

Wheels and Axles 1

2nd or 3rd Grade

Bret Underwood

Benchmarks:

SLC 10: Students will describe simple instruments found in the environment as applications of simple machines (e.g., pulley on flag pole; hammer as a lever, nail as wedge, etc.).

Purpose:

This lesson is designed to help students understand how and why wheels are used in machines.

Materials:

- 4-5 heavy books or boxes (enough for each group)
- 10 (1' x 5/16") dowel rods ("yellow" in hardware stores) for each group (20 student class = 50 rods)

Procedure:

Break the class up into groups of 4-5 students each. Give each group a book or box. Ask the students to push the book or box around to get an idea of how heavy it is and how hard one has to push to move it. (Can you use one finger to push it? Your pinky finger?)

After the students have experimented with the books, give each group 10 of the dowel rods. Ask the students to use the dowel rods to find a way to push the book that is easier than pushing it without the dowel rods. Students will likely think of ideas like pushing the book with the dowel rods or lifting up the book with dowel rods; they should be reminded that they are trying to find a way to make it easier to push the book. Target Idea: Lay the dowel rods next to each other and put the book on top. The rods act like rollers and make it really easy to push the book.

Discussion:

Was the book easier to push when you rolled it on the dowel rods? (Could you use one finger to push it? Your pinky finger?) Why was it easier to push the book on the rollers? What type of simple machine is this an example of? How do wheels/rollers help us? What are some examples of wheels or rollers being used?

Target Model:

-Wheels help us move things by rolling, not sliding.

Wheel and Axle 2

2nd or 3rd Grade

Bret Underwood

Benchmarks:

SLC 10: Students will describe simple instruments found in the environment as applications of simple machines (e.g., pulley on flag pole; hammer as a lever, nail as wedge, etc.).

Purpose:

To discover the role that ball bearings can play in making machines run smoother.

Materials:

- ~16 same-sized marbles per group
- 2 aluminum potpie pans per group
- 1 “object” per group that fits in the potpie pans, and is somewhat heavy.
Examples: Roll of duct tape, taped-up box of paper clips, ball of string, etc...

Initial Demonstration:

Divide the class into groups of 4-5 students per group. Give each group a set of pans and an object. Propose the following situation: you are an engineer and someone wants you to build something using just the pans that will help your object spin. You are not allowed to destroy the pans (i.e. cut them or deform them too much).

Target Observations:

- It is very hard to get the object to spin using the objects given.

Procedure:

Give the groups a set of 16 marbles each, because “the head engineer realized you need some more materials.” Encourage the students to work as a team to keep the marbles from spilling from the table while working on new ideas. Some questions to ask students while they are thinking: If you were walking and stepped on a bunch of marbles, what would probably happen to you? Why? What makes marbles do that? Why do you think I gave you a cup-like pan to use? Why did I give you two of them? Is there any type of simple machine that could use these?

Target Observations/Ideas:

- Place the marbles around the object in the pan
- Place the marbles in the pan, with the object on top of the marbles
- Place the marbles in the pan, with the other pan on top of the marbles, and the object in the top pan.

Target Model:

-Marbles can be used to make things spin and move easier.

Discussion:

Bring the class back together and share ideas as a group. For each group that presents, point out how they took advantage of the marbles and/or the pie pans. Are there any real life examples of this? What could you use these ideas for? When engineers make wheels, sometimes they use little balls like marbles to help the wheel move better.

Or Wheel and Axle 3

2nd Grade

Bret Underwood

Benchmarks:

SLC 10: Students will describe simple instruments found in the environment as applications of simple machines (e.g., pulley on flag pole; hammer as a lever, nail as wedge, etc.).

Purpose:

To discover how the size of a wheel can make a difference, and to emphasize that simple machines trade force for distance.

Materials:

- 4-5 (5/16" x 1') dowel rods, enough for each group (color "yellow" in hardware stores)
- 4-5 (1 1/4" x 1') dowel rods, enough for each group (color "green" in hardware stores)
- 4-5 500 g weights
- String
- Duct Tape or Masking Tape
- Scissors

Setup:

Before the class starts, cut a piece of string ~9" long, tie one end to a weight and the other end to the (5/16" x 1') dowel rod, taping the string in place on the dowel rod with the tape. Repeat for each one of the (5/16" x 1') dowel rods.

Initial Demonstration:

Split the class into groups of 4-5 students each. Give each group the dowel – weight object and ask them to come up with ideas to move the weight up using the tools that they have (note: swinging the weight around is not acceptable!). Ask questions of the students as they work, helping them evaluate their ideas: Does that idea make it easier to lift the weight than just using your bare hands? Are there any limitations to your idea? Would this still work if the weight were made heavier? Are you using any type of a simple machine with this idea?

Target Observations/Ideas:

- Lift up the stick, which in turn lifts the weight.
- Roll the stick, wrapping the string around the stick and raising the weight.

- If the string is attached to the stick at one end, hold the stick vertical and “stir” the stick, wrapping up string as you go.
- Hold the stick to the table and roll, wrapping the string around the stick (doesn’t really lift it up)

Demonstration:

After the groups have had a sufficient time to work on that idea, switch the large dowel rod for the small dowel rod. Ask them to work as they did before, redoing any of the ideas they had with the small dowel and perhaps some new ones. Some questions to ask while they are working: Is it easier to lift the weight using this idea with the fat dowel rod, or the small dowel rod, or are they the same? Are there any things that you can do now that you couldn’t do with the small dowel rod? Are there any ideas that you can’t do now with the fat dowel rod? What makes this dowel rod better (worse) for your idea?

Target Observations:

- When rolling up the weight with the dowel rod, the larger dowel was easier than the small one.
- When lifting up the weight with the dowel rod, there doesn’t seem to be any difference between the small and the large dowel rod.

Target Model:

-A larger wheel works better than a smaller wheel when spinning it.

Discussion:

Have the class share their ideas. Ask the students: Was this a simple machine? Did the idea work better with the fat stick or the small stick? Why? What are some possible limitations of this idea? Are there some examples of this idea that you have seen in the real world? Why are we talking about problems like these? You may want to suggest the idea of a crane or well-bucket if it is not brought up by students.