

brackitz®

U2 L2a
V2.3

LESSONS

WHEELS & AXELS

ONE WHEEL
ON THE CART



★ Lesson 2: ONE WHEEL ON THE CART ★

Students consider designing transportation and including wheels in their designs. This lesson serves as an introduction to the idea of mechanical advantage and to design process with criteria and constraints.

Objectives:



Students will explore the idea of work, effort, and moving items. This lesson will lead them to ask, Students will explore the ideas of work, effort, and enhancing transportation with wheels (mechanical advantage). At the close of this lesson students will be able to describe how wheels help do work.

Vocabulary used in this activity:

work, effort, distance, weight, advantage, benefit, method, constraint

Standards

ECERS-R **Language-Reasoning:** Books and pictures, Encouraging children to communicate Using language to develop reasoning skills | **Activities:** Fine Motor, Art, Math/Numbers | **Program Structure:** Group time

NGSS **K-2nd Engineering Design:** K-2-ETS1-2 Develop a simple sketch, drawing, or physical model to illustrate how the shape of an object helps it function as needed to solve a given problem. K-2-ETS1-1 Ask questions, make observations, gather information about a situation people want to change to define a simple problem that can be solved through the development of a new or improved object or tool.

CCSS-Math K.C.C.6, K.MD.A2, K.G.A.1, K.G.B.4, 1. MD.A.1, 1.MD.A.2, 1.G.A.1, 1.G.B.5

CCSS-ELA SL.K.1, SL.K.1.A, SL.K.1.B, SL.K.5, W.K.3, CCRA.L.6, SL.1.1, SL.1.1.A, SL.1.1.B, SL.1.5, L.1.5.C

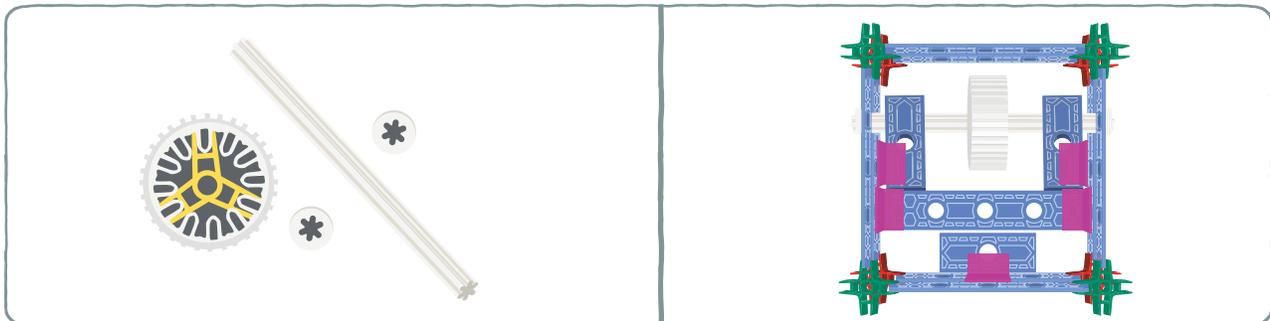
Time needed: 35-40 minutes

Materials and Supplies: Gingerbread character, paper, pencils/crayons, cart or wheeled chair, Brackitz planks (1x1 and 1x2), and 3 and 4-way hubs. Give out exactly one tire and axle-spline and two lock-washers to each group.

Resources/Optional Reading: Richard Scarry's Cars and Trucks and Things That Go.

Set-up and Preparation: Prepare trays of building materials ready to be handed out; help students cooperatively form groups of 2-3 to work together.

Background Knowledge: Prior to this lesson, students do not need special background knowledge. Introducing students to the Gingerbread friend from Unit 1 can help them keep a user in mind who will use their designs.



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35-40 minutes

Whole Class

10 minutes



What are ways you get from one place to another? How did you get to school? How will we get from class to the cafeteria? Let's list ways to get around. (Walking, bikes, cars, busses, planes, trains, etc.)

Instructor Notes and Tips

You may read the Richard Scarry book to help prime the idea of transportation for students. You may also ask for specific examples:

- How will we change classes/get to the cafeteria? (walking, wheelchairs)
- What are fun ways to move when we are playing (roller skates, scooters)
- If you wanted to go to your friend's house, what are three ways to get there? (car, bike, walking)
- What brings some students to school? (bus)

Group Exploration

10 minutes



Feel the work! "Getting from one place to another is always work. Let's see if we can **feel the work** being done. First, I'm going to ask you to carry these books (show pile of books in a box or bag) across the room. Then you'll move the **SAME BOOKS** for the **SAME DISTANCE** but on a cart (or rolling chair). Which one do you think will be easier?"

Try to reach this conclusion:

It's easier to move items when it doesn't depend on just us and our muscles. With the mechanical advantage of wheels, we could go the same distance with **less force from us** AND go faster. Advantage means having an edge or better method, like if we got a head start in a race, or have a way to go faster.

