CAN A MOUSE LIFT AN ELEPHANT?

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Lesson Summary for Grade 3

In this lesson, students use a board and a triangular piece of wood to make a seesaw (first-class lever). They use a 10-pound bag of potatoes for the load and textbooks for the effort. The students experiment with moving the fulcrum to see how it affects the effort needed to lift a load. Students record their results.

Before doing the science lesson, students discuss experiences they've had at the playground. The book, *Just a Little Bit,* by Ann Tompert, is introduced and read to them.

Students map the story and the teacher introduces the science vocabulary (lever, fulcrum, load, effort, work) using the example of the seesaw in the literature selection. The teacher also poses the following questions: Is there any way the mouse could lift the elephant all by himself using the lever? What would happen if we moved the fulcrum?

Students next make a class seesaw. They experiment with moving the fulcrum and record how many textbooks were needed each time to act as the effort to lift the load (the sack of potatoes) at the other end of the lever. The students discuss their findings and relate them to the questions posed earlier.

In a mathematics activity, the students graph their data and interpret the results. Lessons integrating the science objective to careers, citizenship, and writing are conducted. Each lesson is tied back into the science objective.

Featured Fiction Book: Tompert, A. *Just a Little Bit;* Houghton Mifflin: Boston, 1993. (ISBN: 0-39-551527-0) The book is a cumulative tale about Elephant and Mouse on a seesaw. Mouse can't lift Elephant; so other animals get on the seesaw to help. Finally, a little brown beetle lands on Mouse's head and Elephant goes up.

Part 1: Building Bridges

Begin with a class discussion about going to the playground. Ask the students what their favorite piece of playground equipment is. Have they ever played on a seesaw? What does a seesaw look like? Let someone draw a picture on the board. Ask if they have ever had trouble lifting the person on the other end of the seesaw. Tell the students that they are going to do activities with seesaws and tools that work like seesaws.

Show the students the cover of the book *Just a Little Bit,* by Ann Tompert. Tell the students that they're going to start their day with this book. Identify the characters on the front cover.

Reading and Responding to the Story

Read the story to the class. Stop periodically and let the students predict what they think will happen next in the story.

Together, complete a story map in the shape of a hand. On each finger have one of the following words written: Somebody, Wanted, But, So, Then. Write the title and author on the palm of the hand. Have one student use the story map to summarize the book. Use a craft stick to make a handle for the hand summary. Glue the stick to the hand shape.

Bridging to the Science Activity

Refer to the picture of the elephant and the mouse on the seesaw in the literature selection. Ask students if they think there is any way that the mouse in our story could lift the elephant on the seesaw. Tell them that today in science they are going to do an experiment with a seesaw that will help them answer that question.

Introduce the science vocabulary using the picture in the book. (Suggestion—You can use highlighting tape to label the picture in the book.) Also have the vocabulary on the board or on cards for a chart holder. Tell the students that a seesaw is really a simple machine called a *lever*. It can be used to make it easier to lift heavy things. The lever is a bar like a board. It rests on top of something called a *fulcrum.* If you want to lift a heavy *load* like elephant, you have to use force or *effort* to push down on the other end of the lever so elephant will go up.

Part 2: Science Activity: Simple Machines—Levers

Students learn that, when using a lever, the closer the fulcrum is to the load, the less the effort needed to lift the load.

Key Science Topics:

- position and motion of objects
- lever
- fulcrum
- load
- effort

Key Process Skills:

- observing
- predicting
- measuring
- collecting data

Ohio Proficiency Learning Outcomes for Science:
Fourth Grade

I-8	Evaluate observations and measurements made by other persons.
II-10	Explain the operation of a simple mechanical device.
II-12	Explain and/or predict the motion of objects and/or describe the effects of some objects on other objects.

