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U2 L3a
V2.3

TWO WHEELS ON THE CART

LESSONS

WHEELS & AXELS

CREATIVE POWER
PLAY LEARN GROW
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K & 1st grade
teacher plan

Lesson 3: TWO WHEELS ON THE CART

Students continue designing transportation tools, and including wheels in their designs, this time with two wheels.

Objectives:

Students will practice what they learned about transportation, work, effort, and mechanical advantage with more wheels, while still being challenged with a design constraint.

Vocabulary used in this activity:

advantage, benefit, mechanical advantage, request, specific, constraint, design

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.CC.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

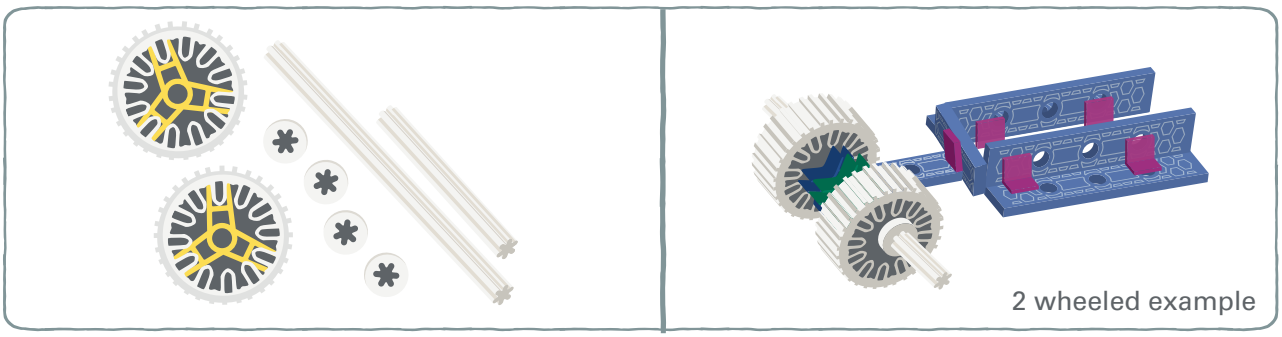
Time needed: 35-40 minutes

Materials and Supplies: Gingerbread friend, paper, pencils/crayons, Brackitz planks (1x1 and 1x2), and 3 and 4-way hubs, as well 1-way pivoting hubs. Give out exactly two tires and axle-splines and 4 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.



2 wheeled example

Lesson 3: TWO WHEELS ON THE CART

35-40 minutes

Whole Class — 10 minutes

"Previously, we experimented with moving things ourselves vs. with wheels. Which one made us use more force? (without wheels) Which way could we go faster to move the same amount of stuff the same distance? (with wheels)

So, wheels can help give us a mechanical advantage to use less force. Who wanted to use more wheels yesterday? Good news - today we're going to use more wheels, but only two. **What are some things that use two wheels?"**

Instructor Notes and Tips

You could put up your chart from lesson one that listed all the forms of transportation the class came up with previously, and ask, "Which have only two wheels?" and circle those.

Help students consider options beyond just bikes and motorcycles, such as scooters, segues and ripsticks!

Group Exploration — 10 minutes

"Let's take a look at some of your one-wheeled designs. What will change if we add two wheels? Can your group draw a new design with two wheels? Where is the best place for a second wheel?"

After groups have had some time to work, ask, "how will we know if your designs are good?" (Build them, test them, and check for safety, stability, and usefulness for your Gingerbread friend.)

Help groups get started by asking them, "If you were adding another wheel - where would it go?" Students may quickly understand that adding a wheel means changing the shape or even the use of their previous design. Ask students to think about, "What will this design help our Gingerbread friend do? Where will this cart or vehicle go, and how will s/he use it?"

Lesson 3: TWO WHEELS ON THE CART

Group Challenge 15 minutes

"Build a design with EXACTLY two wheels. You can't have one or three wheels - it has to be two. This is called a design constraint - it means you have to meet a specific request, or not use everything you may want."

This is a chance for students to begin building. Watch to make sure groups are able to share tasks and ideas functionally. Having trays with prepared Brackitz pieces and exactly two wheels and axles will help.

Reflection 5 minutes

"When you tested your two-wheeled designs, what did you check for? (Stability? Safety? Does it fit the Gingerbread? How would s/he use it?)

Was a two-wheeled design better than a one-wheeled design? Why do you think so?"

As you talk to students about their designs, praise what they have gotten working - perhaps it's a good size or built for a specific use. Ask them about parts of the design that could use improvement - maybe the design needs stability or would present safety concerns for the Gingerbread friend. Referencing things that "may need redesign" or "improvement" is a way to make the reality of redesign in the design cycle less negative.

CHALLENGE ADVANCED STUDENTS

In discussion, ask students to consider vehicles with two wheels and how are they useful. Many are recreational, or are used to create a lighter vehicle, or one that is more maneuverable over obstacles or through narrow places. What is the specific design advantage of two wheels?

In the group challenge, you can expand by asking students to consider if they placed the wheels side by side (horizontally - like on a cart or dolly) or if they placed them inline, (vertically - like on a scooter?) Why? Now have them create or draw a new design, with the wheel placement done in the other alignment, and share how their two designs would be used differently.

SIMPLIFY FOR YOUNGER GROUPS

In discussion, ask students if they have ever seen something with two wheels, aside from a bike or scooter. They may not have. You can show them Youtube videos of Segues or ripsticks to show them other ways to get around with two wheels.

In the group challenge, have students focus first on how and where our Gingerbread friend will use this vehicle (riding at the bike park is different than moving books down a hall), then on where to put the axles to make their design move smoothly, and then on adding wheels.

Name

Lesson 3: TWO WHEELS ON THE CART

Student Worksheet

Draw your two-wheeled design here:

Where will this two-wheeled vehicle get used (school, roads, parks)?
Draw that place.

Name _____

Lesson 3: TWO WHEELS ON THE CART

Student Worksheet

Is a two-wheeled design better than a one-wheeled design? (Circle)

YES **NO**

What are some reasons to prefer a two-wheeled design over a one-wheeled design? (Circle or write your own.)

Safety

Stability

Write your own: _____

Balance

Can make something like real life

Write your own: _____

Count how many Brackitz pieces you used today: _____

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

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