**WAMC Lab Template**

Math Concept(s): Congruent Triangles

Source / Text: N/A

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**Attach the following documents:**

- Lab Instructions
- Student Handout(s)
- Rubric and/or Assessment Tool

**Short Description (Be sure to include where in your instruction this lab takes place):**

- Students will build a popsicle stick bridge using only congruent triangles.

**Lab Plan**

Lab Title: Popsicle Bridge

Prerequisite skills: Congruent triangles, precision glueing

Lab objective: Build a bridge completely out of congruent triangles that can hold the most weight possible.

**Standards:** *(Note SPECIFIC relationship to Science, Technology, and/or Engineering)*

Mathematics K–12 Learning Standards:

- HSG-CO.C.10 Prove theorems about triangles.

Standards for Mathematical Practice:

- 3. Construct viable arguments and critique the reasoning of others.
- 4. Model with mathematics.
- 6. Attend to precision.

K-12 Learning Standards-ELA (Reading, Writing, Speaking & Listening):

- SL.8.1 Engage effectively in a range of collaborative discussions (one-on-one, in groups, and teacher-led) with diverse partners on grade 8 topics, texts, and issues, building on others' ideas and expressing their own clearly.

K-12 Science Standards

- MS-ETS1-2 Evaluate competing design solutions using a systematic process to determine how well they meet the criteria and constraints of the problem.

Technology

- N/A

Engineering

- Use mathematical models and/or computer simulations to predict the effects of a design solution on systems and/or the interactions between systems. (HS-ETS1-4)

Leadership/21st Century Skills:

21st Century Interdisciplinary themes (Check those that apply to the above activity.)

☐ Global Awareness ☐ Financial/Economic/Business/Entrepreneurial Literacy ☐ Civic Literacy
☒ Health/Safety Literacy ☐ Environmental Literacy

21st Century Skills (Check those that students will demonstrate in the above activity.)

**LEARNING AND INNOVATION**
Creativity and Innovation
☒ Think Creatively
☒ Work Creatively with Others
☐ Implement Innovations
Critical Thinking and Problem Solving
☒ Reason Effectively
☐ Use Systems Thinking
☒ Make Judgments and Decisions
☐ Solve Problems
Communication and Collaboration
☒ Communicate Clearly
☒ Collaborate with Others

**INFORMATION, MEDIA & TECHNOLOGY SKILLS**
Information Literacy
☒ Access and Evaluate Information
☐ Use and manage Information
Media Literacy
☐ Analyze Media
☐ Create Media Products
Information, Communications and Technology (ICT Literacy)
☐ Apply Technology Effectively

**LIFE & CAREER SKILLS**
Flexibility and Adaptability
☒ Adapt to Change
☒ Be Flexible
Initiative and Self-Direction
☒ Manage Goals and Time
☐ Work Independently
☒ Be Self-Directed Learners
Social and Cross-Cultural
☒ Interact Effectively with Others
☒ Work Effectively in Diverse Teams

**Productivity and Accountability**
☒ Manage Projects
☒ Produce Results
Leadership and Responsibility
☒ Guide and Lead Others
☒ Be Responsible to Others

## Teacher Preparation: (What materials and set-up are required for this lab?)

Materials

- Plenty of popsicle sticks
- Pencil
- Paper for designs
- Protractor
- Safety goggles

Set-Up Required:

- Some sort of wench or weights to test bridges

## Lab Organization Strategies:

Leadership (Connect to 21st Century Skills selected):

- Students will have to work cooperatively in groups, allowing for roles and responsibilities for each member.

Cooperative Learning:

- All of this is done through groups. Students will have to agree on a plan and design for their bridge, along with building it together.

Expectations:

- Students will design a bridge made from congruent triangles that can at least span the 1.5-foot gap.

Timeline:

- Students will have a day for planning and design, a day for construction and testing, then a day for the real thing.

**Post Lab Follow-Up/Conclusions:**

Discuss real world application of learning from lab

- Building actual bridges, construction of all sorts

Career Applications

- Construction, Engineering, Physics

Optional or Extension Activities

- Try different shapes other than triangles. How can we replicate other bridges made in the real world.

## Lab Instructions

1. Gather and set up materials. At this point, students should already have a plan with their bridges. Now all they need to do is build it. They will need a lot of popsicle sticks, protractors to check angles for congruent triangles, pencils, and their plan in case they need to make changes. Your weight system or wench should also be set up at this point in case anyone finishes before the class period ends.

2. Build the popsicle bridge according to your plans. Remember, your bridge must be made of congruent triangles and span 1.5 feet.

3. Test your bridge. Weight will be added until the bridge breaks. Remember to don safety goggles.

4. Answer the questions given in the student handout.

Answer questions 1, 2, and 3 before testing your bridge. Once your bridge breaks, answer the questions past 3.

1. With your bridge design, how do you know the triangles are congruent?

2. The length of a popsicle stick is 4.5 inches. Calculate the volume of your bridge.

3. Here is a space for recording the amount of weight held by your bridge.

4. A modern beam bridge can span up to 200 ft. Let's suppose our bridge has a scale of 1:100. Approximately how long is your bridge? Scale the weight by the same amount, how much can your bridge hold?

| Requisite | Possible Points | Your Score |
|---|---|---|
| Questions on the handout are answered | 10 | |
| Your bridge spans the gap | 10 | |
| Your bridge is made of congruent triangles and can be proven | 30 | |
| **Total** | **50** | |

Bonus points (5) to be awarded for most weight held, most creative design of congruent triangles, and most beautiful design.