START to STEM

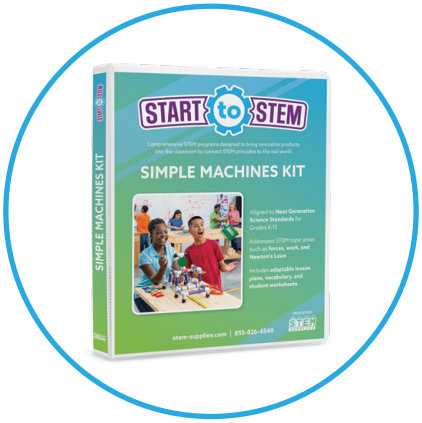
A turn-key solution to STEM!

What is Start to STEM?

Start to STEM is a comprehensive STEM program designed to bring innovative products into the classroom to connect STEM principles to the real world. You have the option to customize your program to create the best solution for your school. We offer:

Engaging STEM Products

- Equipment for a class size of 24
- Centralized around a core STEM topic area
- Reusable for years to come



Day-by-Day Lesson Plans

- Aligned to national education standards
- Scalable across different grade levels
- Includes lessons, vocabulary, equipment instructions, student worksheets, and more

Virtual Professional Development

- Live virtual training with a STEM expert
- Expanded overview of equipment and activities
- Opportunity to learn best practices in using the equipment and teaching real-world applicable STEM lessons

Ready to start your STEM journey?

Whether you're a STEM veteran or new to STEM teaching, we're here to help. The Start to STEM program was designed as a turn-key solution that focuses on real-world applications of STEM fields through hands-on and inquiry-based methods. We're here to provide you the best teaching and learning experience for classrooms, makerspaces, and everything in-between.

Contact Us Today!

stem-supplies.com/start-to-stem | orders@stem-supplies.com | (855) 826-4540

MAKERSPACE

START to STEM
Comprehensive Curriculum Packages

With the integration of new science standards around the United States, educators now face requirements of integrating inquiry-based pedagogy into their teaching while incorporating interdisciplinary content through science, technology, engineering, and math. One of the best places to apply 21st century skills is in the makerspace. A makerspace is any venue that promotes creativity, design-thinking, and tinkering. A makerspace can live on a cart, in a closet, in the corner of a classroom, or even have its own wing at a school. The Start to STEM Makerspace Kit allows you to turn any space into a makerspace with engaging building supplies that can be stored on an included makerspace cart.

The Start to STEM Makerspace Complete Kit includes hands-on equipment for 24 students, a comprehensive curriculum manual aligned to the Next Generation Science Standards, and a three-hour virtual professional development training. You also have the option to purchase the equipment or the manual alone, as well as the equipment and the manual without the training.

Top Subject Areas Covered:

Engineering Design Process

Simple and Complex Machines

Sustainability

Structures

Lesson Objectives:

Daily Instruction Topics	Example Learning Objective
What is Engineering?	Understand that engineers create solutions for problems using the engineering design process.
Bridge Building	Build a bridge with the largest gap between sides that can hold a designated load.
Recycling Materials	Learn how to reuse straws in a sustainable way.
Open-Ended Design	Create a solution to a real-world problem using limited supplies.
Rube Goldberg Machines	Learn what simple and complex machines are.

Learning Objectives

- Understand that wood is a common material used by engineers.
- Using the Keva planks only, build a bridge with the largest gap between sides tat can hold a designated load.

Equipment List

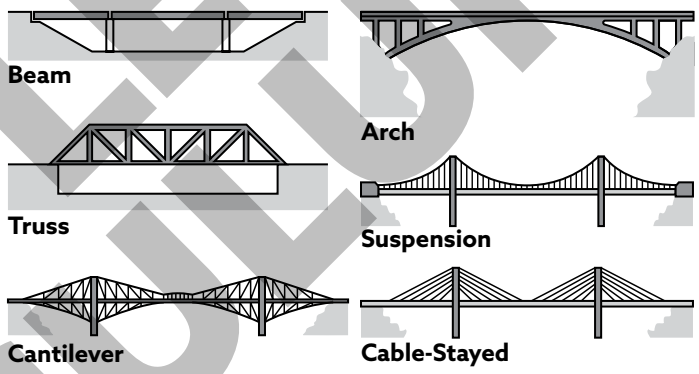
- Keva Planks
- Rulers (from FabricationStation® Deluxe Set and Makerspace Tool Bag)

Suggested Timing

- 60+ minutes

SET UP

- Divide students into small groups.
- Give each group a set number of Keva planks and the "Bridge Building Design Challenge" worksheet from the appendix section.



TEACH

A bridge is a structure built to span a gap (like a river) and must be made strong enough to support traveling people or vehicles. Civil engineers use the engineering design process to design and build bridges.

There are several types of bridges – arch, beam, cantilever, truss, cable-stayed, and suspension. Bridges can be constructed from many different materials including wood, metal, or stone. The material and type of bridge design chosen depends on the requirements of the project (i.e. what is being transported, the weather where it is located, etc.).

