

WHO IS AN ENGINEER AND WHAT DO THEY DO?

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Who is an Engineer and What Do They Do?

Skill Level
Beginner

Learner Outcomes

The learner will be able to:

- Identify similarities and differences between engineers and scientists
- Identify different engineering disciplines and how they would solve an engineering problem

Educational Standard(s) Supported

3-5 ETSI-2
MS-ETSI-1

Success Indicator

Learners will be successful if they:

- Describe the difference between a scientist and an engineer
- Explain how engineers solve problems
- Identify characteristics of at least one engineering discipline

Time Needed
45 to 60 minutes

Materials List
Paper and pencil
Computer with internet access

Introduction to Content

We will focus on identifying who an engineer is, how an engineer is similar and different to a scientist and what specific tasks they may do in their jobs. We will also give a broad overview of engineering disciplines. Students will then use what they learned to help solve a topical engineering problem.

Introduction to Methodology

Students will work with groups to complete activities and learn about different engineering terms and concepts.

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Terms and Concepts Introduction

- **Scientist:** A scientist is a person who studies the world around us using the scientific method.
- **Engineer:** An engineer is a person who uses basic scientific principles to develop new and useful devices, processes and other solutions. In many cases, these solutions make the lives of humans easier and better.

Setting the Stage and Opening Questions

Tell students: COVID-19 social distancing practices have changed how mail and food delivery looks in your neighborhood. Your neighbors know you're an engineer so they've asked if you can think of a way to get packages and food from the sidewalk to your front porch while maintaining a distance of at least six feet between people whenever possible.

Tell students: This is where you come in. But first: do you know what an engineer does for a living? Is an engineer like a scientist? Before you and your group get started solving this problem, perhaps we can start with the relationship between science and engineering, and what a scientist does versus what an engineer does.

A **scientist** is a person who studies the world around us. This exploration is called "research" and it involves what is called the **Scientific Method**. The Scientific Method is a process that allows scientists to make an educated guess, or hypothesis, about the world around them. Then, they conduct research and test the hypothesis before reaching a conclusion. Sometimes the steps of the process need to be repeated multiple times before a conclusion is reached, especially in the experiment and hypothesis-testing phase.

Ask students: If you were a biologist studying penguins, what certain things might you want to learn about penguins?

Experience

Have students create a list of facts they would want to learn about penguins. The list can go on and on, however the key thing to remember is that scientists try to explore and ultimately explain how the world around us works. Some examples can be:

- How do penguins survive in the coldest place on Earth?
- What do penguins eat?
- How do penguins take care of their young?
- How do penguins swim so gracefully and yet waddle to walk?

Tell the students: So, what does an engineer do? In a nutshell, an engineer is a person who uses basic scientific principles (which scientists found in their research) to develop new and useful devices, processes, and other solutions. In many cases, these solutions make the lives of humans easier and better. Engineers often use a process called the Engineering Design Process, which is similar to the Scientific Method but focuses more on applying ideas to create and improve something new rather than to solve a problem. The Engineering Design Process is: **Ask** a question, **Imagine** a solution, **Plan** the solution, **Create** the solution, **Test** the solution, **Improve** understanding to better solve a problem.

Tell the students: That doesn't mean that engineers don't engage in scientific research; in fact, many of them do because they need that. Think of it this way: scientists are interested in understanding the outside world for its own sake while engineers are interested in the application of science to solve problems. Each has different goals and outlooks. Where engineers will use science to help them solve problems, scientists will also use engineering principles to develop better tools and techniques for their research

Tips for Engagement

Extend the lesson to include these engineering disciplines:

- **Industrial engineering:** Devise a system or process that a delivery driver can follow to maximize efficiency.
- **Nuclear engineering:** Talk about using UV lights for sanitizing packages.
- **Biosystems engineering:** What is the impact these options may have on the surrounding environment (both natural and human-think neighbors)?

Share

Tell the students: Now, back to our penguins. Look at the list you created and think like an engineer. How can the research scientists collected on penguins help you to make better technology, devices, etc. for humans? Have the students work together to use the list of facts to come up with other ideas, like using research about how penguins swim to create vehicles, swimwear for athletes, etc. There are many different disciplines of engineering. Some examples: Aerospace, Biomedical, Chemical, Civil, Electrical, Industrial, Material Science, Mechanical, and Nuclear engineering.

Have students spend some time looking at the U.S. Bureau of Labor Statistics Occupational Outlook Handout: <https://www.bls.gov/ooh>.

Process

Tell the students: Now, remember our earlier design challenge - COVID-19 social distancing practices have changed how mail and food delivery looks in your neighborhood. Your neighbors know you're an engineer so they've asked if you can think of a way to get packages and food from the sidewalk to your front porch under the following constraints:

- Package or food must be signed for/must have human recipient
- Must maintain a distance of at least six feet when possible.

Break students into groups and have each group come up with 1-2 ideas (can be completely serious or completely wacky) on how an engineer would get a package from a delivery driver to someone's front porch.

Generalize

Things to consider:

- How far the sidewalk/road is from the porch (distance)
- How high the porch is from the sidewalk (elevation)
- Is there a yard between the porch and the sidewalk? What about a driveway?
- Are there obstacles like a dog, a fence or steps?
- What is the minimal distance that a person can be?
- What can you design (or use) to get the packages from the sidewalk to the porch without problems?
- What is the size and shape of the package? Can it roll? How about dragging?
- Will you need to provide something to pad or protect the package?
- Will you use levers, pulleys, motors, etc.?

Apply

Then, have students go back over their design. Identify what aspects of the design apply to different engineering disciplines.

Examples:

- Using a drone to get the package from the road to the porch – aerospace engineering
- Remote controlled cars, motors, RF – electrical, mechanical engineering
- Paving something – civil engineering

Have students write and share a summary of their discoveries.

Life Skill(s)

Work together with other students to complete an activity. (Hands, Working)

Use problem-solving skills to complete a task. (Head, Thinking)

Supplemental Information

Educational Standards Met

3-5 ETS1-2: Engineering Design- Generate and compare multiple possible solutions to a problem based on how well each is likely to meet the criteria and constraints of the problem.

MS-ETS1-1: Engineering Design– Define the criteria and constraints of a design problem with sufficient precisions 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.

Author’s Note:

This work was supported primarily by the ERC Program of the National Science Foundation and Department of Energy under NSF Award Number EEC-1041877 during a Research Experience for Teachers (RET) program at the Center for Ultra-wide-area Resilient Electric Energy Transmission Networks (CURENT).

Please help us improve this lesson: https://tiny.utk.edu/tceoutreach_feedback

Engineering Careers: Summaries

Summaries modified from U.S. Bureau of Labor Statistics Occupational Outlook Handbook.