above to assess K-12 students' attitudes toward engineers. How does your drawing and responses to the questions above compare to the students assessed in this study?

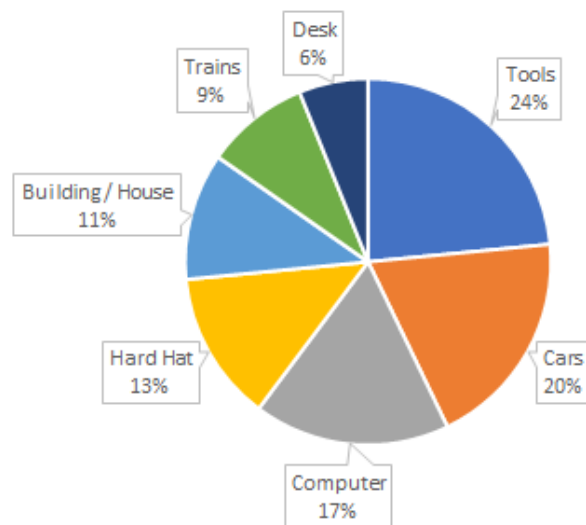
Drawing Gender



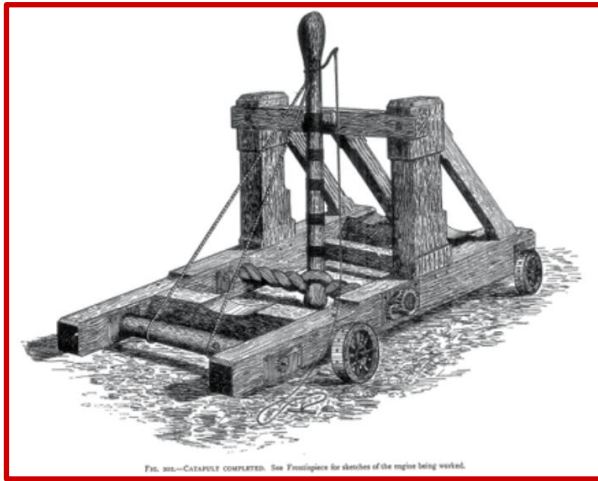
Activities of an Engineer



Common Images in Drawings



## Activity



For this week's activity, you will be building a popsicle stick catapult with the goal of launching *projectiles* as **far** and as **accurate** as possible. A catapult is any machine that stores up energy and releases it to launch an object (also known as a *projectile*) through the air. Historically, catapults were used as weapons of war. Nowadays, however, they are mostly used for other purposes or for fun. One example of how catapults are still used is an aircraft carrier runway. Because aircraft carrier runways are too

short for planes to take off by themselves, catapults are used to give the aircraft extra speed so they can achieve lift before hitting the end of the runway. To learn more about catapults and how they work, check out our prezi: <https://prezi.com/fzyagqvvvlxf/catapults-prezi/>

Topics of Discussion:

- What types of engineers might design catapults? Why?
- Is there anything catapults might be useful for that we have not already discussed?
- What problems could catapults solve?
- How do you think engineers came up with the idea for catapults? Do you think there may have been simpler versions of a catapult invented first? What might they have looked like?

To complete the activity, see the worksheet at the end of this newsletter.

### Materials needed

- **Popsicle Sticks**
  - *Alternatives: wooden dowels, paint mixers, chopsticks*
- **Rubber Bands**
  - *Alternatives: hair ties, string, yarn*
- **Plastic Spoons**
  - *Alternatives: metal spoons, dixie cups, folded paper*
- **Duct Tape**
  - *Alternatives: Any other type of tape, glue*



## Share Your Results

We'd love to know how the activity and/or the "do now" turned out! What worked and what didn't work? Please share pictures of your engineer drawings, final catapults, or the process of building the catapult! Email us at [stem@northeastern.edu](mailto:stem@northeastern.edu).

## Related links/Extensions

To read the study referenced in the Do Now, visit:

<https://tinyurl.com/y57ddk3k>

To learn more about the different types of engineering, check out:

<https://www.teachengineering.org/k12engineering/types-of-engineering>

Video: Inspiring the next generation of female engineers | Debbie Sterling | TEDxPSU

