ENGINEERING

IS IN THE DESIGN

PURPOSE

IN *"ENGINEERING IS IN THE DESIGN,"* STUDENTS WILL:

- Reflect upon their knowledge of technology and engineering.
- Define what is engineering.
- Understand the elements of the Engineering Design Process (EDP).
- Build a structure (tower) with index cards using the Engineering Design Process
- Use 21st century skills in their engineering challenge.

BACKGROUND FOR THE TEACHER

In the previous lesson, technology was defined and how technology was connected to the field of engineering.
Again, the definition of technology is:

> ***"Technology is an object (marble, spoon), a system (pen, pencil, glue stick), or a process (step-by-step procedure that is man-made, a recipe) whose purpose is to solve a problem or make life easier (meets a need)."***

Once all the students understand technology, the need to connect it to engineering is the next step (This lesson). Engineering is where students will plan, create, and improve their projects.
Engineering is defined as:

> ***"Engineering is using anything human-made (creativity, understanding of materials, tools, mathematics, and science) to design things to solve a problem or fulfill a desire."***

Students will use the Engineering Design Process to get a better understanding of engineering and how it is used in daily practices.
The Engineering Design Process (EDP) has many steps, however, for elementary purposes, the EDP, according to LAUSD Science, can be summed up in five steps.

Students will be given an engineering challenge. They will be given criteria and constraints for their design problem. The students will then be guided through the Engineering Design Process.

ENGINEERING DESIGN PROCESS (EDP)

ASK

- What Is The **Problem** or **Need**?
- What Is Already Out There?
- What Are The **Requirements (Criteria)** and **Restrictions (Constraints)**?

BRAINSTORM

- What Are Possible **Solutions**?
- Choose Your Two Best Solutions.

CREATE - A - DESIGN

- **Draw** A Diagram With Labels.
- Have A Critical Design Review (Peer Review & Input).
- What Materials Are Available?

