

# “Extending the CTE-STEM Pipeline into Middle Schools”

## Engineering and Architecture

### Introduction to Engineering and Engineering Design Process

Solutionary Phase	Fundamentals
Lesson # and title	Lesson 1: Introduction to Engineering and Engineering Design Process
Duration	45 minutes

#### Lesson Overview

Students are presented with an overview of engineering, including the various disciplines of engineering, and the engineering design process. This lesson provides the fundamentals for the first engineering design project, presented in lesson two.

#### Learning Objectives

After this activity, students should be able to:

- Understand that engineering is a process used to solve problems.
- Relate that engineers create things to benefit society.
- Recognize that there are different types of engineers who focus on solving different types of problems.
- Explain the stages/steps of the engineering design process.
- Be able to apply the engineering design cycle steps to future engineering assignments.

#### Content Standard(s)

**(Foundations for) MS-ETS1-1.** Define the criteria and constraints of a design problem with sufficient precision to ensure a successful solution, taking into account relevant scientific principles and potential impacts on people and the natural environment that may limit possible solutions. (Grades 6 - 8)

**(Foundations for) MS-ETS1-4.** Develop a model to generate data for iterative testing and modification of a proposed object, tool, or process such that an optimal design can be achieved. (Grades 6 - 8)

**CTE.EA.B.6.1.** Understand the steps in the design process.

**(Foundations for) CTE.EA.B.6.5.** Demonstrate the process of developing multiple details, within design constraints, into a single solution.

**(Foundations for) CTE.EA.C.3.2.** Produce proportional two- and three-dimensional sketches and designs.  
**(Foundations for) CTE.EA.C.3.1.** Apply sketching techniques to a variety of architectural models.  
**(Foundations for) CTE.EA.C.2.1.** Employ engineering design equipment using the appropriate methods and techniques.

## College and Career Connection(s)

Engineers apply their in-depth understanding of scientific and mathematical subjects to design and create devices, structures and systems that improve our lives. While scientists investigate what already exists and discover new knowledge by peering into the unknown, engineers create what has not been—they make things that have never existed before. Engineering teams follow the steps of the engineering design process: understand the need/problem, brainstorm different designs, select the best design, make a plan, create and test a prototype(s), and improve it until a satisfactory solution is achieved. The process is cyclical and may begin at, and return to, any step.

## Equipment, Instructional Resources, and Materials

**Building Materials:** Basic Maker/art materials for props/drawings: Group Activity (slides 11-12)

**Experiment Materials:** N/A

**Technology Tools:**

- Access to Google Apps for Education: Google Slides
- Youtube
- Kahoot
- Book Creator App: (optional) for Engineering Notebook and for student Reflection (Google Slides can also be used as a Engineering Design Notebook)

**Additional Resources:** [Engineering Discipline Descriptions for Group Activity](#)

## Suggested Student Grouping

- Group Activity: Who wants to be an Engineer: Small groups of three-four students for each field based on student interest.

## Vocabulary

- **design:** Loosely stated, the art of creating something that does not exist.
- **engineering:** The use of science and mathematics to solve problems to improve the world around us.
- **engineering design process:** A series of steps used by engineering teams to guide them as they develop new solutions, products or systems. The process is cyclical and may begin at, and return to, any step.

## The Lesson

## Preparation

### Prior to Class

- Gather and prepare all materials in advance.
- Decide on the number of team tables needed to work on group activity.
- Assemble desks into groups if necessary.
- Printouts:
  - Copies of Various Engineer Handouts
- (optional) Props for various engineers
- (optional) Maker materials to make props for various engineering fields

## Lesson Procedure

[Link to Lesson Slide Deck:](#)

Activity/Task	Description	Time (min)
Slides 1-3: Quick Engage	<ul style="list-style-type: none"> <li>• Show pictures to class</li> <li>• Discussion of similarities</li> <li>• Review topic and agenda for day</li> </ul>	5 mins
Slides 4-11: Pre-lesson Quiz / Direct Instruction	<ul style="list-style-type: none"> <li>• Quiz: What do you already know about engineering               <ul style="list-style-type: none"> <li>◦ Discuss or capture answers digitally</li> </ul> </li> <li>• What is Engineering and Design?</li> <li>• What does an engineer do?</li> <li>• How do engineers do this?</li> <li>• Grand Challenges for Engineers</li> </ul>	10 mins
Slides:12-13: Group Activity	<ul style="list-style-type: none"> <li>• Introduce various engineering disciplines by polling them about problems they would like to solve.</li> <li>• Group students according to their problem area interest. Assign corresponding engineering disciplines.</li> <li>• Give them the printout of their engineer. Ask them to take turns and read the handout.</li> <li>• Each group has to come up with a prop or drawing that represents their engineering discipline</li> </ul>	15 mins (~5 min read, 5 mins discuss with group, and 5 mins collaborative work)

Slides: 14-17: What is design? What is the Engineering Design Process?	Introduction and video on Engineering Design Process	10 mins
Slide 18: Kahoot : Name that Engineer	End of the lesson formative assessment <b>*If there is extra time, start Lesson 2 (slides 5-8) to allow more build time on the next day*</b>	5 mins

## Extension

Slides 19: (Optional) <a href="#">Sample Book Creator Notebook</a>	Book Creator or Google Slides for daily journal for documentation and reflections. Can be assigned as homework.	20-30 mins
Slide 11: (Optional) <a href="#">Explore Grand Challenges</a>	Read through the description of the “Grand Challenge” that most interests you. Add notes to the optional daily journal.	