

2. Bowling Fun

LEGO Spike Essential - Crazy Carnival Games

Subject: STEAM, Science	Topic or Unit of Study: Energy, Energy Transfer
Grade/Level: Grades 3-5	Time Allotment: 1.5 hours
Objectives: <ul style="list-style-type: none">● We will predict outcomes of the changes in energy that occur when objects collide.● We will observe and describe the relationship between energy and force.● We will engage effectively in a range of collaborative discussions.	Standards: <p>3-PS2-3: Ask questions to determine cause and effect relationships of electric or magnetic interactions between two objects not in contact with each other.</p> <p>4-PS3-3: Ask questions and predict outcomes about the changes in energy that occur when objects collide.</p> <p>4-PS3-4: Apply scientific ideas to design, test, and refine a device that converts energy from one form to another.</p> <p>ISTE 1.3d: Students build knowledge by actively exploring real-world issues and problems, developing ideas and theories, and pursuing answers and solutions.</p> <p>MS-PS2-1: Apply Newton’s Third Law to design a solution to a problem involving the motion of two colliding objects.</p>
Synopsis: <p>This unit will develop your students’ understanding of energy, energy transfer, and collision. They’ll explore ways of using observation skills as they anticipate the outcomes of changes in energy during a collision, describe the relationship between energy and speed, and predict how energy moves from place to place. They’ll also broaden their understanding of energy conversion (potential and kinetic) by investigating a solution that converts energy from one form to another, testing the solution to improve and refine its function.</p>	Materials: <ul style="list-style-type: none">● Teacher/instructor lesson plan● Teacher/instructor Google Slides presentation● Teacher computer with access to internet and teacher presentation● Student computers● LEGO Spike Essential kit (one kit per two students)● Paper copies of building instructions (optional)

SLIDE 1:

Display the RoboMasterminds info. Allow students/guardians time to scan the QR code for website access.

SLIDE 3:

Share the following words and definitions with students:

- *Force*: A push or pull
- *Modify*: Make changes to
- *Potential Energy*: Stored energy
- *Ramp*: A surface with one end higher than the other

SLIDE 4:

Have students brainstorm a list of sports where two objects collide.

Examples: football - the ball with players, two players

golf - club and ball

baseball - ball and glove, ball and bat

SLIDE 5:

Ask students, "What happens when two or more objects collide in these sports?"

Ask follow-up questions as necessary:

- What will you see when two objects collide?
- What do you think happens to the energy of the objects when they collide?

SLIDE 6:

Introduce your students to Daniel (using the LEGO minifigure bios) and today's challenge: bowling a strike.

SLIDE 7:

Share the SOARing expectations for the LEGO kits.

SLIDE 8:

Distribute a Prime Essentials set to each pair of students.

Teacher/Instructor Note: It would be best to have pairs pre-selected.

SLIDE 9:

Have students open the LEGO Education SPIKE Essential App.

- Open the app
- Click SPIKE Essential
- Click Unit Plans
- Click Crazy Carnival Games

- Click Bowling Fun

SLIDE 10:

Students will read/listen to slides 1 through 3.

1. Daniel is frustrated. He wants to be able to bowl like his friends.
2. Daniel thinks there must be a way that he can bowl too. He'd like to try bowling with a ramp.
3. Build a bowling game like Daniel's and try it.

SLIDE 11:

Tell students they are now going to build their bowling game. Explain to students that if they do not follow each direction exactly as shown, their game will not work properly.

SLIDES 12-40:

On Step 4, students will go through all twenty-nine steps in pairs using their Spike Essentials kits. Circulate the instructional space to ensure students are building correctly.

Teacher/Instructor Note: There is a picture of each building step on a separate slide in the presentation.

SLIDE 41:

Step 5 provides students with today's challenge: create the program to get a strike.

SLIDE 42:

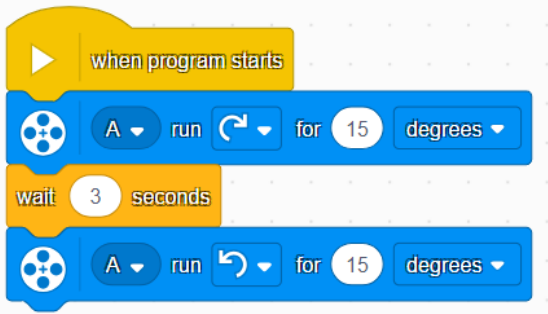
Step 6 has students connect their Hubs to the Spike Essentials App using the white USB cable.

Pictures are included on the slide of where to connect the cable into the Lego hub.

SLIDE 43:

Students will begin their coding sequence. The App is interactive and shows students exactly which coding blocks to drag into the work area.

They will end up with this sequence:



SLIDE 44:

Students will click the yellow PLAY button when directed to, to test their program.

Ask students, “What happened? How can we modify our code to be more successful?”

Teacher/Instructor Note: Students should notice the ramp does not rise high enough for the ball to roll down.

SLIDE 45:

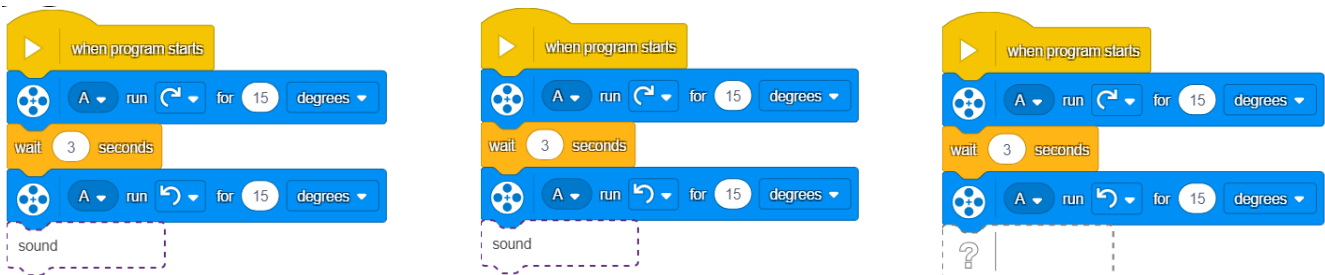
Provide students with time to modify and re-test their codes to get the ball to roll down the ramp and knock over all of their pins.

Teacher/Instructor Note: Students will need to modify **both** of the degrees fields to approximately 70°, and keep the 3 second rest the same between raising and lowering the ramp.

SLIDE 46:

After the students complete this challenge, they’ll be provided with three Inspiration Coding Blocks to help them modify their programs.

The Inspiration Coding Blocks are intended to spark their imaginations as they experiment to find their own solutions.



SLIDE 47:

Host a debrief discussion to reflect on the completed challenges. Ask questions like:

- ❖ How did you bowl a strike?
- ❖ How did the ball's energy impact the bowling pins?

SLIDE 48:

Prompt your students to discuss and reflect on the changes in energy that occur when objects collide..

Ask questions like:

- ❖ How do you know that two objects have collided?
- ❖ Why does the speed of an object affect what happens when two objects collide?

SLIDE 49

Display the RoboMasters info. Allow students/guardians time to scan the QR code for website access.

SLIDE 50:

Ask students, "How does today's activity connect to robotics?"

SLIDE 51:

Provide students with ample clean-up time, helping to ensure they are separating all pieces and placing them back appropriately.