WAMC Lab Template

Math Concept(s): Explore the need for congruent triangles for strength and stability.
Source / Text: Illustrative Math HS Geometry Unit 2 Lesson 3
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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):

After prerequisite skill – students will watch only the start of a video about strong stable supportive shapes. They will be encouraged to build square then triangular structures and test how much load they can hold. More video can be shown for details on tetrahedrons or adding triangular supports to other shapes. The goal is to experiment, allow structures to fail, and learn by doing.

Lab Plan

Lab Title: Build the strongest structure – what will it hold?

Prerequisite skills: Corresponding points are connected in the same order for congruent polygons.

Lab objective: To understand why triangles (and congruent triangles) are critical in construction which leads to the need for efficient methods to check for congruence. To explain what features of construction materials and methods produce triangles that are/are not congruent.

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

Mathematics K–12 Learning Standards: .G.A.2

- Understand that a two-dimensional figure is congruent to another if the second can be obtained from the first by a sequence of rotations, reflections, and translations; given two congruent figures, describe a sequence that exhibits the congruence between them

Standards for Mathematical Practice:

- MP1: Make sense of problems and persevere in solving them

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

- Initiate and participate effectively in a range of collaborative discussions (one on-one, in groups, and teacher-led) with diverse partners on grades 11–12 topics, texts, and issues, building on others' ideas and expressing their own clearly and persuasively.

K-12 Science Standards

- HS-ETS1-2. Design a solution to a complex real-world problem by breaking it down into smaller, more manageable problems that can be solved through engineering.

Technology

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Engineering

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Leadership/21st Century Skills:

- 1.B Work Creatively with Others
- Student Outcome: The student will demonstrate the ability to incorporate and utilize the principles of group dynamics in a variety of settings

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
☐XThink 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
M edia 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

- Toothpicks and gummy worms.
- Clipboard and any heavy objects that can be placed on clipboard (bottled water, tape dispenser etc)

Set-Up Required:

- Search Youtube: strong structures with triangles. Show ONLY the first minute

Lab Organization Strategies:

Leadership (Connect to 21st Century Skills selected):

- After Lab intro, get input from class on "Specs" for building. Can we use double toothpicks? Size of gummies? Everyone try anything and see what innovations arise? Work individually or in pairs? Expectation for collaboration and agreement.

Cooperative Learning:

- Students work in pairs, but as each has new ideas, they can build individually and share results for what is working/not working as they go.

Expectations:

- Be willing to watch your structure fail. Then try something new

Timeline:

- Agree on ample time, after which there will be a final contest between structures for most weight and/or longest time supporting the same weight.

Post Lab Follow-Up/Conclusions:

Discuss real world application of learning from lab

- How long do bridges last? Do you remember news stories of bridges failing? Was it the engineering structure or something else (longevity of materials?)
- Go out on the internet to find pictures of structures that use triangles. Where would it be important for the triangles in the structures to be congruent? Why?

Career Applications

- Engineering, construction, even a wedding cake

Optional or Extension Activities

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Lab Instructions:

Experiment with toothpicks and gummy worms. Build structures using all squares and others using all triangles. Place objects with a flat surface on top of your structures. What happens? Can you improve your designs? How much can your strongest structure hold? For how long?

Square/cube structures

Triangle/pyramid structures

Student Handouts:

Assessment: