Marshghetti Bridges: Design, Build, Test

A Learning Activity for Grades 6-8

Overview

Roads and bridges are a critical part of a society's infrastructure. They are used to visit relatives, participate in activities, travel to school and as supply chain routes for accessing the things we need to live! The road and bridge building process includes a wide range of skilled workers; from those who plan and design, to the site preparation and construction, the finishing, and the maintaining and repairing of these important community connectors. In this lesson, learners will explore the design process, while using critical thinking skills to problem solve within a set of challenge parameters, to create their own marshmallow and spaghetti bridge structure!

NB Curricular Connections

Middle Block Learning Areas
Technology: ○ *Strand:* Design Thinking Skills - *Big Idea:* Problem Solving – *Skill Descriptor:* Plan, execute (construct) and present a project within given parameters and with assistance
Mathematics: ○ *Strand:* Shape and Space - *Big Idea:* 2-D Shapes and 3-D Objects
Personal Wellness: ○ *Strand:* Career Connected Learning - *Big Idea:* Experiencing Potential Career Pathways - *Skill Descriptor:* Engage in frequent and ongoing career connected experiential learning to learn about preferred career pathways and develop personal competencies.

What You'll Need

Please Note: These materials are for a class size of 28 with students in groups of 2.

- 15 – 750 g packages of spaghetti
- 15 – 400 g bags of mini-marshmallows
- 15 – 400 g bags of "regular" marshmallows
- 15 Solo cups *(this can be substituted with any container that can hold water)*
- Graph Paper
- Scissors
- PowerPoint Presentation – *Marshghetti: Design, Build, Test*

Instructions

1. Road and Bridge Building Introduction: Before reading the statements below, ask students: *What is roadbuilding? What is bridgebuilding? Are they connected? What are the potential careers associated with roadbuilding?* Allow time for learners to share their thoughts. Then, read/show them the information below (on slides 2-8 of the PowerPoint presentation).

What is Road and Bridge building?

Road building is one of the oldest professions in the world with the first road estimated to have been built in 4,000 BC!

Roads and bridges play a crucial role in economic development, linking communities, enabling trade and improving accessibility.

The process includes a group of people from laborers to engineering professionals coming together to make the world a better, more accessible place!

What are potential careers associated with roadbuilding?

- *Business Operations* – Human Resources, Finance, Estimators, Marketing/Sales
- *Professionals* – Industrial Engineers, Civil/Mechanical Engineers, Design, Engineer Technologists, Quality Control, Occupational Health and Safety
- *Skilled Trades* – Carpenters, Labourers, Form Builders, Welders, Heavy Mechanics
- *Operators* – Truck and Transport, Heavy Equipment. Crane Operators

2. Bridge Designs and Elements Exploration: Before reading the statements below, ask students: *What are some different designs/types of bridges? What ae the key elements/parts of a bridge?* Allow time for learners to share their thoughts. Then, read/show them the information below (on slides 10-16 of the PowerPoint presentation).

What are some different designs/types of bridges?

Beam – Utilizes a horizontal beam supported at both ends by abutments and piers/footings in the middle.
Arch – Utilizes a curved arch that transfers weight to the abutments at either end.
Truss – Utilizes a series of interconnected triangular units that distribute weight efficiently.
Suspension – Utilizes cables that hang from tall towers, which bear most of the load.
Cantilever – Utilizes horizontal sections (cantilevers) supported at only one end, extending outwards before connecting
Covered – Primarily wood in structure and has a roof to protect the deck from rotting

What are the key elements/parts of a bridge?

Foundation

Footings – The base of piers and abutments that distribute weight to the foundation.
Piles – Deep structural elements driven into the ground or riverbed to provide stability.

Sub Structure

Piers – Vertical supports placed at intervals to hold up the bridge deck.
Abutments – Structures at the ends of the bridge that support the load and connect the bridge to the ground.

Super Structure

Deck – The surface where vehicles or pedestrians travel. It is often made of concrete, steel, or wood.
Beams – Horizontal supports that hold up the deck and distribute the load.
Railings – Safety barriers that prevent vehicles or pedestrians from falling off the bridge.
Abutments – Structures at the ends of the bridge that support the load and connect the bridge to the ground.

3. Bridge Building Competition: In this activity, students build a miniature model of a bridge. They will only use marshmallows and spaghetti to construct their bridge. Using slide 17, review the Bridge Building Challenge!

Each bridge **MUST**:

- Span a minimum of 30 cm (12”)
- Have a deck (platform) to place the red cup
- Support one cup full of water
- Not use any other materials other than spaghetti and marshmallows!

Each bridge **SHOULD** consider:

- Creative Design Elements
- Clean Building Work
- Material Cost Efficiency
- Bridge Design Representation

4. Competition Judging Categories: Have students create bridges that demonstrate the most creative design, the most economical design (and still hold a cup of water), best bridge design replication (ie: Cantilever, Covered, etc) and the best overall bridge creation.

5. Pair & Share: Give time for learners to do a Pair & Share – small groups showing and sharing about their bridge building exploration with another group. Have each group share with one another something that went well, something that they would change for next time, and one challenge that they overcame.

Extension Ideas

- Idea #1 – Maximum Load Test – Keep filling up water cups (or use weights) to place on your bridge to see how much it can hold!
- Idea #2 – Let's get creative! What are some other materials that could be used to build a bridge? Combine many materials to make a true representation of a bridge!
- Idea #3 – New Brunswick is known for its Covered Bridges. How many still exist? How many were there in 1900? What is the closest one to where you live? Pick one covered bridge and research its history. Investigate other important/famous bridges (ie: walking & train bridges) from NB history both past and present!

Reflection Activity

Please see the attached PDF for several choices on how you and your learners can reflect upon today's activity.

Global Competencies


Collaboration


Communication


Critical Thinking & Problem-Solving


Innovation, Creativity & Entrepreneurship


Fostering and Teaching Self-Awareness and Self-Management

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