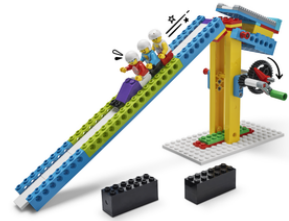


Bobsled

The crowd cheers as bobsleds zoom down the ice track! What sets the winner apart?

Grab your crash helmet and get ready to ride a bobsled to find out!

🕒 30–45 min. 📦 Intermed. 🎓 Grades 3–5



Teacher Support

Key objectives

Students will:

- Explore how gravity affects the motion of bobsleds based on mass
- Observe a pattern and make predictions
- Understand the difference between mass and volume

Things you will need

- LEGO® Education BricQ_Motion Essential Set (one for every two students)
- Masking tape
- Yardsticks (one per group)

Additional resources

[Building instructions book "B," pages 40 - 66](#)

[Student Worksheet](#)

[Assessment Rubric](#)

Educational standards

- NGSS 3-PS2-2
 - ISTE: 4c ,6a, 7c
 - CCSS.ELA-LITERACY.SL.3.1
- Lesson extension
- CCSS.MATH.CONTENT.3.MD.B.4

Prepare

- Review the online student material. Use a projector to share this material with your students during the lesson.
- Make sure that you've covered how to make predictions in an earlier lesson.
- Consider the abilities and backgrounds of all of your students. Differentiate the lesson to make it accessible to everyone. See the *Differentiation* section below for suggestions.

Engage

(Whole Class, 5 Minutes)

- Watch the student video [here](#) or access it via the online student material.
 - Facilitate a quick discussion about which forces the students have seen in action when they've been sledding or watching sledding or bobsledding.
 - Ask questions, like:
 - Which force makes the bobsled move? (*Push*)
 - What else makes the bobsled move? (*Gravity is the force that pulls the mass down. The more mass an object has, the faster it'll move. This is called "momentum." Momentum will make an object in motion stay in motion longer or give it more force. So, if you add mass, you get more momentum. And that makes the bobsled slide farther.*)
 - Tell the students that they're going to build a bobsled and ice track, and then explore how they can make the bobsled go farther by increasing its mass.
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Explore

(Small Groups, 30 Minutes)

- Have the students work in pairs to build the Bobsled model. Tell them to take turns, one partner searching for the bricks while the other builds, switching roles after each step has been done.
- You can find support for building in the *Tips* section below.
- Have the groups stop building after 20 minutes, or when all of the groups have at least built the bobsled and weights, and have completed the ice track up to step 23 on page 51 in the building instructions book.

Have the students test the ice track with the Minifigures and bobsled. Tell them to hold the bobsled at the purple marker at the top of the ice track and let it go. Groups that were able to complete the ice track and launcher can turn the handle to launch the bobsled.
- Ask them to use a yardstick to measure the distance the bobsled traveled from the base of the ice track. Tell them to record the distance on their Student Worksheets (Teacher Support – Additional Resources) or on a chart in their notebooks.
- To ensure fair testing, have the students repeat the test three times and use the middle value as the final measured distance. Tell them to place a brick next to the yardstick to mark the distance traveled in each run.
- If the students haven't already built the launcher, and if time allows, ask them to

do it now.

Explain

(Whole Class, 10 Minutes)

- Gather your students together and facilitate a group discussion about what they've observed.
 - Ask questions, like:
 - Which force made the bobsled slide down the ice track? (*Gravity*)
 - What other variable(s) can help a bobsled go faster and farther down the ice track? (*A good push at the start will help, and a heavier bobsled has the advantage. A smooth bottom to the bobsled and a smooth ice track will reduce friction.*)
 - Tell the students to hold the Minifigures in one hand and the two connected black bricks in the other.
 - Ask them which is heavier (*i.e., has more mass*) and which will slide farther.
 - Have the students use a brick to mark their predictions and then test to see if they were right.
 - Ask them to use a yardstick to measure the distance traveled, and to fill in their charts.
 - Tell them to take the weighted brick and compare it to the black bricks they've just tested.
 - Have the students use another brick to mark their predictions and again test to see if they were right.
 - Ask:
 - How is it different? (*Weight/mass*)
 - How is it the same? (*Volume, color*)
 - Will it go farther? (*It should, however, if the surface isn't smooth, it'll create more friction, and it'll travel a shorter distance.*)
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Elaborate

(Whole Class, 5 Minutes)

- Gather the students together to review and discuss their experiments.
- Ask questions, like:
 - Did you recognize any patterns in the motion of the bobsled as you changed its mass? (*The heaviest mass slid the farthest.*)

- Where you able to predict what would happen next?
 - Allow time for the students to disassemble their models, sort the bricks back into the trays, and clean up their workstations.
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Evaluate

(Ongoing Throughout the Lesson)

- Encourage them to explore the model's movement as they build it. Ask questions, like:
 - Can you find the hand crank?
 - What does it do when you turn it?
 - How many turns does it take to tip the top of the ice track?
- Ask guiding questions to encourage your students to "think aloud" and explain their thought processes and reasoning in the problem-solving decisions they've made when building their models.

Observation Checklist

- Measure your students' proficiency in describing the pattern in the motion of an object and how this pattern can be used to predict future motion.
- Create a scale that matches your needs. For example:
 1. Needs additional support
 2. Can work Independently
 3. Can teach others

Self-Assessment

- Have each student choose the brick that they feel best represents their performance:
 - Green: I think I can recognize a pattern in the motion of the bobsled.
 - Blue: I know I can recognize a pattern in the motion of the bobsled.
 - Purple: I can recognize a pattern in the motion of the bobsled, use this pattern to predict future motion, and I can help a friend understand, too.

Peer-Feedback

- In their teams, have the students discuss their experiences working together.
 - Encourage them to use statements like:
 - I liked it when you...
 - I'd like to hear more about how you...
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Tips

Model Tips

- To test their models, the students will require a smooth flat surface at least one yard long. Ideally, everyone should test on the same surface because the results will vary on wood, tile, paper, carpet, etc. due to the differences in the coefficient of friction.
 - The students should use a piece of tape to mark a spot, or identify a mark on the table or floor that they can use to align the ice track to ensure that it stays in the same position each time they test.
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Differentiation

Simplify this lesson by:

- Having your students work with just the bobsled and weighted brick (*i.e., don't build past step 23 on page 51*)

Increase the difficulty by:

- Asking your students to free-build something that will make the bobsled go farther (*e.g., a heavier bobsled, something to reduce friction [e.g., wheels], a taller ice track, something to give a push at the top*)
 - Challenging the students to design and build something to start their bobsleds off with a running push at the top of the ice track
 - In bobsled competitions, the winners optimize their mass, and start with the strongest, fastest push at the top of the track. After learning about mass, your students can try to make something that gives a strong push to make their bobsleds travel even farther.
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Extensions

(Note: This will require additional time.)

To incorporate math skills development, have your students weigh the different bobsled configurations. Have them create a chart in which the vertical axis is the weight of the different bobsleds, and the horizontal axis is the distance traveled by the bobsled. Ask the students to make at least 5 trials, and then calculate the mean distance traveled.

bobsleds. Ask them to repeat each test 5 times and then plot the results on their charts using a dot. Facilitate a discussion about how much variation they observed, and the relationship between weight and the distance traveled.

CCSS.MATH.CONTENT.3.MD.B.4