Materials

Per class

- 2-inch x 6-inch x 6-foot board for the lever (framing lumber)
- triangular piece of wood for the fulcrum (6 inches on each side and 8 inches long)
- 10-pound bag of potatoes (or something comparable in size and weight)
- stack of textbooks of similar size and weight

- tape measure
- marker

Getting Ready

1. Gather the necessary materials.
2. Measure and use a marker to mark 12-inch intervals on the board from one end to the other.
3. Label the marks from left to right with the numbers 1–5.
4. Put your fulcrum (the triangular piece of wood) at mark 4.
5. Place the sack of potatoes on one end of the lever.
6. Have a stack of textbooks ready.

Procedure

To find out how many books (how much effort) it will take to lift the sack of potatoes (the load) at the 4-foot mark on the lever:

1. Place books on the other side of the lever until the load lifts. Count the books. Record the number on a class chart.
2. Move the fulcrum to the 3-foot mark. Again place books on the other side of the lever until the load lifts. Count the books. Record the number on the class chart.
3. Do the same procedure above for the 2-foot and 1-foot marks.
4. Discuss the results. Draw the conclusion that the closer the fulcrum is to the load, the fewer the books (effort) needed to do the work.

Science Explanation

In this science activity, the students use a lever to do work. A lever is one of the six simple machines. A lever consists of a bar and a fulcrum, a pivot point, on which the bar rests. When someone pushes down with force (effort) on one end of the lever, the resulting work is an upward greater force at the other end of the lever. This enables people to lift heavy objects using little force.

The lever in our activity is a seesaw. A seesaw is an example of a first-class lever. In a first-class lever, the fulcrum is between the effort and the force. When the fulcrum is in the center of the lever, it takes a force (effort) equal to the load to balance the seesaw. If the fulcrum is moved closer to the load, the arm on the other side of the fulcrum is lengthened and the amount of force needed to lift the load is decreased. A Greek scientist, Archimedes, is credited with saying that with a long enough lever he could lift the world.

In the literature selection, *Just a Little Bit,* the fulcrum was in the center. The arms on both sides of the seesaw were equidistant. Therefore, to lift the elephant, the total weight of the animals on the other side of the seesaw had to equal the elephant's weight. In order to decrease the weight needed to lift the elephant, the mouse could have moved the fulcrum closer to the elephant.

Many tools found in the toolbox and garage are examples of first-class levers. In the career activity in this unit, the students will examine tools like the hammer, screwdriver, shovel, tin snips, wire strippers, pliers, crowbar, car jack, and dolly. These are all first-class levers like the seesaw.

Part 3: Lesson Extensions

Career Activity

Students examine examples of first-class levers that could be found in Dad's or Mom's toolbox and garage. These tools help make work easier using less effort. Students name the tools, discuss their uses, and identify the lever, fulcrum, load, and effort.

Materials

Per class

- examples or pictures of first-class levers that can be found in toolboxes and garages: clamps, screwdriver, hammer, needle-nose pliers, wire strippers, dolly, jack, crowbar, tin snips, shovel

Procedure

1. Tell the students that they are going to look at some tools that are levers. Like the seesaw in *Just a Little Bit*, levers help us do work more easily. Have the students look at some levers that can be found in a home toolbox or garage. Ask students if they can think of tools that might be in a toolbox or garage. List them.
2. Divide the students into groups of several students. Give each group a tool. Tell them to look at their tool and consider the following questions:
   a. What is the name of your tool?
   b. What work is the tool used for?
   c. Can you point to the fulcrum and the lever bar?
   d. Where would the load go?
   e. Where would you push to apply force (effort)?
3. Tell the students that one person from each group will need to report to the class about their group's tool. (Note: If you wish, you can discuss one tool together before passing out the tools to the groups.)
4. Discuss each tool. Demonstrate its use if you wish.
5. If time is available after the discussions, have the students draw their tool. Have them label the lever and the fulcrum. Label where the load would go and what effort it might take to lift it. Have the students name their tool and describe what work is done with their particular lever.

Citizenship Activity

Students use a balance to understand how an individual's rights and responsibilities should "balance out" in group or community interactions.

Ohio Proficiency Learning Outcomes for Citizenship:
Fourth Grade

VI-17 Identify and assess the possibilities of group decision-making, cooperative activity, and personal involvement in the community.

