

Overview

SPRK STEM challenges are fun, interactive activities that challenge students to use creativity and teamwork to move through simple steps of the design process in order to build Sphero-based creations. In this challenge students will build bridges from finite resources and then program Sphero to drive across. Students have the opportunity to research bridges and brainstorm potential concepts, as well as determine design specifications, and effectively communicate their vision for the bridge before building it.

Getting started

Spheros are controlled via Bluetooth on either Apple (iPod, iPhone, or iPad) or Android devices. Ideally, you would do this lesson in groups of 3 or 4 students, each with their own Sphero and device. This lesson is designed for iPads or other tablets, but other devices could be used. Here is what each group would need

- iPad or tablet with Sphero Macrolab loaded. You can get Sphero Macrolab for free from the iTunes app store or Google Play
- Sphero that has been fully charged

Materials

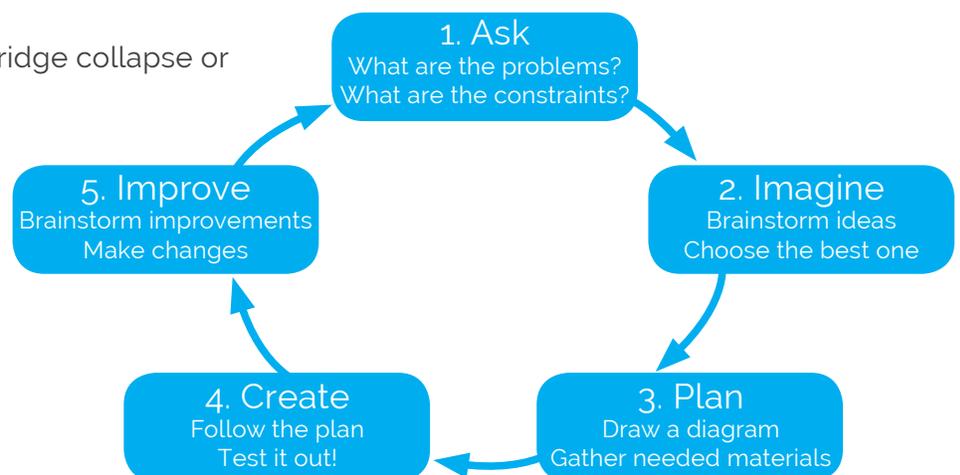
- Popsicle sticks, toothpicks, uncooked pasta, balsa wood, cardboard or other building material
- Glue, tape
- String
- Measuring tape or rulers
- 2 tables or other objects to span the bridge across

PART 1: Introduction – 20 minutes

Gather materials for students to build bridges out of and set up the gap that students will build bridges to span.

- Break students into groups
- Watch video of Tacoma Narrows Bridge collapse or another famous bridge collapse.
- Briefly introduce Sphero to class
- Outline the engineering design process (right)
- Pose the challenge to the class:

Sphero can drive on the table but it needs to get across the gap between 2 tables (or other objects). (We have found 12-14 inches is a good bridge distance to span)



PART 1: Introduction (continued)

- Each group has a set of materials (Popsicle sticks/pasta/balsawood/toothpicks/cardboard).
- You can provide each team with a mystery material that they have to incorporate into their bridge for an added challenge
- You can also include different incentives to encourage students to design efficiently like a prize for the lightest successful bridge.

PART 2: Specifications – 20 minutes

In this part of the challenge students should gather information so that they can create a list of design specifications. These can include physical dimensions or specifications regarding material limitations or time constraints. Students can also set goals for the weight of their bridge.

- Have students take measurements of Sphero
- Students also will need to measure size of gap they need to span
- Students should determine what the road surface needs to be made of so Sphero can drive across it
- Have students create a list of 5 or more specifications for their bridges

Optional physics/science focused activities (Steps 3 – 4)

PART 3: Bridge research in groups - 60 minutes

The teams will research different types of bridges and then use this information to develop their designs. Groups are each assigned to different types of bridges. Some bridge types that could be assigned include: Arch, Beam, Cable-Stayed, Suspension, and Truss. You may want to just assign subtypes of a certain type, such as different types of Truss bridges.

PART 4: Presentations - 30 minutes

Each group has 4 minutes to show a picture of the type of bridge that they researched as well as primary advantages/disadvantages and any notable features.

