ACTIVITY
BUILDING BRIDGES

Time: 240-300 minutes

Grade Level: Upper Secondary

Days of Implementation: 4-5 days

Designed by: Lizzie Muringi

Alignment with STEAM subjects

Technology: Exploring new ways to design using 3D rendering software.
Engineering: Designing and constructing working models.
Arts: Creating sketches, content, and presentation materials.

Related or achieved SDGs

- SDG 9: Industry, Innovation, and Infrastructure: Encourages innovation in sustainable solutions
- SDG 12: Responsible Consumption and Production: Promotes awareness and hands-on experiences.
- SDG 17 Partnerships for the Goals: Fosters teamwork and collaboration to address challenges.

Objectives

By the end of the class, students will be able to:

- Design a bridge, drawn by hand or with 3D rendering software.
- Explore recyclable waste materials to design creative solutions.
- Test, analyze, and refine prototypes to improve efficiency.
- Present their findings and reflect on the real-world applications of their projects.

Materials Needed

- Research tools (tablets, books)
- 3D Printer
- Recyclable materials
    - Paper & Cardboard: Newspapers, office paper, magazines
    - Cardboard without corrugation (like cereal boxes)
    - Aluminum (soda cans)
    - Steel cans (from soups, sauces, beans, or fruit)
    - Plastic: #1 (PET: transparent plastics, like water and soda bottles), #2 (HDPE: usually more opaque plastics, like laundry soap and milk jugs), and #5 (yogurt, butter, sour cream containers
    - Fabric: Textiles

Lesson Plan

Introduction

What makes a bridge sustainable? In addition to being strong and safe, sustainable bridges utilize local materials and eco-friendly construction methods that blend seamlessly with their natural surroundings.

1. Inquiry & Exploration
Group Brainstorming:
How can we build a model bridge using recycled materials?
Introduce the activity, telling students that they will create a model bridge. Set parameters and guidelines around the expectations for this model bridge. For example, to ensure all the prototypes are the same size, provide parameters on the bridge's dimensions. We suggest that the model bridges have the following dimensions: a maximum width of 50 cm, a maximum length of 100 cm, and a maximum height of 75 cm.

2. Investigation & Research
Team Research:

- Research how to build a bridge with recycled materials. Some links include:
    - School Science Projects | How To Make A Bridge From Cardboard
    - DIY Recycled Suspension Bridge, Engineering 201
    - Build A Bridge | Amazeum YOU

Sketching Designs:

- Students are divided into groups to sketch possible designs for their prototype in STEAM Journals or digitally.
- Each team presents their ideas for their bridge design in pairs or to the entire class before moving to the design phase.

3. Implementation & Design

Building Prototypes:

- Guide the students in building the prototypes of their bridges, based on the parameters set forth at the beginning of the activity:
    - Option 1: Teams construct their models physically using the provided materials.
    - Option 2: Students use software to design their models using a 3D printer.
- Encourage the students to design bridges that are creative and visually appealing. This is an opportunity to merge engineering, architecture, and design skills.
- Encourage students to experiment and modify designs.

4. Testing & Reflection

Prototype Testing:

Test that the bridge does not break or fall by:

- Checking for weak joints, cracks, or loose connections.
- Ensuring all materials are correctly bonded or fastened.
- Placing small weights on the bridge

Reflection Questions:

- What worked well?
- What challenges did you face?

5. Presentation & Action

Final Presentations:

After modifying their prototypes based on the outcomes of the testing stage, students can present their final prototypes to the entire class. Alternatively, arrange a school showcase, science fair, or assembly to display the bridges for the entire school.

Criteria

- Use of recyclable materials
- Creativity of the design
- Stability and strength of the model bridge when sustaining weight
- Adherence to the original design and material list
- Display of engineering and design skills
- Practical considerations of how the project influences local sustainability, including the likelihood of long-term benefits.

Reflection

- Did students fully understand?
- What should I improve for next time?
- Was the lesson interesting enough for the students?