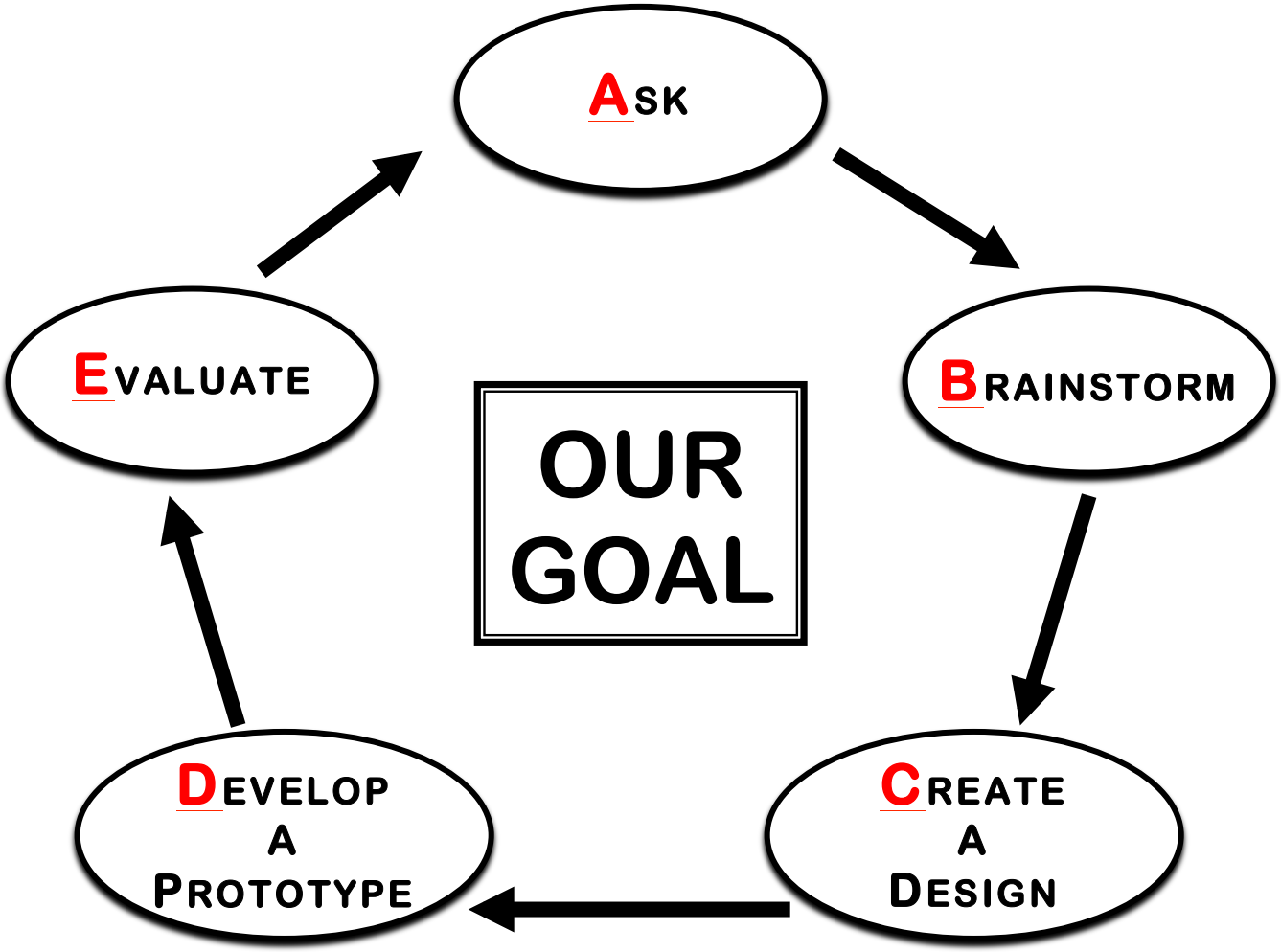
DEVELOP - A - PROTOTYPE

- Follow Your Best Diagram and **Build** a Prototype.
- **Test** The Prototype!

EVALUATE

- **Improve** Your Prototype!
- Conduct More Compatibility Tests.

THE ENGINEERING DESIGN PROCESS (EDP)



MATERIALS

ENGINEERING IS IN THE DESIGN

FOR EACH STUDENT

- Student engineering notebook

FOR EACH GROUP

- 1 Pack of 100 index cards (3” x 5”)

FOR THE LESSON

- 1 Small stuffed animal, 6-10” tall, 4-10 oz.
- 1 Stopwatch, Smartphone or tablet timer
- 1 Yard stick

GETTING READY

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1. **Schedule The Engineering Session**

   The lesson will take about 45 - 60 minutes

2. **Obtain a Stuffed Toy Animal and Packs of Index Cards**

   Get a stuffed toy animal, about 6 to 10 inches tall, weighing about 4 to 10 ounces.

3. **Prepare Charts**

   Write the question on the chart or the board:

   - **What is engineering?**

   Prepare another chart with the following questions:

   - **Where is engineering used?**
   - **What are some problems that engineering solves?**
   - **What impact does engineering have on daily life routines?**

4. **Engineering Design Process Poster (Optional)**

   If you have a poster maker at school, make an EDP poster.

   If not, enlarge each section of the EDP and create a poster.

GUIDING THE LESSON

ENGINEERING IS IN THE DESIGN

1. Ask - Focus Question: "What Is Engineering?"

- Ask students "What is engineering? When you hear the word engineering, what do you think it means?"
- Record student answers on the board or on chart paper.
- Answers may include but not limited to:
    - Drive a train
    - Build bridges
    - Build big buildings (skyscrapers)

2. Present Engineering Challenge

Start with a short story, telling students that they need to build a structure for the new statue (stuffed animal) for their school.

3. Students Should Have their Engineering Notebooks Ready

This is another opportunity for the students to record their thinking while going through the activity.

4. Give The Requirements (Criteria) And The Restrictions (Constraints) Of The Project

- **Requirements (Criteria):**
    - A structure that will hold the stuffed animal with no help.
    - The structure must be at lease 24 inches tall.
    - The structure must be free standing.
    - The structure must hold the stuffed animal for 10 seconds.
- **Restrictions (Constraints):**
    - The team has 20 minutes to build the structure.
    - The team will only have 100, 3" x 5" index cards.
    - Teams may not test their structures with the stuffed animal.

5. Follow The Engineering Design Process

ASK:

WHAT IS THE PROBLEM OR NEED?
WHAT IS ALREADY OUT THERE?
WHAT ARE THE REQUIREMENTS (CRITERIA) AND RESTRICTIONS (CONSTRAINTS)?

BRAINSTORM:

WHAT ARE POSSIBLE SOLUTIONS?
CHOOSE YOUR TWO BEST SOLUTIONS

CREATE-A-DESIGN:

DRAW A DIAGRAM WITH LABELS.
HAVE A CRITICAL DESIGN REVIEW (Peer Review & Input).
WHAT MATERIALS ARE AVAILABLE?

DEVELOP-A-PROTOTYPE:

FOLLOW YOUR BEST DIAGRAM AND BUILD A PROTOTYPE.
TEST THE PROTOTYPE!

EVALUATE:

IMPROVE YOUR PROTOTYPE!
CONDUCT MORE COMPATIBILITY TESTS

6. **B**rainstorm and **C**reate-A-Design

- Give Teams 5 minutes to Brainstorm and Draw a design of the structure. Have them draw their design in their engineering notebooks.

7. **D**evelop-A-Prototype

- Let the teams build their designs for the next 20 minutes. Teams should be able to improve their designs within the 20 minutes.
- When time is up, no one can touch the structures.

8. **E**valuate (Test)

- Have all groups observe and test the structures one at a time.
- Have teams discuss their designs and why they chose those design features.

9. **Reflection/Wrap Up**

- Review definitions of technology and engineering
- Review the Engineering Design Process

10. **Engineering Notebook Entry**

Once each group has had an opportunity to discuss, ask students to record in their notebooks the categories and list the objects from their bags under each category.