PART 5: Brainstorm – 45 minutes

Provide teams with the following guidelines for brainstorming; as developed by the Stanford D School:

- One conversation at a time.
- Go for quantity
- Headline! (Quick, Concise Ideas)
- Build on the Ideas of others
- Be Visual
- Encourage wild ideas
- Stay on topic
- Defer Judgment

Set a goal for each team to come up with 20 different ideas in 20 minutes. Once teams have their ideas have them determine as a group which idea they would like to use

PART 6: Drawings and materials – 30 minutes

In Part 6, teams create a clear drawing of their bridge and determine what materials they will need.

- As an option, ask students for dimensioned drawings. Each group, or each student should create a drawing of the bridge with the correct dimensions labeled on it.
- As an option, ask students to create a Bill of Materials. Each group should create a table or list of the materials they will need to build their bridge as well as the amount of each material.

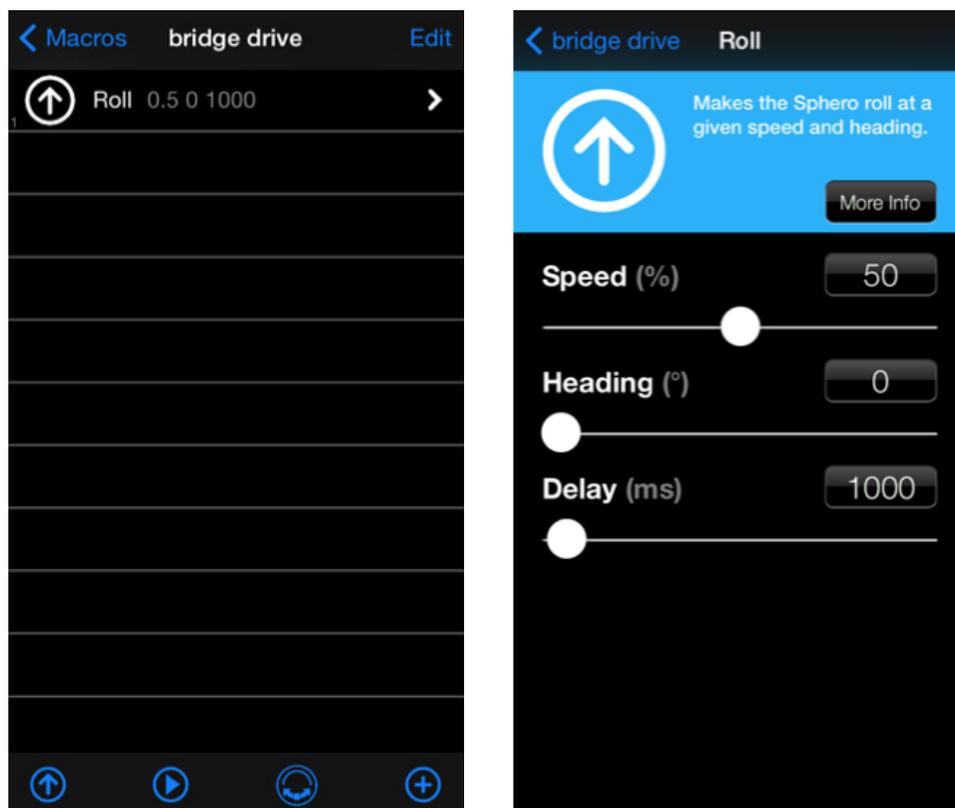
PART 7: Present – 30 minutes

Each team should make a short presentation (4-5 minutes) about their bridge plan. If the optional section above (Dimensioned Drawing and Bill of Materials) was completed have the students present those sections as well. Each group should be able to present about the following.

- Why they believe their bridge will be successful
- What materials they will use
- What they anticipate will be the hardest part of the building process
- Any notable features of their bridge

PART 8: Build bridges and program Sphero – 2 - 3 hours

- Teams build their bridges and if they finish early they can test them. Each team will also need to write a simple macro that gets Sphero across their bridge; it can be only one line long. See an example below:



PART 9: Bridge Testing – 60 minutes

Finally it is time to test the bridges! If you offered incentives building the lightest bridge, you may want to begin by weighing all of the bridges.

- Each group should set up bridges across the gap.
- Next, each group should try out their macros to see if they can successfully get Sphero across the bridge.
- Each group should record whether or not their bridge was successful and if it failed note where the failure occurred.

PART 10: Reflection and discussion– 45 minutes

Each individual should write up their reflections on the activity. Some potential prompts and questions that you may want to ask are:

- What worked and what didn't?
- How would each student do things differently in the future?
- What materials worked best?
- What bridge type worked best?
- What was the hardest or most fun part of the challenge?

PART 11: Share your experience on @SpheroEdu

We love seeing SPRK in action! Tweet us a few photos and we'll share them with the world!

PLAY IS A
POWERFUL
TEACHER