

4. A-Maze-Ing

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 observe and explain how interactions between two objects can impact the energy of an object.● We will compare and iterate to improve the design of the solution.● We will engage effectively in a range of collaborative discussions.	Standards: <p>4-PS3-2: Make observations to provide evidence that energy can be transferred from place to place by sound, light, heat, and electric currents.</p> <p>CSTA.1B.AP.10: Create programs that include sequences, events, logos, and conditionals.</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>CCSS.ELA-LITERACY.SL.4.1: Engage effectively in a range of collaborative discussions (one-on-one, in groups, and teacher-led), building on others' ideas and expressing their own clearly.</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 per two students)● Building instructions (optional)

SLIDE 2:

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

SLIDE 3:

Share the following words and definitions with students:

- *Capable*: can do something
- *Evidence*: proof that shows something is true
- *Obstacles*: something that stands in the way of progress or achievement
- *Record*: fastest or quickest at something
- *Tilt*: to move or lean
- *Transfer*: to convey from one place to another

SLIDE 4:

Have students brainstorm a list of sports where a ball has to hit something.

SLIDE 5:

Facilitate a quick discussion about ways of finding evidence that energy can be transferred from place to place, by asking “

- When two objects collide, what happens to their energy?
- How can you tell that energy is being transferred?

SLIDE 6:

Introduce your students to Maria (using the LEGO minifigure bios) and today’s challenge: counting the number of tilts that are needed to complete the maze.

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 A-Maze-Ing

SLIDE 10:

Students will read/listen to slides 1 through 3.

1. Leo won the maze competition. He completed the maze in only six tilts!
2. Leo wonders if he can do even better. He thinks he can complete the maze in just five tilts.
3. Build a maze like Leo's. See if you can complete it in four tilts.

SLIDE 11:

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

SLIDES 12-35:

On Step 4, students will go through all twenty-four 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 36:

Step 5 provides students with today's challenge: create the program for the maze. Try to complete it in four tilts.

SLIDE 37:

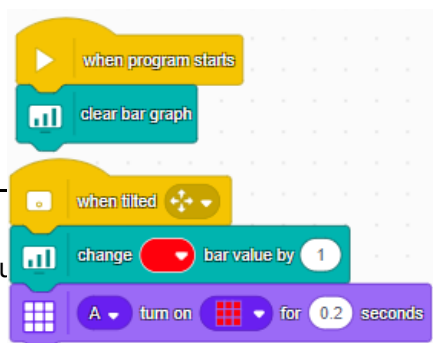
Step 6 has students connect their Hubs to the Spike Essentials App using the white USB cable.

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

SLIDE 38:

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 39:

Students will click the yellow PLAY button to run their program.

Ask students, "What happened? How can we modify your code to be more successful?"

Teacher/Instructor Note: Students should notice they are going to do less tilts to navigate the ball through the maze.

SLIDE 40:

Provide students with time to modify and re-test their tilts to get the ball through the maze in less moves.

SLIDE 41:

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 42:**

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

- ❖ How many tilts did it take for the ball to reach the goal?
- ❖ How did the ball's energy change when it interacted with an obstacle or the wall of the maze?
- ❖ How was it visible in the ball's motion?

SLIDE 43:

Prompt your students to discuss and reflect on the importance of observing and understanding how energy transfers.

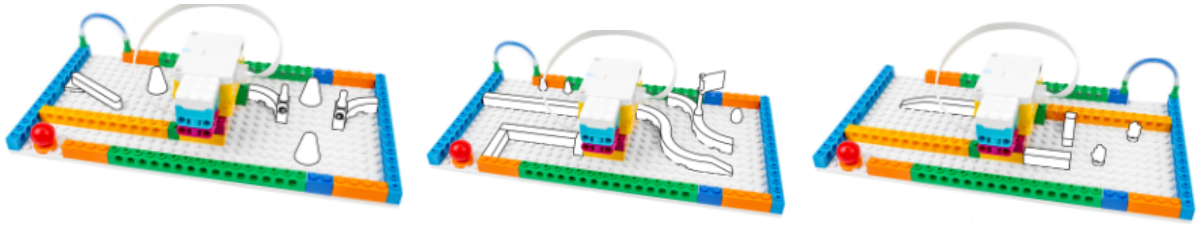
Ask questions like:

- ❖ Where did you see interactions that affected the energy of the ball in the maze?
- ❖ What else could you see or hear that would indicate that energy was being transferred?

SLIDE 44:

Provide your students with ample time to complete these two challenges:

1. Modify the program to make the maze more fun.
2. Upgrade the maze to make it more difficult to navigate the maze. Some suggestions:



Teacher/Instructor Note: There are no building instructions for the challenge.

SLIDE 45:

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

SLIDE 46:

Ask students, “How does today’s activity connect to robotics?”

SLIDE 47:

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