Materials

- balance (with one side labeled "Rights" and the other side "Responsibilities")
- marbles or similar objects to represent rights and responsibilities

- poster-size marker
- 2 chart-size papers, cut and shaped like parchments

Procedure

Show the students a balance. Discuss this first-class lever. Tell the students that they will use this balance to balance *rights* and *responsibilities* that we have as citizens or members of a school community. As a class, have them write a Student Bill of Rights and a Student Declaration of Responsibility. (Have the terms "rights" and "responsibilities" on the board. Also have the two charts on the board already labeled "Student Bill of Rights" and "Student Declaration of Responsibilities.")

Tell the students that we are citizens or members of many groups: for example, family, school, clubs, city, state, country, world family. As members of a group, we have certain rights. Rights are things we deserve and expect as being part of a group. For example, as a child in a family, you have the right to be fed, to be given clothes and a safe place to live, to be sent to school for an education, and to be loved.

Continue by telling the students that, as members of a group, we also have responsibilities. These are things we should do to help out the group and do what is right. For example, as a child in a family, you have the responsibility of obeying your parents, getting along with other family members, taking care of your things, and helping out with chores for the good of the family.

Our rights (what we deserve for being part of the group) and our responsibilities (what we should do for the good of the group) should balance out. Let the students brainstorm their rights as members of their school and balance them out by thinking of their responsibilities for being a part of this group. Each time they think of a right they have, they drop a marble in the balance on the rights side. Then they think of a responsibility they have and drop a marble in on the responsibility side. They then write these on their charts.

Continue by soliciting ideas for rights and responsibilities. Drop a marble in the balance each time. Record the responses on the appropriate charts. If you wish, you can have student groups brainstorm and record ideas before discussing them as a whole group.

Read the two documents and summarize.

Language Arts Activity

Students plan and write their own stories about using a lever to lift something heavy.

Ohio Proficiency Learning Outcomes for Language Arts:
Fourth Grade
Reading:

I-1	Summarize the text.
II-5	Analyze the text, examining, for example, actions or characters, problems/solutions, plot, or point of view.
II-10	Demonstrate an understanding of text by predicting outcomes and actions.

Writing:

II-3	Write an organized and logical response that flows naturally and has beginning, middle, and end.

Procedure

1. Review the story of *Just a Little Bit:* characters, setting, problem, main events, solution, and ending.
2. Tell the students that they are going to plan and write their own story about using a lever to lift something heavy like in the book. The students use the story map described in Reading and Responding to the Story.
3. Tell the students they can plan the setting and characters in their story. The problem must be that the characters have to lift something heavy. The solution should include using a lever. The story must be illustrated.
4. Let the students work alone or with partners to plan and write the story. This activity could also be done as a class story. Let students take turns being the scribes.
5. If time allows, let the students orally share their stories.

Mathematics Activity

Students complete a graph of the number of books needed to lift a weight vs. the position of the fulcrum.

Ohio Proficiency Learning Outcomes for Mathematics:
Fourth Grade

VIII-24 Make or use a table to record and sort information.

Materials

Per class

- individual worksheets of student graph
- transparency of student graph for overhead projector
- crayons
- overhead markers in 4 different colors

Procedure

1. Tell the students that they are going to graph their data to look for any patterns they can find.
2. Pass out individual student graphs. Have students take out pencil and crayons.
3. Show the student graph on the overhead.
4. Together write a title for the graph: “How Does Moving the Fulcrum Change the Effort?”
5. Label the horizontal axis: “Position of the Fulcrum from the Load.”
6. Label the vertical axis: “Number of Books to Lift the Load.”
7. Number the vertical axis to the top of the graph and the horizontal axis 1–4.
8. Together color in the bars on the graph using the information from the science experiment.
9. Ask: Do you see a pattern on the graph? As the fulcrum gets closer to the load (sack of potatoes) what happens to the number of books needed to lift it? As the fulcrum is placed farther away from the load, what happens to the number of books needed to lift it?
10. Together write a summary of the data on the graph: The closer the fulcrum is to the load, the easier it is to lift the load.

References

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