<https://www.youtube.com/watch?v=FEeTLopLkEo>

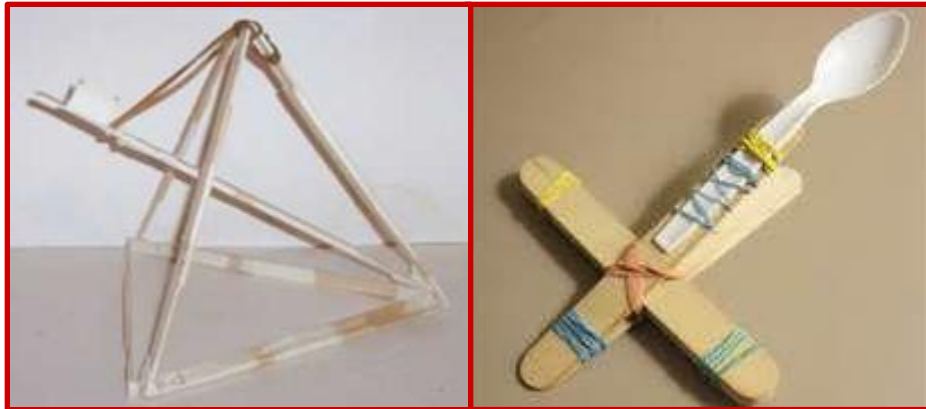
### Types of Engineers Wordsearch:

## Types of Engineers

O	R	C	H	B	I	O	M	E	D	I	C	A	L
C	G	H	M	I	N	D	U	S	T	R	I	A	L
I	E	E	I	L	L	U	L	L	C	E	E	L	I
E	O	M	A	C	A	P	E	A	I	C	S	E	A
C	T	I	E	A	C	C	R	C	A	C	C	A	E
A	E	C	S	C	I	I	A	I	E	S	E	M	V
P	C	A	T	O	N	C	W	R	C	B	R	C	C
S	H	L	R	M	A	C	T	T	H	C	A	C	T
O	N	R	U	P	H	P	F	C	L	C	N	I	I
R	I	U	C	U	C	D	O	E	N	E	F	N	C
E	C	N	T	T	E	U	S	L	U	C	L	M	I
A	A	I	U	E	M	L	S	E	T	V	I	B	G
C	L	R	A	R	C	N	E	E	I	E	E	A	A
A	B	C	L	S	T	S	I	H	C	I	V	I	L

ELECTRICAL  
MECHANICAL  
STRUCTURAL  
INDUSTRIAL  
BIOMEDICAL  
CHEMICAL  
COMPUTER  
AEROSPACE  
GEOTECHNICAL  
CIVIL  
SOFTWARE

Play this puzzle online at : <https://thewordsearch.com/puzzle/970909/>

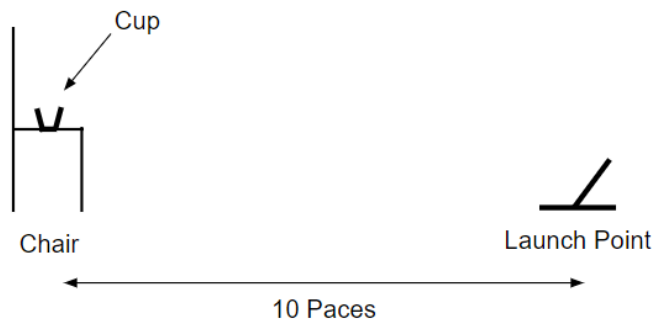


## CATAPULTS

### Challenge

Working with a partner, you will build a catapult in whatever way you choose. You will create your own design using Popsicle sticks, tape, rubber bands, and plastic spoons. You should aim to make your catapult sturdy and repeatable - one shot will not get the job done. Your goal is to gather the most possible points during launch tests. You can use skittles or other small candies as the projectiles.

**Scoring:** Mark a spot on the floor; this will be your launch point. Place a plastic (or other material if you don't have it) cup on a chair at least 10 paces away from your launch point with the chair facing your launch point. You will score 10 points for getting it in the cup, 5 points for hitting the cup, 3 points for hitting the Seat portion or the chair, 2 points for hitting the back of the chair, 1 point for hitting the sides or bottom portion of the chair, and 0 points for missing the chair.



**Before you get any materials to build, sketch a blueprint of your design (use the space below). This is the “Imagine” step of the Engineering Design Process.**

Scoring Sheet

<p><b><u>Testing - Round 1:</u></b></p> <p>Points for Shot 1: _____</p> <p>Points for Shot 2: _____</p> <p>Points for Shot 3: _____</p> <p>Total Points: _____</p> <p><b>Observations:</b></p>     <p><b>How can you improve your catapult?</b></p>	<p><b><u>Testing - Round 2:</u></b></p> <p>Points for Shot 1: _____</p> <p>Points for Shot 2: _____</p> <p>Points for Shot 3: _____</p> <p>Total Points: _____</p> <p><b>Observations:</b></p>     <p><b>How can you improve your catapult?</b></p>
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## Conclusions

Compare your catapult to others. What makes for a good catapult?

Define the engineering design process and the steps involved. What is the engineering design process used for?

1.

2.

3.

4.

5.

What is the importance of the angle at which you launch an object? What is the ideal angle to launch from?

What is the difference between accuracy and precision?