- Students must brainstorm with their group before building their bridge.
- Groups work together, using the materials in any manner they choose, to execute their design.
- Groups have an unlimited number of iterations they can make; however, when the time ends, their design at that point is their final design.
- Students must record notes on their worksheet, describing each prototype they make.
- Students must share their final designs with the class.

REFLECTION QUESTIONS

- What kind of engineers design and build bridges?
- What types of bridges are there?
- Why are triangles such an important shape in bridges?
- What types of structures besides bridges are typically made from wood in the real world?
- How do engineers decide what materials to use when they build structures?

NGSS Alignment

ETS1.A: Defining and Delimiting Engineering Problems
• The more precisely a design task's criteria and constraints can be defined, the more likely it is that the designed solution will be successful. Specification of constraints includes consideration of scientific principles and other relevant knowledge that are likely to limit possible solutions.

ETS1.C: Optimizing the Design Solution
• The iterative process of testing the most promising solutions and modifying what is proposed on the basis of the test results leads to greater refinement and ultimately to an optimal solution.

Vocabulary

- **Truss** – a framework made out of a series of triangular structures
- **Abutment** – a structure built to support the pressure of a span, e.g. at the ends of a bridge

Worksheets

- Bridge Building Design Challenge, p 17

TEACHING SUGGESTIONS

- Outline the rules on the board so the expectations for the challenge are clear.
- Make sure to give students frequent updates of how much time is remaining to complete the challenge.
- Work with groups using the engineering design process to work through any issues with the bridges.

ADDITIONAL LESSON OPTIONS

- Instead of the largest gap with a constant load, challenge students to make a bridge to hold the largest load. Provide weights or objects for the bridge to hold.
- Combine multiple groups to make longer bridges with wider gaps.
- Challenge each group to make a different type of bridge (e.g., truss, beam, arch, etc.).
- Challenge groups to recreate famous bridges (e.g., Golden Gate Bridge).

TEACHER REFLECTION

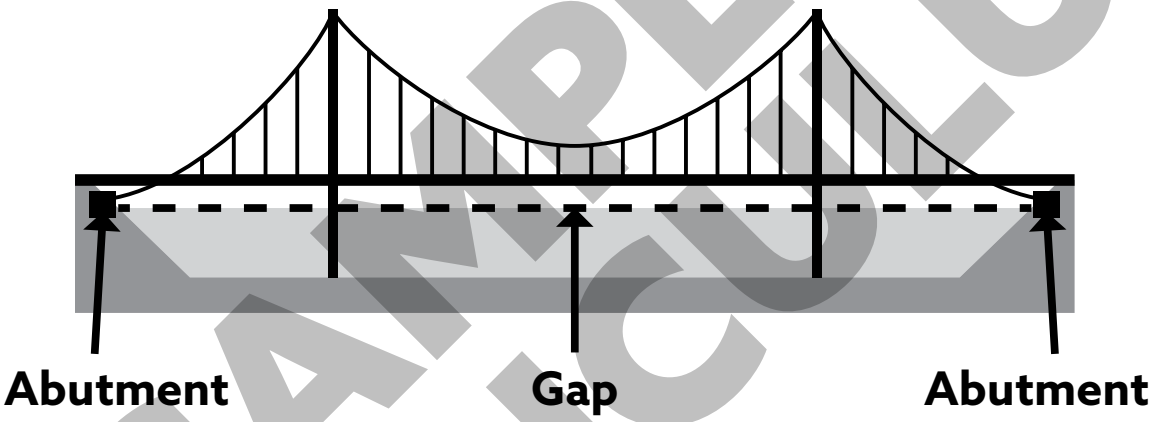
BRIDGE BUILDING DESIGN CHALLENGE

Name: _____

Partner Name(s): _____

Define and Research the Problem:
You and your team must build a bridge with the widest gap. Your bridge can only use wooden planks provided to you by your teacher. You are free to use these planks in any way that you choose, but these are your only supply (i.e. you cannot use tape, glue, etc.). Additionally, your bridge must support a load/weight provided by your teacher.

The gap that the bridge spans is defined by the distance between the bridges supports on each end. These bridge supports are called abutments, and are a structure that connects the deck of a bridge to the ground:



You have an unlimited number of prototypes that you can make in the amount of time you are given, but once time ends, your current design at that point is your final design. At that point, your group must measure the gap and present the design to the class.

Brainstorm and Prototype a Solution:
In the space below, draw your plan for a bridge. Consider the different ways planks can be stacked and fit together to build a bridge with the largest gap between sides that can hold a designated load.

Testing and Improving Your Solution:
Keep a record of the number of prototypes you create. What worked in each iteration? What needed to be changed?

Prototype	What worked?	What needed to change?
1		
2		
3		
4		
5		

If you have more than 5 prototypes, use an additional sheet of paper.

Sharing the Best Solution:
How wide was the gap in your final bridge?_____

Did your bridge support the load without collapsing?_____

What was different in your final design from the bridge you originally sketched?

_____

_____

_____

_____

If you were going to do this challenge again, what would you do differently?

_____

_____

_____

_____