



MECHANICAL BUILDING BLOCKS - THE SIMPLE MACHINES

Subject Matter: Science - Simple Machines, Complex Machines

Grade Levels: 3-5

Time Allotment: Two 45-minute class sessions

Master Teacher: Ken McCoy

Overview

This lesson provides students with an introduction to simple machines, their purpose and their role in the world around them. Students will begin with an exploration of several common tools or objects that illustrate common tools in action. Following an example of expected outcomes, students will describe, in writing and drawings, and in their own words, how these tools or objects work and their common use. Students will then view clips from the video, “Push and Pull: Simple Machines at Work,” and make informed notes or additions to their initial work. In the following session, students will have an opportunity to explore the various types of simple machines through two interactive Web sites. For the culminating activity, using what they’ve learned in the unit, each student will invent their own simple or complex machine, illustrating it in drawings, and in their own words, for display.

Learning Objectives

Students will be able to:

- Identify and detail simple machines.
- Define basic terminology related to machines.
- Explain how machines help people work.

Oregon Standards Available at:

<http://www.ode.state.or.us/cifs>

Science - Physical Science

- Identify examples of magnetism and gravity exerting force on an object.
- Recognize and describe the motion of an object in terms of one or more forces acting on it.

Science - Scientific Inquiry

- Make observations. Ask questions or form hypotheses based on those observations, which can be explored through scientific investigations.
- Summarize, analyze and interpret data from investigations.

Media Components

Video

Check the link at <http://www.opb.org/edmedia/trs/> to find access to the video(s) from unitedstreaming™ referenced in this lesson plan.

- “Push and Pull: Simple Machines at Work” (23:00)
 - **Clip:** “What are Work and Force?” (01:15)
 - **Clip:** “The Lever” (03:55)
 - **Clip:** “The Inclined Plane”(02:38)
 - **Clip:** “The Wedge” (00:58)
 - **Clip:** “The Screw” (01:05)
 - **Clip:** “The Wheel and Axle” (02:22)
 - **Clip:** “The Pulley” (03:13)
 - **Clip:** “Compound Machines” (02:24)

Web

- **Vector Park Lever Activity**
A beautifully designed, ethereal activity exposing students to levers and balance. Very interactive, this site requires the Flash Player and a trial-and-error approach to exploration.
<http://www.vectorpark.com/levers.html>
- **Edheads Simple Machines Activities**
An expansive and fun Web site, created by Edheads, covering simple and complex machines through interactive Flash activities which require the Flash Player to run.
<http://www.edheads.org/activities/simple-machines/index.htm>

Materials

Session I:

- Large sheets of paper for student use in illustrating tools and objects presented. Paper should be at least 12” x 18” and no larger than 20” x 24”. Students should use pencils for their initial work and colored pencils or pens for their additional notes from the video.

- An example of a simple machine with which students may not be familiar and your rendering of an initial drawing of the example, laminated, so that you can add notes to the drawing with dry erase markers. Examples may include hand tools such as butane torch igniter, canvas stretcher, mat board cutter, zester, piecrust cutting wheel, melon baller, trowel, scooped chisel, hand-drawn knife sharpener, weed puller, upholstery sewing needle, upholstery staple puller, rotary grass edger, fence post hole digger, action hoe (hula hoe), box nose snips, tube cutter, etc.
- Examples of simple machines for students: levers - hammer, scissors, crow bar; inclined plane - picture or model of a slide, ramp, staircase; wedge - axe, knife, zipper, boat; screw - bolt, screw, water bottle screw top; wheel and axle - door knob, toy car, hand truck; pulley - picture or model of flag pole, crane, mini-blinds.
- A computer (or computers) with Internet connectivity, the Windows Media Player installed and downloads of the video clips listed above

Session II:

- Computers with Internet connectivity and the Flash and Shockwave Players installed

Prep for Teachers

Session I: Acquire materials, examples and equipment.

Create an example of the initial work students are to perform, using your introductory example. Engineering, architectural or design drawings can be helpful.

