# Western Engineering Outreach

## 3D Name Sculptures

## Grade 6-8

## Meet Today's ENG HERO!

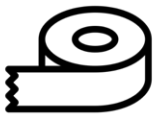
Jason Gerhard - Dr. Jason Gerhard is a professor in the Civil Engineering Department of Western University. He has nearly 20 years of experience leading research into the remediation of organic contaminant in soils and groundwater. His innovative laboratory and field work, as well as numerical model development and application, has led to breakthroughs in understanding of contaminant transport and remediation in both unconsolidated and fractured media. Dr. Gerhard is co-inventor of the STAR thermal remediation technology. For more information about Dr. Gerhard please visit: https://www.eng.uwo.ca/civil/faculty/gerhard_j/index.html

## Learning Goal:

- Students will learn about the engineering design process
- Students will develop problem solving and design skills by building a strong and stable tower
- Students will learn about reinforcements in buildings and why they are necessary
- Curriculum connections: Grade 6- Flight, Grade 7- Form and Function, Grade 8- Systems in Action

## Materials Needed:

- Markers
- Paint brushes
- Stickers
- Pompoms
- White Card Stock
- Cardboard (as base)
- Rulers



- Scissors
- Skewers
- Tape
- White Paper

## Engineering and Science Connections:

### What is the Engineering Design Process?

The engineering cycle or engineering design process is a series of steps that engineers follow to come up with a solution to a problem. Many times, the solution involves designing a product (like a machine or computer code) that meets certain criteria and/or accomplishes a certain task.

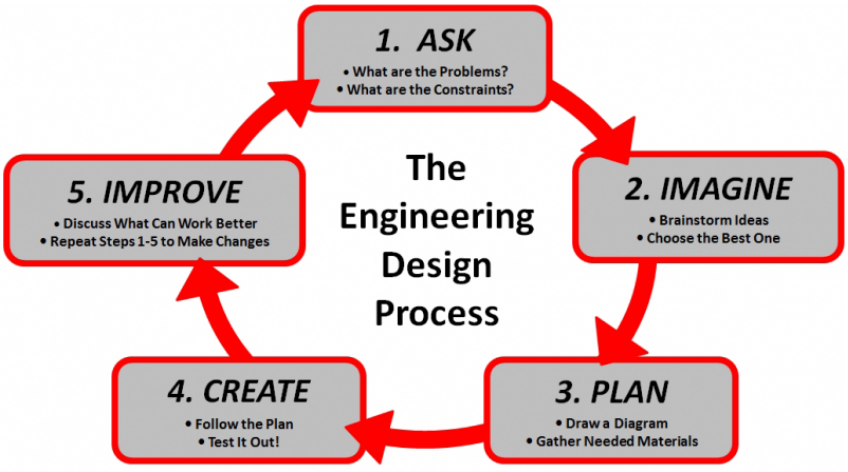
### What is the difference between the Engineering Design Process and the scientific method?

The engineering design process is different from the Scientific Method, which you may be more familiar with. If your project involves making observations and doing experiments, you should probably follow the Scientific Method. If your project involves designing, building, and testing something, you should probably follow the Engineering Design Process. For today's activity we will be using the engineering design process.

### What are the steps to the engineering design process?

The steps of the engineering design process are to:

- Define the Problem
- Do Background Research
- Specify Requirements
- Brainstorm Solutions
- Choose the Best Solution
- Do Development Work
- Build a Prototype
- Test and Redesign (ITERATE)




Engineers do not always follow the engineering design process steps in order, one after another. It is very common to design something, test it, find a problem, and then go back to an earlier step to make a modification or change your design. This way of working is called iteration, and it is likely that your process will do the same!

### Be creative as an engineer!

Since engineers often need to get creative in the solutions they find to everyday problems, a great way to explore this line of thinking is actually through art. Every great engineering innovation started with an idea that no one had ever tried before, so the more creative you are, the better you can be as an engineer!

# 3D NAME SCULPTURES

## Strength of structures and its shapes

A structure's strength is derived from its shape and the materials it is constructed from. The strength of a structure is its capacity to withstand the forces that tend to break the structure or change its shape. A triangle is considered the strongest structural shape. In the case of a triangular building, collapse occurs only due to material fatigue and not geometrical distortion.

Square and rectangular buildings or structures can collapse due to geometrical distortion when forces, such as high winds, act upon the structure. For this reason, triangles are the building blocks of many man-made structures. Other geometrical shapes add to the strength of a structure, such as arches and domes. These shapes can be seen prominently in bridges and large buildings. For example, arches utilize compression to strengthen bridges, while domes excel at bearing weight.

## What is a compressive force?

Compression is the inward pull of a structure and is opposed to the tension of a structure, which is its tendency to pull outward. Compression and tension are additional components of a building's strength. Compression and tension are what cause skyscrapers to sway slightly. A structure's strength differs from its stability. Stability is a structure's ability to maintain balance.

## Activity:

Today we will be exploring civil engineering, and what makes a strong structure. Let's get started to make our strong structure.

### Step 1: Ask

What is the problem?

- You are challenged to design and build a 3D tower using letters. You need to build a strong structure that will be able to handle a strong force.

What are the constraints?

- You will be designing 3D towers using the letters of your names as building blocks. The structure needs to be a name or an appropriate word that is at least 8 letters and a maximum of 12 letters. If you have a shorter name, you can repeat your name to meet the minimum length requirement.

- You are allowed to have a maximum of 3 pieces of cardstock.

# 3D NAME SCULPTURES

- Divide each page into 4 rectangles. Try to make the letter as big as the rectangle to ensure that your structure is fairly large.
- In each rectangle, write an individual letter of their name. Try to use different fonts for each letter.
- Once you have drawn each letter, cut each letter out.
- You can decorate each letter using paint, markers, pom poms, etc. Make sure they completely cover both sides of each letter.
- You may use 1 skewer and attach it standing upright to your base of cardboard. Remember that you are challenged to find a way to stack your letters in such a way that it creates a tower that can stand upright.
- Use only the materials that are in the material list.

## Step 2: Imagine

- Using a paper and pencil and brainstorm different ideas for your towers. Choose the best design of your 3D tower and execute it.

## Step 3: Plan

- Draw a diagram of the best design that you would like to execute, civil engineer! You are encouraged to think about the materials that you have, and which ones would help best accomplish this challenge.

## Step 4: Create

- Start executing your plan and build your 3D tower!

## Step 5: Test and Improve

- Do a shake test by shaking the structure firmly for 5 seconds. If it remains standing, it passes the shake test.
- If your structure does not pass the shake test, think about what you can do better to improve the strength of your structure.

## What Did You Learn?

- What is the engineering design process and how to use it?
- Learning to solve an engineering problem that has many constraints.
- Learning how to strengthen a structure that you are building.

## Future Learning

- Turn this activity into a project! What would you do differently next time to improve your design? Think about what qualities makes the structure the strongest and try to improve your structure. You can even build other towers that are stronger in order to make an alphabet world.

## Share your creations!

We would love to see what you made. Email as at discover@uwo.ca or tag us on social media.

Instagram: @westernueng
Twitter: @westernueng
Facebook: @westernueng

Thanks for discovering with us!