



Subject Area(s) Science and Technology

Associated Unit Engineering

Lesson Title What is engineering

Grade Level 6 (5-7)

Lesson # 1 of 1

Lesson Dependency

Time required Four 60 minute sessions

Summary

Although engineering is one of the oldest professions in this country and all over the world, there is still a large amount of confusion as to what engineering really is. If you ask many people of all ages what engineering is, more than 50 % will not be able to give you a good concise answer. The goal of this lesson is to provide students with an idea of what engineering is, how is it used all around us, the many different types of engineers, as well as what preparation is needed in order to become an engineer. At the end of this lesson students should be able to establish the connection between engineering and science/math. Students will also be able to recognize the activities of various types of engineers in many real world applications that we come in contact with daily.

Engineering Connection

Students will be introduced to the real world activities of many types of engineers, as well as perform an engineering activity.

Keywords: Engineering, Rocket Cars, tower building

Educational Standards

Science: • Science: A.1, A.2, E.8, F.3, F.4, F.5, G.1, G.3, E.2, E.1

Pre-Requisite Knowledge

Since this is an introduction lesson, there are no pre requisites.

Learning Objectives

Students will be expected to:

- Identify the connection between science and engineering
- Identify the connection between math and engineering
- Identify the role of engineering in activities all around us
- Evaluate in a technical manner the performance of their rocket cars

Introduction / Motivation

Although engineering is one of the oldest professions in this country and all over the world, there is still a large amount of confusion as to what engineering really is. If you ask many people of all ages what engineering is, more than 50 % will not be able to give you a good concise answer. The goal of this lesson is to provide students with an idea of what engineering is, how is it used all around us, the many different types of engineers, as well as what preparation is needed in order to become an engineer.

Lesson Background & Concepts for Teachers

Engineering is the application of science to the needs of humanity. This is accomplished through the application of knowledge, mathematics, and practical experience to the design of useful objects or processes. Professional practitioners of engineering are called engineers.

Vocabulary / Definitions

Word	Definition
Mechanical Engineering	Is an engineering discipline that involves the application of principles of physics for analysis, design manufacturing and the maintenance of mechanical systems.
Civil Engineering	Is a discipline that deals with the design and construction of the physical and natural built environment, including bridges, roads, canals, dams, and buildings.
Chemical Engineering	Deals with the application of physical science with mathematics to the process of converting raw materials or chemicals into a more useful or valuable form.
Electrical Engineering	Deal with the study and application of electricity or electronics.

Associated Activities

The associated activities in this lesson include rockets cars, news paper towers, and building circuits.

Lesson Closure

Students will be asked simple questions about the various engineering disciplines, and asked to describe any engineering activity that they observe throughout their day.

Assessment

Teachers will have a worksheet of possible engineering activities that students may come in contact with each day.

Pre-Lesson Assessment**DO YOU PASS AN ENGINEER THIS MORNING**

The teacher will question students about their knowledge of engineering. The goal will be to get students thinking about what engineering is and if they know any engineers, or what an engineer may have designed or built.

Post-Introduction Assessment**LET'S TALK ABOUT AN ENGINEER**

Students will be asked to take an engineering activity that they have identified and write about it. The specific questions that they will answer will be what type of engineering it is, what the engineer who designed it did (i.e the steps he/she took to design it or how it may be made better).

Lesson Summary Assessment

The assessment activity here will be how the students are able to identify engineers as well as engineering activities in their daily lives. This will be done in the form of a science notebook.

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What is engineering?

Engineering is the application of science to the needs of humanity. This is accomplished through the application of knowledge, mathematics, and practical experience to the design of useful objects or processes. Professional practitioners of engineering are called engineers. **Who can give me a simple definition for this?**

Using the things you learn in science and mathematics to make life easier for a lot of people.

What do engineers do?

What types of engineers are there and what specifically do they do?

Aeronautical or Astronautical engineers-

Study jet engines and aircraft design. They may also work on applications for space missions.

Agricultural engineers-

Design farm equipment, animal shelters, crop systems, and product processing systems.

Chemical engineers-

Develop processes and products made with chemicals perhaps in the food, petroleum, or pharmaceutical industries.

Civil engineers-

Design roads, buildings, transportation systems, and other large-scale construction projects. Categories within this area may include structural, environmental, geological, hydraulic, transportation and construction engineering.

Electrical and computer engineers-

Design, construct, and maintain electronic systems, which may include working with computer chips, circuits and electronic communications.