Download and preview the video clips, discovering helpful points to highlight for students during discussion and activities. Acquire the free Windows Media Player to view clips.

Session II: Bookmark Web sites on each computer to be used. Prepare each computer to be used with the necessary plug-ins for Web sites used (especially the free Flash and Shockwave Players available at <http://www.macromedia.com/>).

When using media, provide students with a **Focus for Media Interaction**, a specific task to complete and/or information to identify during or after viewing of video segments, Web sites or other multimedia elements.

Introductory Activity

Show students an example of a simple machine with which they may not be familiar (for example: plumber's snake, c-clamp, wood plane, bench/workshop vise, box end snips, tack puller, awl, etc. – the more obscure the better as long as it can be used to illustrate an aspect of a simple machine). Ask for suggestions as to what it could be and how it might be used. Explain the activities of the lesson using your laminated rendering of the object.

Learning Activities

Session I

Step 1: Show students an example of a tool they may not know the name of or use for. Ask for suggestions and guesses, prodding or converting answers to subtly introduce the terms “work” and “force.” Reveal your example rendering of the object and use it to write a short paragraph regarding the tool’s function, using one of the wrong suggestions from the class, but including words to later change to “work” and “force.” Explain to the students that you have six more objects that they will need to draw and then explain, in their own words, the tool’s use in writing. (2 minutes)

Step 2: Hand out drawing paper and have students fold the large sheet of paper into sixths to yield six equally sized panels when unfolded. Ask students to number the panels 1-6. These panels will be used to illustrate the tools and objects presented. (1 minute)

Step 3: Begin the activity by displaying examples of each type of simple machine in the same order as given in the video clip, “The Six Simple Machines” (15:41), from the video, “Push and Pull: Simple Machines at Work” (23:00) (lever, wheel and axle, pulley, inclined plane, screw and wedge). Remind students that while this activity is not a finished piece, it should be complete, neat and organized, just as your example shows. Give students time to complete their drawings and notations, including their explanation of the object’s function. (18 minutes: 3 minutes per object)

Step 4: Give your students a **Focus for Media Interaction** by having students listen for the words “work” and “force” and their definitions in the video clip, “What are Work and Force?” (01:15), from the video, “Push and Pull: Simple Machines at Work” (23:00). **Play** the video. When the clip completes, allow students to discuss the terms and definitions. (3 minutes)

Step 5: When students have illustrated an understanding of “work” and “force,” use a different color marker to change words in your initial description to “work” and “force.” Encourage students to do the same to their initial descriptions with a colored pencil or pen. (2 minutes)

Step 6: Give your students a **Focus for Media Interaction** by having them make notes on their first drawing regarding the object’s parts and possible purposes given any hints from watching the video clip, “The Lever” (03:55), from the video, “Push and Pull: Simple Machines at Work” (23:00). **Play** the video. When the clip completes, give students time to complete their notes. (5 minutes)

Step 7: Give your students a **Focus for Media Interaction** by having them make notes on their second drawing regarding the object’s parts and possible purposes given any hints from watching the video clip, “The Wheel and Axle” (02:22), from the video, “Push and Pull: Simple Machines at Work” (23:00). **Play** the video. When the clip completes, give students time to complete their notes. (3 minutes)

Step 8: Give your students a **Focus for Media Interaction** by having them make notes on their third drawing regarding the object's parts and possible purposes given any hints from watching the video clip, "The Pulley" (03:13), from the video, "Push and Pull: Simple Machines at Work" (23:00). **Play** the video. When the clip completes, give students time to complete their notes. (4 minutes)

Step 9: Give your students a **Focus for Media Interaction** by having them make notes on their fourth drawing regarding the object's parts and possible purposes given any hints from watching the video clip, "The Inclined Plane" (02:38), from the video, "Push and Pull: Simple Machines at Work" (23:00). **Play** the video. When the clip completes, give students time to complete their notes. (3 minutes)

