

Tennessee 4-H Youth Development

Building Bridges

An Introduction to the Engineering Design Process

Skill Level
Intermediate

Learner Outcomes

The learner will be able to:

- Identify the steps in the engineering design process
- Design and build a bridge using the engineering design process

Educational Standard(s) Supported

6.ETS1.1: Evaluate design constraints on solutions for maintaining ecosystems and biodiversity.

Success Indicator

Learners will be successful if they:

- Construct a bridge using the engineering design process

Time Needed

45 Minutes- One Hour

Materials List

Student handout- one per student
One file folder for each group of students
Tape for each group
Paper clips for each group
Weights- one set

Introduction to Content

This lesson introduces students to the engineering design process through a hands on activity. Through this lesson, students learn to define a problem, research solutions, set criteria, design and prototype their solution and then test their solution.

Introduction to Methodology

Students will learn the actions to take for each step of the engineering design process. Each group of students will receive a kit of materials used to construct a bridge. Students will test their designs to determine how much weight can be held by their bridges.

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Terms and Concepts Introduction

Arch Bridge- A bridge with connections at each end that is shaped like a curved arch.

Suspension Bridge- A bridge in which the weight is supported by cables that are connected to towers.

Truss Bridge-A bridge whose structure is supported by combined elements that form triangular units.

Setting the Stage and Opening Questions

Say to the students: **“How many of you had to cross a bridge to get to school in the morning? Have you ever thought of what would happen if all the bridges were closed? Today, we’re going to be learning about the engineering design process and bridge design. You will have a chance to build and test your own bridge to see how much weight it can hold. To start today’s class, we’re going to go through a brief presentation that shows different types of bridge designs that you can use for your bridge.”**

Present the bridge design PowerPoint to the students.

Experience

After sharing the presentation with the students, say the following: **“In just a moment, we are going to break up into teams of three to four and start working to design our bridges. Here are the rules for your design:**

- 1) You should design the bridge to hold the maximum amount of weight possible.**
- 2) You can design and build the structure in any way that you like, but it must be portable.**
- 3) You will have 20 minutes to sketch your design and have it approved before you start the building process.”**

Break students into groups and have them begin the design process on their handout. The time allowed for this step can be altered depending on the time in the classroom, but students should have at least 15 minutes for this portion of the activity.

Tips for Engagement

As students design and build their bridges, ensure that all students are engaged in the process. Consider having students assign roles to each person in the group.

Possible roles include:

Time Keeper- Responsible to keeping time for the group

Materials Manager- Organizes and distributes materials

Scribe- Takes notes for the group

Communications Specialist- Presents the design to the class

Share

As students complete their design, bring the class to a stopping point and have each group share their design. Briefly discuss with the students how each group's design is different and how they are similar.

Process

After the students have shared their designs, ask them to begin the building process. Allow students approximately 20 minutes to build their bridges. They are free to test their bridges during this time and make revisions. Remind students to document each step of the design process on their handout.

Generalize

After all the groups have built their bridges, have the students test their bridges one at a time in front of the class. Record the weight that each bridge holds on the board.

Apply

Ask the students the following questions:

“After seeing the other designs, what would you change about your design?”

“What are some things you learned about the engineering design process from today's lesson? In what ways can you use that outside of class?”

Life Skill(s) from TIPP's for 4-H

6th Grade

Identify the parts, steps and necessary sequence or order to achieve a goal. (Head Managing)

Supplemental Information

Educational Standards Met

6.ETS1.1: Evaluate design constraints on solutions for maintaining ecosystems and biodiversity.

Programs in agriculture and natural resources, 4-H youth development, family and consumer sciences, and resource development. University of Tennessee Institute of Agriculture, U.S. Department of Agriculture and county governments cooperating. UT Extension provides equal opportunities in programs and employment.