Children's Discovery Museum of San Jose

Ball Tower

Teacher's Guide: Grade 2

California Content Standards

Grade 2

- Science: 1c, 1d, 4c, 4d
- Visual and Performing Arts: Theatre 2.1, 5.1

What's Going On?

The *Ball Tower* teaches children about the engineering principles behind simple machines and encourages them to influence the path of the balls as they decide which controls to activate. They turn cranks, work levers, and maneuver magnetic ramps to guide the balls along many different pathways through the sculpture. In the activities described in this guide, learn about simple machines by exploring common gadgets and inventing their own gadget.

Before You Visit

Before You Visit CDM, find out how some simple gadgets work. Explore the simple machines that work within each gadget and learn what they are called.

After Your Visit

After You Visit, use your knowledge of simple machines to invent a gadget to perform a common classroom task.

Simple Machines

Objective:

Children will be able to describe simple machines and how they work.

What you'll need:

- ❑ Examples of simple gadgets, in brown paper bags if possible, such as: Manual can opener, scissors, window blinds, egg beater, fishing reel, manual pencil sharpener, hand mixer, hand drill, corkscrew, stapler, small wind-up toys, clothespins, Jack-in-the-Box toy, toy dump truck with moveable dump, vise, flag on a flag pole
- ❑ Pencils
- ❑ Paper

What to Do:

1. Divide the students into groups of 4. Hand each group a paper bag.
2. In their groups, they should take the gadget out of the bag, play with it, and discuss its function and how it works.
3. While still seated with the group (so that discussion can continue as needed), each child should draw a detailed, labeled diagram of their object that demonstrates its working mechanism.
4. After groups have had ample time to complete their work, bring the class back together. Each group can explain to the rest of the class how their object works.
5. If this is the class's first experience with simple machines, be sure to introduce the vocabulary below into the explanations. These simple machines are used in some common gadgets:

   Wheel and axle – turning one causes the other to turn (the manual pencil sharpener)

   Pulley – a simple machine that uses a wheel and a rope to lift a heavy load (the window blind)

   Lever – a stiff bar that can rotate on a single pivot point (the stapler)

   Inclined plane – a ramp connecting a higher surface with a lower one (the toy dump truck)

   Screw – an inclined plane that winds around itself to raise or lower objects (hand drill)

Assessment:

Collect children's diagrams as evidence of their understanding and ability to explain how a gadget works.

Extensions:

- Have each group act out their gadget while the rest of the class tries to guess what it is.
- Play Simple Machine 20 Questions. With all of the gadgets on display,

Simple Machines (continued) ☞

describe a gadget by saying, for example, "I am an example of a wheel and axle. What am I?" Continue with more and more specific clues, such as, "I am found in the kitchen … I am used to open things …"

- Play Simple Machine Bingo. Create bingo cards by simply having children choose some of the gadgets on display to write onto their own bingo cards; by shrinking and duplicating the children's diagrams for them to glue into bingo squares; or by photographing the gadgets and copying the pictures into bingo boards. Rather than calling out names of gadgets, call out categories of simple machines (Cover an inclined plane.) or where the object is found (I am in your house.). Children will need to justify their answers when they claim BINGO!

During Your Visit

What you'll need:

- ❑ Pencils (optional) - 1 per student
- ❑ Clipboards or other sturdy writing surface (optional) – 1 per student
- ❑ Student Guide, Simple Machine Hunt (optional) – 1 per student or group of students
- ❑ Camera(s) (optional)

Guided Exploration of the Exhibit

What to do:

Before entering the Museum, remind the children about the categories of simple machines. Tell the children that while they are in the Museum, they can go on a simple machine scavenger hunt. Challenge children to complete their scavenger hunts by finding at least one example of each type of machine within the exhibit. When you return to the classroom after your visit, have the children discuss where they found the different machines. (Note: Teachers or parent chaperones may choose to use the categories as oral discussion topics as they and their class travel through the exhibit or may choose to copy the student sheet for the children to find their own examples of these machines. Some of the machines are found within the "Ball Tower" exhibit, but others are found throughout the Museum.)

For teacher reference, here are just some of the examples of simple machines in the Museum:

- **Pulley:**
  Power Girl asks for help using a pulley to lift a heavy ball to the ceiling.