Step 10: Give your students a **Focus for Media Interaction** by having them make notes on their fifth drawing regarding the object's parts and possible purposes given any hints from watching the video clip, "The Screw" (01:05), from the video, "Push and Pull: Simple Machines at Work" (23:00). **Play** the video. When the clip completes, give students time to complete their notes. (2 minutes)

Step 11: Give your students a **Focus for Media Interaction** by having them make notes on their sixth drawing regarding the object's parts and possible purposes given any hints from watching the video clip, "The Wedge" (00:58), from the video, "Push and Pull: Simple Machines at Work" (23:00). **Play** the video. When the clip completes, give students time to complete their notes. (2 minutes)

Step 12: Students can submit their work to you as a check for understanding.

Session II:

Step 1: Students meet in one common area away from computers to receive instructions and ask questions. Explain to students that they will explore two Web sites on simple machines during this session. Direct students as to how to find the Web sites. Give each student the Web Review Worksheet to complete during their Web site work. (5 minutes)

Step 2: Give your students a **Focus for Media Interaction** by having them complete the initial items on the Web Review Worksheet, as per your instructions, while they load the Vector Park Lever Activity Web site and wait for your direction. (1 minute)

Step 3: As students load the Web site and work on the Web Review Worksheet, check for students who may be having difficulty. If problems are not readily fixed, have students pair up with another student.

Step 4: Show students the beginning stages of working with the Web site. Give your students a **Focus for Media Interaction** by having them complete the remaining items on the Web Review Worksheet while they work with the Vector Park Lever Activity Web site. (15 minutes)

Step 5: As students finish, they can quietly walk around and view the solutions other students have created.

Step 6: Have students return to their seats.

Step 7: Give your students a **Focus for Media Interaction** by having them complete the Web Review Worksheet while they work with the Edheads Simple Machines Activities Web site. (15 minutes)

Step 8: Upon completion of the session, allow students a few minutes to share their learning with the rest of the class in a short discussion. Ask students, “What did you learn about simple machines from these two Web sites?” (5 minutes)

Step 9: Give students the culminating activity assignment either as homework to complete or homework to start, allowing future class time to complete. (1 minute)

Step 10: Students turn in their Web Review Worksheets and follow normal computer lab procedures for resetting the computers for the next class and cleaning up. (3 minutes)

Culminating Activity

Using what they’ve learned in the unit, students will invent their own simple or complex machines, illustrating them in drawings and in their own words, for display. Color, layout, organization, neatness, detail and correct terminology should all be encouraged. Originality should be emphasized, however, students may inadvertently but earnestly “reinvent” an existing machine. Possibilities might include the fanciful (“the dirty sock pick-up,” “automatic skateboard ramp system,” etc.) or the practical (“olive slicer,” “necktie lengthening tool,” etc.). Display student work.

Cross-Curricular Extensions

Visual Arts

- Drawings during each session can be expanded on, especially those of Session I and the Culminating Activity.

Mathematics

- During Session I, students can measure distances of movement to explore force and work. Extensions would include higher-level thinking and exploration of equations for force, mass, slope, etc.

History and Social Studies

- Create an interactive station for each form of simple machine with a historical scenario of the simple machine and its use by societies and individuals in history. Have students recreate the simple machines' historical use by building working models.

Community Connections

- Have a construction worker come to the class to illustrate the use of simple machines in their job.
- Have students go to a home improvement store and interview a store employee regarding the many simple machines they sell as tools.
- Invite a product designer, engineer or machinist to come speak to the class about the design of simple machines.

WEB REVIEW WORKSHEET

Name: _____

Date: _____

Web Site: _____

URL: _____

How Did You Find This Site?

Teacher ____ Linked ____ Search Engine: _____

Subject(s) Covered:

Learning You Discovered:

Would You Recommend This Web Site to Others? Yes ____ No ____ Maybe _____

Web Site: _____

URL: _____

How Did You Find This Site?

Teacher ____ Linked ____ Search Engine: _____

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