Create start and stop spots for each group, so that they can line up for this exercise. Have each student take a turn carrying a box or bag of books. Repeat the exercise but with students pushing the same amount of books on a wheeled cart or rolling chair. Each student's turn carrying the books should take 20-30 seconds or less, and if 4 or 5 students are carrying/rolling at once, this means "feeling the work" should take 6-7 minutes.

When you ask which is easier, help students consider feeling their muscles. Students may also talk about speed, and this is an excellent time to point out that greater speeds are more achievable when using something with wheels because it gives us an advantage of doing work using less force to move the same distance.

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Group Challenge

15 minutes



“If we want to give our Gingerbread character a way to move things around that will be faster and use less force, what do you see on your tray that we should use? (Wheels!) What can you build with ONLY one wheel that would help our character get around faster?”

Pass out trays of planks, connectors, wheels, and axles that are already prepared for groups. This is a chance for students to begin building. Watch to make sure groups are able to share tasks and ideas functionally.

Reflection

5 minutes



“I gave you only one wheel to see if you could build, even if I had a limitation on your building materials- that’s called a constraint. Can one wheel still help create an advantage for moving around so you can move things more easily (using less force)?”

Make sure that before this section of the lesson closes out, students understand the basic idea of doing the same task (moving Gingerbread from A to B or moving books) with less force.

CHALLENGE ADVANCED STUDENTS

In discussion, ask them to name which ways to get from place to place are fastest (cars are faster than bikes), and which ways are safest (planes and trains are fast and safe), and which ways can move the most stuff/people (planes, trains, busses), and discuss how this relates to getting work done with an advantage.

In the group challenge, ask students, “With only one wheel, how will this cart have to be used?” To lead them to the idea that a user will still have to lift, push, and balance.

SIMPLIFY FOR YOUNGER GROUPS

Before the discussion, read Scarry’s, **Cars and Trucks and Things That Go.**

In discussion, specifically ask for things that may use 4 wheels (cars, trucks, busses) and things that use fewer than 4 wheels. You may have some youtube videos or pictures ready to share of wheelbarrows, bikes, scooters, and other vehicles, to help students brainstorm.

In the group challenge, lead students directly to building a 1-wheeled cart or wheelbarrow.

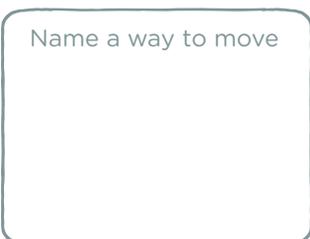
Name _____

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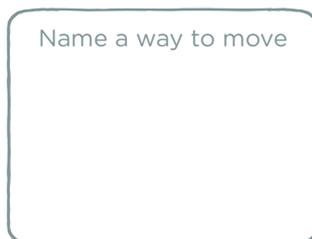
Student Worksheet

What are some ways we can get around from place to place?
Draw and write the name of at least three!

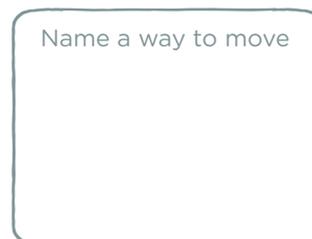
Name a way to move



Name a way to move



Name a way to move



Think about if you had to move everything in our school to a new school building. Would it be easier to carry them all by hand or to put them in a truck and drive them? (Circle which is easiest.)

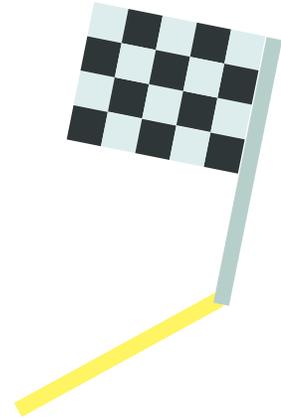
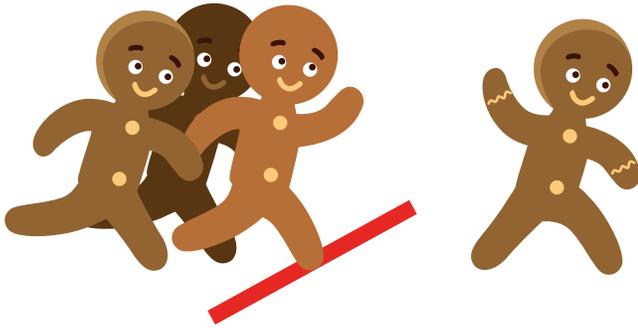


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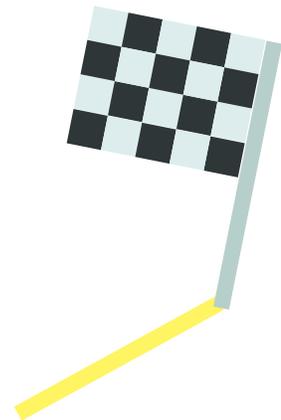
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Student Worksheet

Who has an advantage in this race? (Circle)



Who has an advantage in this race? (Circle)



Count how many Brackitz pieces you used today: _____

Count how many wheels you got to use in building today: _____

Name

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Student Worksheet

You made something with just one wheel. Draw your design here: