KEEP Adaptations

Refining or Adjusting KEEP Activities and Sparks to Support Energy Understandings

Simple Machines

The main understanding for students to achieve during a simple machines lesson is that the tools change the direction of a force. Machines change the state of energy to produce work. Work is force times distance. Another way of saying this is that humans use their energy with simple machines to do work by changing the state of energy of the object (system) they're working on (e.g., from potential to kinetic).

The result of simple machines is that the same amount of energy is transferred (used), but because the effort is less students often mistakenly think less energy is used. Machines make the effort easier for humans, but the same amount of work is done. Simple machines also make work easier because they use less power (i.e., they are faster and require less time; they increase the speed at which the work is done). Students might have heard the term "powerful" used with certain automobiles. The car is powerful because the engine allows the car to increase from 0 to 60 mph in less time.

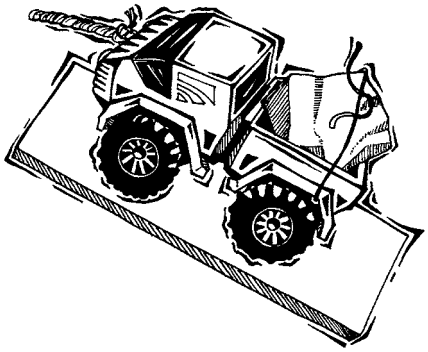
It might be too difficult to introduce the role of energy in the simple machines lesson; however, the following challenge could help students consider energy transfer when examining how simple machines "work." The main objective of this exercise is to help students who equate energy with effort or with force. This activity can help these students begin to understand that saying the amount of energy varies with machines is not a scientifically accurate use of the term energy. Of course, in everyday language, these applications are acceptable.

Challenge Question:

A person is directed to put a heavy box that is on rollers onto the back of a truck. She can lift the box to the truck, use a steep ramp, or a ramp that is less steep.

Ask students:

- Which simple machine does the ramp represent? (The lever)
- Which method they would choose and why? (Notice if they use the term energy in their answers.)
- Which method gets the most work done? (This question is a tricky one; the work is essentially the same: work = force x distance. Because of friction force, there would be some minimal difference among the methods.)
- Which method uses the most energy? (This is another tricky question. With any of the methods the box ends up at the same height, so whatever amount of energy is transferred is essentially the same. The individual might need to use more effort to lift, pull, or push the box with the steeper ramp or with no ramp, but the energy transferred to the box is the same no matter which method is employed.)



Energy Forms

Within the KEEP Energy *Education Activity Guide* as well as in other energy education resource materials there are lessons that help students explore energy forms. In strict scientific terms, there are only two forms of energy: potential and kinetic. More specific forms of energy include thermal, elastic, electromagnet (light, electricity, magnetic), sound, gravitational, chemical, and nuclear. However, it is important for younger students to recognize the evidence of energy in their lives rather than to worry about whether something is a true form of energy.

The KEEP activity "Evidence of Energy" provides an overview of the presence of energy transfers in students' lives. "Taking Temperatures" and "Exploring Heat" provide a variety of ideas to help students understand heat energy transfers.

Following are some objectives for student learning about motion, sound, and light. The Energy Sparks identify a variety of ideas to help students explore these "forms" more extensively.

Motion

Students will be able to:

- Identify objects in motion around them
- Discriminate between fast- and slow-moving objects
- Compare how various objects move (walk, roll, jump, etc.)
- Analyze whether still objects are really moving (e.g., a plant)
- Investigate what makes objects move
- Explain how muscles enable human movement

Sound

Students will be able to:

- Associate sound with vibration (observe how vibrating objects produce sound and how sound causes objects to vibrate)
- Compare how sound travels through different objects
- Contrast the sounds made by different objects
- Demonstrate how sound travels (via vibration) through solids, liquids, and gases (air)
- Diagram how the vocal cords produce sound
- Explain how the ears transmit sound (through the ear canal to nerve cells so the brain can interpret the sounds)
- Create instruments that generate different types of sound

KEEP Adaptations Continued

Light
Students will be able to:

- Identify sources of light
- Examine how light reflects off different objects
- Discriminate among transparent, translucent, and opaque materials
- List the colors of the rainbow
- Compare how different colors absorb light (radiation)
- Diagram parts of the eye and explain how it transmits light (to nerve cells to the brain so it can interpret what you see)

Other Teaching Ideas

- Read students a story and have them tally the number of times motion, light, sound, or heat is mentioned.
- Have students create a weather station where they record temperature, windiness, and amount of sunshine.
- Students can keep a Sound Log where they notice noises common and unique to each day.

Station Break Down

The KEEP activity "Station Break" provides students with a number of mini-activities to explore different types of energy conversions. For younger students, take one of the stations and expand it into a more extensive unit where students further explore types of conversions.

For example, the station titled Toyland has students investigate wind-up toys. Allow students to look at a variety of toys in more detail. They can take them apart, with supervision, to see how they operate. A number of popular toys move when a child pushes a button that pushes a spring. Challenge students to explore how energy is transferred from them to the toy and how the toy then moves.

Elementary Energy Use Then and Now

The KEEP activity "Energy Use Then and Now" can easily be adapted for younger students. Encourage students to survey or interview their parents and grandparents about how they heated their homes, cooked food, or got around town in their day. Work with students to think of creative ways to share their information with each other or other classes. Students might enjoy acting in a play where they pretend they're pioneers traveling across country and homesteading. Other students can create a picture book titled "Then and Now" where they draw comparative illustrations of how activities took place in the past and the present. Involve students in a matching game where they make connections between past and current appliances (e.g., what would be the match to a mangle? NOTE: See the KEEP activity "Energy Use Then and Now" for information about what a mangle is). Some appliances might not have a match.

Conservation Consternation

The need to conserve energy resources might be a difficult concept for students to grasp. Stories can help students relate this concept to their lives. For example, Aesop's fable "The Grasshopper and the Ant" contains important messages related to saving resources. Read the story to students (or have them participate in a role-play) and ask reasons why saving resources is important. Other stories, such as "The Wump World," "The Lorax," and "Milo and the Magical Stone" can be used to help students make mental connections between the abstract need to conserve resources and implications if resources are not used wisely.