



LESSON 8:

Simple Machines, Ben Franklin and the Technology of the 1700s

OVERVIEW

Throughout his life Franklin was the consummate tinkerer and innovator. His endless curiosity was matched only by his ingenuity. As a young boy and avid swimmer, Franklin's desire to propel himself faster across the water led to his creation of the swim fins. Similarly, as an older man and still voracious reader, Franklin's need to reach the books stacked on his top library shelf led to his creation of the mechanical long arm. Both the swim fins and long arm were simple machines.

Franklin was, of course, a scientist; but he was also a mechanic. In the 1700s anyone who worked with tools and machines was called a mechanic. As a printer, Franklin relied on his mechanical press, which depended on a screw, or simple machine, for its function. Like his fellow tradesmen, Franklin made his living with his tools, hands, and mind.

OBJECTIVES

Students will:

- Understand inventions through knowledge and design of simple machines and through an examination of 18th-century prints (Diderot graphics).
- Design their own invention using one of the six simple machines that serve as a basis for all mechanical innovations.

TIME

This lesson and activity require two to three class periods.

MATERIALS

- The Franklin Institute, "Simple Machines." Available at www.fi.edu/qa97/spotlight3/
- Common kitchen and school tools
- Digital projector or access to Internet
- Diderot graphics: images of 18th-century occupations derived from the History of Work Information System. Available at http://historyofwork.iisg.nl/detail_page.php?act_id=35200:
 - Ploughman: http://historyofwork.iisg.nl/detail_images.php?know_id=50853&lang
 - Smith: http://historyofwork.iisg.nl/detail_images.php?know_id=50946&lang
 - Founder: http://historyofwork.iisg.nl/detail_images.php?know_id=50953&lang
 - Miller: http://historyofwork.iisg.nl/detail_images.php?know_id=50863&lang
 - Slate Miner: http://historyofwork.iisg.nl/detail_images.php?know_id=50983&lang
 - Toolmaker: http://historyofwork.iisg.nl/detail_images.php?know_id=50990&lang
 - Blacksmith: http://historyofwork.iisg.nl/detail_images.php?know_id=50993&lang
 - Swordmaker: http://historyofwork.iisg.nl/detail_images.php?know_id=50999&lang

McREL STANDARDS

Technology

Standard 4. Understands the nature of technological design

Standard 6. Understands the nature and use of different technologies

LESSON AND ACTIVITY

1. Introduction

Introduce the topic by asking students to define and give examples of simple machines. Review with students the six simple machines: inclined plane, wedge, screw, lever, wheel and axle, and pulley. Following discussion, distribute “Simple Machines” handout.

2. Introducing Simple Machines in 18th-Century Occupations

Using a computer and digital projector, show students a variety of images depicting 18th-century occupations. (If you do not have access to a digital projector, students in groups can examine these images online.) Explain that these drawings are from the world’s first encyclopedia, edited by the great French Enlightenment thinker, Denis Diderot, a contemporary of Benjamin Franklin’s. (You may want to tell students that Diderot personally contributed close to one thousand articles to this multi-volume encyclopedia, and that the remaining articles were authored by other worldly scholars, including Benjamin Franklin.) As you go through these images, ask students to identify the simple and (and compound) machines (wheel, plane, lever, etc) depicted in each illustration.

3. Activity

Assign each group one of the six simple machines. Ask groups to assemble their own simple machine using any tools or materials they find in the classroom among items you have gathered. Once the machines are assembled, the groups are charged with changing the direction or location of an object using their simple machine. This exercise should take no more than 20 minutes. Each group will demonstrate its machine and its function.

4. Homework

For homework, ask students to identify six simple machines around their homes. Ask students to draw and describe the machines. Explain to students that they may also identify compound machines, a machine or gadget that is comprised of two or more simple machines.

5. Challenge Activity

At the next class, students share their drawing and descriptions of simple machines from around their homes. Challenge students to design a gadget that uses simple (or compound) machines to solve a common-day problem, such as screwing in a light bulb in a tall ceiling with no ladder, turning a cook book page with messy hands, falling back asleep after turning off the alarm clock, or moving a heavy book bag up three flights of stairs. Working in their groups, students should identify their own problem or act on one of the suggested ones, develop a solution, design or draw the gadget, and label the gadget. (Note to teachers: This activity may require two periods to complete.)

6. Invention Museum

Exhibit machine designs around the classroom.

ASSESSMENT

Students are assessed based on their participation in group activities, the homework assignment, and the originality and detail of the final project.

EXTENSION ACTIVITIES

- Students build and exhibit the gadgets based on their designs.
- Students research Denis Diderot's efforts to document the technology of the 1700s and then document some aspect of modern technology for exhibition at school.

FURTHER RESOURCES

- Boston Museum of Science at www.mos.org/
- The Franklin Institute at www.fi.edu