Wheel and Axle
4th or 5th Grade
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Benchmarks:
(4<sup>th</sup>)  SLC 10: Students will identify and explain how simple machines help mechanical devices operate (e.g., bicycles, pencil sharpener, fishing rod, etc.) by describing the work a machine can do (e.g., change the size of the force, change the direction of force, and/or change the distance a force moves something).
(5<sup>th</sup>)  SLC 6: Students will identify the differences between work and force as they relate to each of the 6 simple machines.

Objectives:
To help students understand how wheels help us, why they help us, and to recognize wheels in the world around us.

Materials:
• Crates
• Books
• Dowel rods

Initial Model (from Incline Plane and Lever lesson):
- To make lifting an object easier we can use (simple) machines.
- Some simple machines take up a lot of space – the more space they take up, usually, the more they help lift things.
- Simple machines can be used to help us do things everyday.

Initial Demonstration:
What if the stack of books was at the other end of the room? How could I get it to the bookcase without hurting myself (try to think of a simple machine other than the incline plane and lever we just talked about)?

Target Observations:
• You could push the books from one side of the room to the other
• You could take the books one by one from one side of the room to the other
• You could put the books on a wheelie-cart and roll them from one side of the room to the other.

Discussion:
We see that there are many different ways to solve a problem like moving the books. Let’s concentrate on deciding if it is easier to push or roll the books across the room. Which do you think will be easier? Why?

Target Observations:
• It will probably be easier to roll the books across the room than to push them
• It will be easier to roll because the books will have a lot of friction if you push them.

**Target Revised Model:**
- To make lifting an object easier we can use (simple) machines.
- Some simple machines take up a lot of space – the more space they take up, usually, the more they help lift things.
- Simple machines can be used to help us do things everyday.
- There is usually more than one way to solve a problem.
- Wheels help things move easier.

**Procedure:**
So far we have predicted that wheels will help things move easier. This means that you can push something far with a small force (push). Try pushing the stack of books with your pinky finger. Is this a large force? Can you get the stack of books to move? Now, stack the books on top of a bunch of dowel rods, and push the stack with your pinky finger again. Could you get the stack to move? Why? What type of a simple machine is this? Is this what we expected?

**Target Observations:**
• Pushing with your pinky finger is a small force
• The stack of books on the ground does not move if you push it with a pinky finger
• The stack of books on the dowel rods does move if you push it with a pinky finger
• The dowel rods are acting like wheels

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- There is usually more than one way to solve a problem.
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**Discussion:**
We noticed that there usually is more than one way to solve a problem like moving the books, but simple machines make the problems easier. What are some examples of wheels making things easier around us? What part is the wheel (if it’s not obvious)?

**Target Observations:**
• Cars, buses, bikes, and rollerblades make getting around easier.
• Gears are wheels, and they make engines work.

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-There is usually more than one way to solve a problem, but simple machines make the problem easier.
-Wheels help things move easier.