Geological engineers-

Solves earth related technical problems while at the same time protecting the environment.

Industrial engineers-

Plan and design industrial and business facilities for the best product quality and employee working conditions.

Materials engineers-

Study metals, ceramics, plastics, and composites to design materials for applications that may involve transportation, communication or power production.

Mechanical engineers-

Create machines and may work on transportation systems, power production or performance analysis.

Nuclear engineers-

Work with nuclear reactors, fusion and radiation applications.

What sought of people become engineers?

Forget the stereotype. The pencil-necked geek with pocket protectors and a slide rule hasn't fit the image of a typical engineer for years. Today's engineers do everything from designing roller coasters to inventing lifesaving gadgets to working behind the scenes on space missions. Sound like a challenge you could meet?

How do I become an engineer?

An understanding of math and science is essential in engineering, but you must love problem-solving, too. First and foremost someone interested in engineering must love to solve tough problems. Good solutions to interesting problems involve technology, business, and excellent people skills."

Math ability? *Check*. Science skills? *Check*. People skills, problem-solving? *Check, check*. Once you have the interest level and abilities the opportunities abound.

Beginning engineering jobs usually require a bachelor's degree in engineering from an accredited program, but in engineering specialties in high demand, physical science or mathematics degree-holders may qualify for some jobs.

Engineering bachelor's degree programs typically are designed to last four years, but many students find that it takes between four and five years to complete their studies.

Most engineering degrees are granted in branches such as chemical, mechanical, civil or electrical engineering. In addition to the standard degrees, many colleges offer degrees in engineering technology. These programs prepare students for practical design and production work rather than for jobs that require more theoretical, scientific and mathematical knowledge.

How much do they earn?

Starting salaries for engineers with the bachelor's degree are significantly higher than starting salaries of bachelor's degree graduates in other fields.

According to the National Society of Professional Engineers, the 1996-97 recommended entry-level salary average for engineering graduates with a bachelor's degree was

\$37,355. For experienced mid-level engineers, the recommended salary range was \$56,032 to \$95,255. Recommended annual earnings for engineers at senior managerial levels ranged from \$112,065 to \$168,098 and well above.

What do I do as an engineer?

Do you have any questions for me about what I do or about engineering?

Engineering Activities: Wind turbines

- 1) Talk about engineering.
- 2) Ask about motor, and how it can be powered without a battery.
- 3) Talk about tools needed.
- 4) Watch video.
- 5) During video stop it and ask questions.
- 6) Talk about what I want them to do.

Why won't my dowels fit into the Tinkertoy hub?

Sand more! Or you can cut some slits in the end of the dowel. If sanding is a pain then

you should head out and buy yourself some Tinkertoys. They work great but are a bit

expensive!

Why are the dowels flying out of the hub?

You sanded too much!

Why won't the rotor spin when I put my turbine in front of the fan?

Check the orientation of the blades. Are your blades oriented in the same direction? Are

they flat? Are they hitting the tower? Look at some pictures of old and new windmills to

get some ideas about how to orient your blades.

Why does the turbine slow down when I attach it to load (pump, bulb, motor)?

Loading the generator forces it to do work. This makes it harder to push electrons through

the circuit. The more load you add the harder it is for the generator to turn and the more

torque you must generate from the blades. The only way to do this is to make bigger

blades or relocate your wind turbine to a place with higher wind speeds.

Why are the readings on my multimeter all over the place?

Your readings are fluctuating because the wind coming out of your fan is fluctuating. It

can also be caused because your blades are not spinning smoothly. This can be caused by blades that are not balanced, evenly distributed or are causing unequal amounts of drag.

What are the best blades?

That is for you to figure out! Lots of testing and playing will get you closer to your answer.

Is a fan a good wind source to test with?

Well, it is the best we have got, unless you want to build or have a wind tunnel handy.

The wind that comes out of a fan has a great deal of rotation and turbulence. It isn't very

smooth. While it will still make your turbine spin it is not exactly like the wind outside. To

see this turbulence, hold a short piece of thread in front of a fan and move it from the

center out. It should head out straight all the time...does it?

Can I take my turbine outside? Can I leave it there?

You can certainly take, use and test your wind turbine outside. But unless you have a

yawing turbine it will not track the wind and may not perform optimally. To make it work

well you will have to continually face it into the wind. I would not leave your turbine outside for too long. It is designed for basic lab tests and not to endure the rigors of the

outdoor environment!