  Pulleys are used in the *Secrets of Circles* exhibit to lift fruits and vegetables.
- **Lever:**
  Power Girl asks for help using a treadle. As children cooperate to move the treadle back and forth, they activate a lever which in turn winds a wheel.

  Scissors in the *Art Loft* are levers used to cut paper.

  A toilet flusher uses a lever to push a plunger into the tank.
- **Wheel and Axle:**
  Tennis balls in the *Ball Tower* travel through a maze of connections lifted by cranks.

  Power Girl asks for help turning a crank to make a toy airplane fly.

  Gears in the *Secrets of Circles* exhibit turn a doll.
- **Inclined Plane:**
  Children create a maze which transports tennis balls from the *Ball Tower* to the Museum floor.

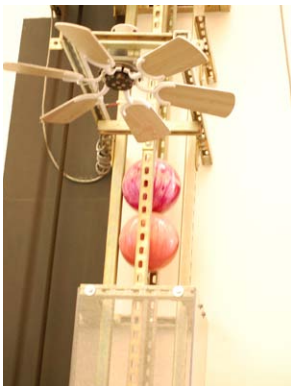
Guided Exploration of the Exhibit (continued) ☞

In Waterways, children create a fountain to lead water from a pipe to a trough at the bottom of the display.

- **Screw:**
  Children turn a crank to operate a screw that brings tennis balls in the *Ball Tower* from the floor to the ceiling.

Variations:

- Assign one type of machine to each child or group of children. Challenge them to find as many examples of it as they can.
- Ask children to take close-up photographs of the machines that they see. When you return to your classroom, create a bulletin board of "Museum Machines."



Making a Machine

Objective:

Children will use the discoveries they made at the Museum to design a gadget to perform a simple task.

What to Do:

1. Lead children in a discussion about what they learned at the Museum. Where did they find each of their examples of simple machines? What did each machine accomplish?
2. Divide the children into groups of 4. Challenge each group to design a gadget to make a common classroom task easier. Depending on your class, you may want to start by having the children brainstorm a list of common tasks that happen in the classroom (picking up pencils, turning off the lights, opening and shutting the door, erasing the board, feeding classroom pets, etc.) to give them a list from which to choose. (Note: The children's machines most definitely will not make the task easier!)
3. Give children ample time to build their machines, test them, and make changes. "Ample time" may mean more than one class session. It may also mean that after students are given time for initial exploration and trials, you bring the class back together to discuss their work, learn from each other, and provide some feedback from the teacher before proceeding with the building of their machines.
4. Once all of the children have completed their machines, have a celebration by letting each group explain their design and give a demonstration of how it performs its task.

What you'll need:

Items for building machines, such as:

- ❑ Rubber bands of various sizes
- ❑ Paperclips
- ❑ Scissors
- ❑ Pencils
- ❑ Rulers
- ❑ Tape
- ❑ Glue
- ❑ Small wooden dowels, cut in different lengths
- ❑ Corks
- ❑ Straws
- ❑ String
- ❑ Stapler
- ❑ Popsicle/craft sticks
- ❑ Cardboard
- ❑ Washers or other small weights
- ❑ Spools
- ❑ Empty shoeboxes or smaller boxes
- ❑ Brass fasteners
- ❑ Legos
- ❑ Tinker Toys
- ❑ Hobby/modeling wheels

Assessment:

As the groups are working, ask individual children explain particular design choices. Note whether or not the choices reflect accurate knowledge about the types of simple machines and the work they accomplish.

Extensions:

- If you often have the children design Leprechaun traps for St. Patrick's Day, this lesson is easily adapted for turning the traps into simple machines.

Related CDM lesson plans:

- Boing!: Wind Me Up
- Boing!: All Coiled Up
- Boing!: Scavenging for Springs
- Boing!: Springboarding

Making a Machine (continued) ☞

Weblinks:

- www.mos.org/sln/Leonardo/InventorsWorkshop.html
- www.rubegoldberg.com/
- www.coe.uh.edu/archive/science/science_lessons/scienceles1/finalhome.htm

Additional reading for children:

- The Three Pigs & the Scientific Wolf, by Mary Fetzer

Student Recording Sheet

Name _____

Type of Machine	Where I Found It	A Sketch of the Machine
Pulley		
Lever		
Wheel and Axle		
Inclined Plane		
Screw		