TECHNOLOGY

INTRODUCTION

As described in the introduction to this manual, technology means using knowledge of the physical world for practical purposes such as creating something or solving a problem. The earliest **technologies**, the inventions and developments that make humans' work easier, were simple ones that helped people meet their basic needs for survival. Stone tools that humans used to crush seeds or kill small game are examples of early technologies. Technologies have advanced and continue to advance thanks to thousands of individuals' work and ingenuity. These individuals have come from many different parts of the world and many different times in history.

Technologies affect people's quality of life in countless ways today. For example, medical technologies make it possible to take X-rays of broken bones, and water treatment technologies mean that cities can provide safe drinking water to their inhabitants. Technologies benefit from new scientific knowledge. For example, microscope technology has improved over time as scientists develop a better understanding of lenses. Similarly, science

benefits from advances in technology. For example, as microscopes become more powerful, people are able to see smaller and smaller objects.

Technology changes the way people do things and can have both positive and negative effects. For example, in many parts of the world, people no longer need to visit the bank to withdraw money from their bank accounts. They can simply go to an automated banking machine. The advantage is convenience, but the disadvantage is that an opportunity for social contact is lost. In a world full of wondrous inventions, where it is easy to be swayed by the latest gadget, it is important for students to be able to assess both benefits and disadvantages, both to themselves and to people in other parts of the world. Teachers can help students develop this awareness by making links like these:

- showing how a technology developed in one part of the world affects people in another part of the world (e.g., medicine)
- comparing how a technology is used in two different parts of the world (e.g., motorized vehicles)
- debating with the students the benefits and disadvantages of technologies (e.g., nuclear energy)
- discussing what barriers exist for some people to access technologies (e.g., lack of opportunity, education, adequate finances)
- showing the close relationship between technologies and the **environment**, the surroundings and conditions affecting all living things on earth

The following sections provide background information and activities associated with three aspects of technology:

- Simple Machines — encourages students to investigate the properties of the ramp, wedge, screw, lever, wheel and axle, and pulley.
- Technologies to Meet Basic Needs — gives students the opportunity to explore some primitive or ancient technologies such as making tools, starting fires, and making pottery and bricks.
- Engineering Technologies — invites student to build their own Roman arch, windmill, and water wheel.

SIMPLE MACHINES

Background Information

People have always used tools to help them to do their work, which in science, simply means moving objects by using force. A **force** is a power capable of making an object change its speed or direction. A **simple machine** is a device that makes it easier to lift or move an object, or that changes the direction of a force. Technology would not exist if not for simple machines, which are the basic elements of more complicated machines such as automobiles.

There are six simple machines, which fall into two families:

- The **inclined plane family** of machines includes the ramp, wedge, and screw.

- The **lever family** of machines includes the lever, wheel and axle, and pulley.

The inclined plane family of machines

A **ramp**, also called an **inclined plane**, is a slope. Less force is needed to move a heavy object up a ramp than to lift or push the object straight up. This is why movers use a ramp to load furniture into a moving van. It is also why mountain roads often wind around a hill rather than going straight up a hill. If a ramp is steep, stairs may be cut into it so people do not lose their footing while climbing the ramp.

Although less force is needed when using a ramp, the same total amount of energy is needed to move a load up a ramp because the trip up the ramp takes longer than would the trip straight up.

Less force is needed to push a load up a ramp than to push it straight up

A **wedge** looks like a ramp, or like a pair of ramps back to back. Most wedges are used to push things apart. When a wedge is driven into wood, for example, the downward force on the wedge creates an outward (sideways) force on the slanted side or sides of the wedge, thereby pushing the wood apart. Examples of wedges that push things apart are an ax, a chisel, a knife, a saw, and a ship's bow. A few wedges hold things together, for example nails or doorstops.

Most wedges are used to push things apart

ACTIVITY 1

Pulling a Load Up a Ramp

Purpose

To explore technology by examining the first of six simple machines — the ramp — and to discover that pulling a load up a ramp requires less force than lifting the load straight up.

Material

Illustration of a ramp.

Whiteboard and marker.

Sturdy chair.

Plank of wood about 3 ft (1 m) long or longer.

Brick (or other heavy object).

Toy car with moving wheels.

Roll of string.

Scissors.

Large, strong elastic band.

Yardstick (meterstick) and ruler.

Scientific Method & Technology journals and pencils.

Presentation

- Most Montessori teachers present this concept in Year 5.
- Announce that the students will have the opportunity to explore the ramp, the first of six simple machines that are the basis of technology.

BACKGROUND

- Define and discuss technology. Ask for and discuss examples of early and modern technology.
- Define and discuss work, force, and simple machines. Explain that technology is based on six simple machines, the first being the ramp, also called an inclined plane.

- Display the illustration of a basic ramp and explain how it is used. Draw on the whiteboard other examples of ramps (e.g., stairs, winding mountain roads) and discuss their workings. Ask students for examples of ramps they have used or seen.

- Review that a ramp is a simple tool because it makes it easier to do work, which in science, means moving things. Ask students to imagine how humans might have first discovered how to use a ramp.

MAKING AND USING A RAMP

- Invite the students to lean the plank on the chair to make a ramp. (It may be necessary to place a brick at the bottom of the ramp to keep it in place.)

- Invite a student to cut a length of string about 3 ft (1 m) long and tie it to the toy car.

- Invite a student to tie the elastic band to the other end of the string.

- Invite a student to hold the end of the elastic band and pull the toy straight up off the ground as if to place the toy on the chair.

- Ask a student to take the ruler and measure how long the elastic band is with the toy hanging from it, and report the measurement to the group. Ask the students to use their journals to record the length.

- Invite a student to hold the end of the elastic and pull the toy car part way up the ramp, then stop and hold still while another student takes a measurement.

- Ask a student to measure and report how long the elastic is while the toy is held in place on the ramp. Ask students to record their measurements in their journals.

- Ask the students to compare the lengths of the elastics and say whether more force was needed to pull the toy straight up or to pull it up the ramp.

- Discuss how the ramp affected lifting the load of the car.
- Ask the students to use their journals to draw a ramp, write a paragraph about how a ramp works and give examples of ramps, then describe what happened in this activity.

Extensions

- Modify the above activity by making the ramp steeper or less steep and see how the change affects the length of the elastic and the lifting of the load.
- Formulate a question and hypothesis, then design and carry out a science experiment involving a ramp. Be sure to record the experiment, following the science experiment template included in the Resources section of this manual.
- Conduct experiments that compare the time it takes to move a load up a ramp with the time it takes to lift the load straight up.
- Take a walk around your house, school, and neighborhood to look for ramps in everyday life. Make a list of at least five ramps. (Examples: the slope of a sidewalk across the end of a driveway, a multi-level parking garage, a wheelchair ramp, a flight of stairs.)
- Next time you are on a bike, skateboard, or scooter, go up and down some ramps such as hills or other inclines. Think about how much harder it would be to go up and down without the ramps.
- Create and perform a short play that demonstrates how early humans may have first discovered and used the ramp.
- Research and write a short illustrated report about the history of the ramp.