BUILDING BRIDGES USING TRUSSES

OUTREACH PROGRAM LESSON PLAN

WAAW foundation

Working To Advance STEM Education for African Girls

WAAW Foundation is an international non-profit organization dedicated to bringing hands-on STEM education to girls all over Africa.

Our Mission: To increase the pipeline of African women in Science, Technology, Engineering and Math (STEM) disciplines and to ensure this talent is engaged in African innovation.

Our Vision: To eradicate poverty in Africa through female education and science and technology innovation.

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Building Bridges Using Trusses

CLASS DESCRIPTION:

A construction based challenge can be an excellent project for encouraging children to think creatively, to solve problems and to express their own ideas using a range of practical materials.

In this lesson, students are going to construct various bridges that can withstand a certain amount of load (weight).

TOTAL CLASS TIME: **2 hours**

CLASS OUTCOMES:

At the end of this lesson, the students will have the platform for developing a range of critical thinking, work and life skills, including;

- Inventiveness
- Creative thinking
- Analytical thinking
- Use of a range of real life tools
- Problem solving
- Perseverance and motivation
- Evaluation and Re-designing
- Team-Building

LIST OF MATERIALS:

- 10cm by 1/2cm, 10cm by 1cm, 10cm by 2cm wood pieces
- Wood gum
- Pen and notebook.
- Weights (measured in Pounds or Kilograms)

PRE-CLASS PREPARATION AND SET-UP:

- Begin this challenge by talking about the problem and identifying what needs to be resolved.
- Brainstorm a list of challenge solutions. Encourage students to be as creative as possible and explain that no idea is a silly idea.
- Don't show your students examples of finished projects before beginning as this is likely to hinder their creativity and problem solving skills.
- Collect your materials and talk through problems and challenges as they build.

INTRODUCTION (15 minutes)

Truss is a framework, typically consisting of rafters, posts, and struts, supporting a roof, bridge, or other structure

A Bridge is a structure carrying a road, path, railroad, or canal across a river, road, railroad, or other obstacle.

Ask your students the following questions:

1. Can you name a bridge?
2. Have you seen a bridge from a train or airplane?
3. Have you seen a bridge being built?
4. Have you walk over a bridge?
5. Have you seen a pedestrian bridge?
6. Have you seen an arch bridge?
7. Do you cross a bridge to go home?

This construction challenge requires you to build bridges using local materials around us. We will achieve this by creating different designs and testing them to determine the strongest of them all.

The Engineering Design process requires you to:

With teams of students, encourage openness and sharing of ideas.

Collaboration and sharing often lead students to develop more sophisticated responses when designing and building problems occur

DESIGN (20 minutes):

Geometric Shapes in Bridge Trusses

There are six main designs of trusses.

- Square
- Rectangle that is not square
- Parallelogram
- Rhombus
- Triangle within one square
- Arch

You're now working to construct a bridge based on principles and efficiency
So what can you do two make a strong structure with these materials?

The strongest bridge known in architecture is a truss bridge, made of a calculated series of triangles. When you push anywhere on a triangle, it either contracts or expands (tries and fails) instead of bending.

If all three sides are made of rigid material, the angles are fixed and cannot get larger or smaller without breaking at the joints, unlike a rectangle, for example, which can turn into a parallelogram and even collapse totally.

If you take a rectangle and place one diagonal piece from corner to corner, you can make that strong and stable, too, but doing that...
makes two triangles!!

An arch bridge is really just a pretty series of triangles arranged in a different way.

