

Bridge Engineering Unit

Divide your class into groups of four. Each group should create a company name.

Display the scenario for all groups to see and give them a written copy of it.

Scenario- (What has been asked)

The city needs your help. One end of our park has a deep ravine. There is a beautiful garden on the other side of the ravine but there is no access to it. The city would like to have a pedestrian footbridge across the ravine so that visitors can enjoy the beauty of the garden.

You and your team may decide what type of bridge is best suited for the project. Keep in mind the city does not want to detract from the beauty of the park and garden. The footbridge prototype should span a distance of two feet. It must be at least 4 ½ inches (11 cm) wide and must hold at least 10 pounds. The deck height should be set 8 inches (20.5 cm) above the ground. You will have a budget of \$200 to build your prototype.

Before you determine which type of bridge to build, you will investigate four types of bridges: a beam bridge, an arch bridge, a suspension bridge, and a truss bridge. Find out everything you can about each bridge and then use your information to help you decide as to which one would be best suited for this job.

- After reading the scenario each group will:
 - Define the problem or task
 - Identify the needs and wants of the client
 - Identify the budget
 - Identify the criteria and constraints

Content stations:

To provide students with information to help them create a solution to the task/scenario identify content they need to understand. With that in mind,

create some content stations for the groups to work through to give them the content they will need to create a solution.

Ideas for stations: tension/compression; research types of bridges; properties of materials; strength of shapes; stability; ramps

Teams will work through stations. Some stations may be facilitated, others may not. Check points should be identified for students. Teacher should monitor for misconceptions through questioning as the students move through the content stations.

Whole group discussion on types of bridges. Students should identify characteristics of each type of bridge they researched: beam, suspension, arch, and truss. Create a chart with the characteristics of each type of bridge.

Planning:

With this information, teams will brainstorm which bridge would be best for the scenario they have been given.

Four Square Brainstorm

Fold a piece of chart paper into four squares with a diamond shape in the middle. Each student will have one square. Give them 10 minutes to create what they envision as a solution to the scenario. During this time the students should not talk to each other at all. At the end of the 10 minutes, each team member will present their ideas to the rest of the group one at a time. Team members will have time to ask questions of their teammates. Team will then discuss and decide what ideas from each person are the strongest to help build their bridge.

Design Proposal

Teams will create a drawing/blueprint of what their solution will be. They will identify materials they will use and when they have a completed proposal they will submit it for approval.

Build

Teams will build their bridge. During this phase they should test the bridge, check to make sure they have answered all the criteria and constraints. This is a process of testing, refining, retesting and coming up with a final product. Each change that is made should be recorded and an explanation should be written. When they are satisfied with their product they will create a presentation.

Communication/Presentation

Team will present their product. They will share what they learned and how they made their choices for the final product. They should explain the changes they made during their testing. They should also include some ideas of what they could do to improve the design. Audience may ask questions.

Engineering Design Process Examples

Ask: Identify the problem
Imagine: Brainstorm all ideas
Plan: Share ideas and narrow down what would work
Create: Build your product
Test/ Retest: Test, redesign, evaluate
Final Product: Create your final product
Present: Share your final product

Tension and Compression

1. Ask the students to pair up and stand facing their partner. Have each team member grasp the other's forearms. Both students should lean back, letting their arms stretch out between them. Go around to each pair of students and gently lean on top of their arms to test their structure. Explain that when you lean of them you are pushing down and causing their arms to stretch or be put into tension.
2. Have the team partners press the palms of their hands together and lean toward one another, making an arch with their bodies. Go around to each pair and push on the top of the arch. Explain that when you push down you cause them to push together causing their arms to move together or be put into compression

How does a suspension bridge work?

Build a human suspension bridge with your students so they can understand how a suspension bridge works.

Materials:

Two pieces of sturdy, wide rope, each 10-12 feet in length

Photographs of various suspension bridges

16 students

Directions:

1. Two pairs of taller students- the Towers-stand across from each other and hold the ropes (cables) on their shoulders.
2. Four students act a anchors. Each one sits on the floor directly behind each tower and holds the end of the cables.
3. Eight students can act as suspenders. Four in a straight line between each of the opposing towers. They can kneel or sit while pulling the cables down toward the floor.
4. Discuss what forces are at work on the different areas of the bridge.