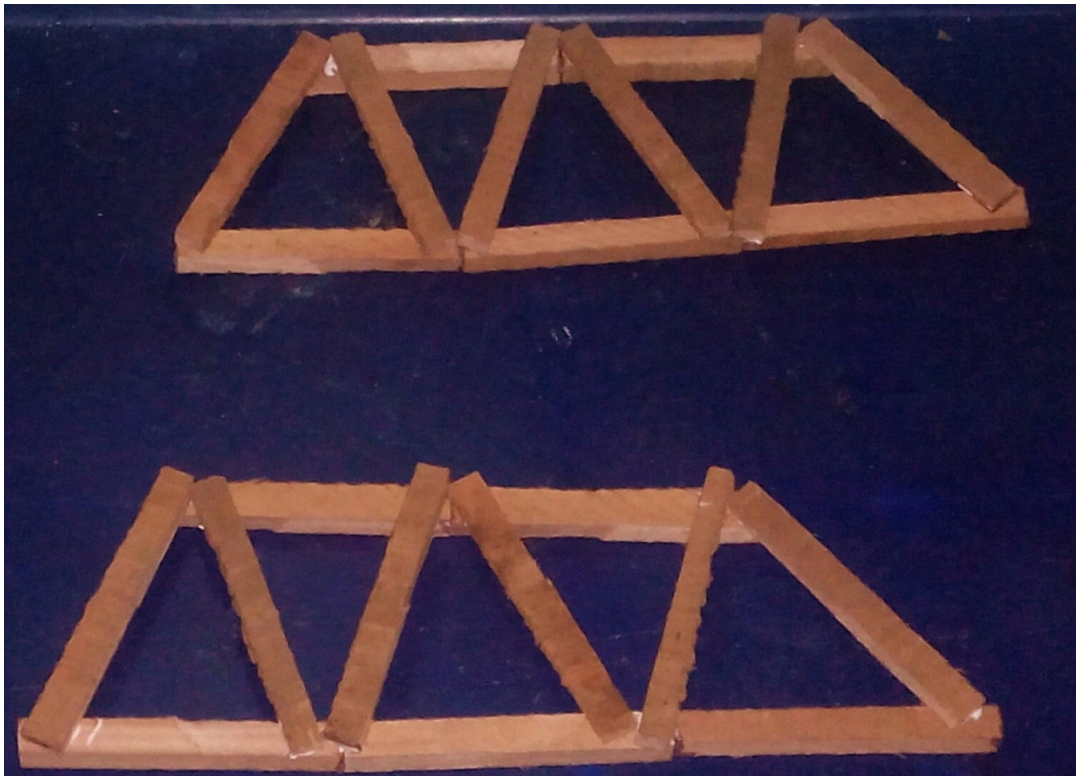
Each team of students is to build a different bridge.

So 6 teams will build 6 different bridges according to the geometrical shapes outlined.

BUILD (50 minutes)

This is where we actually pull our imaginations and designs into reality!

For example: the picture below shows the first building stage of a bridge using the triangular truss.



Note: The wood gum can take time to get dried, so ensure the building process is done strategically and sequentially in order to save time!

When students get stuck instead of providing them with an answer ask a series of probing questions to help them to describe what they think is happening and how they might find alternative solutions.

TEST (20 MINUTES)

Different structures and shapes have different load-bearing capabilities.
Test the bridges by placing weights on top and underneath. Then take note when the bridge is just about to bend/break.
This determines the amount of load each bridge can withstand!

Place load on top

Place load underneath

The point of breaking!

The triangle is the strongest geometric shape.
The triangle is common in all sorts of building supports and trusses.
It is strong because the three legs of a triangle define only one triangle.

Help children to accept that false starts and wrong turns are part of the learning process and that revision, tests and redesigns are often a necessary part of the process.

CONCLUSION(15 minutes)

What did you observe?

- Provide results of strength of bridge comparing the loads to that of other bridges.
- Present results of conclusions.
- Talk about which brainstormed solutions are most achievable given limits on materials, tools and time.

EXPLORE, PLAY & SHARE!

- Talk about completed inventions
- What is the best feature of the invention?
- What would you improve if you had more time?
- What was the most difficult part of the invention to build?
- What would you do differently next time?
- What are the real-world applications of this lesson?

Ensure the students discuss their observations.

Relate this lesson to various Real-world Applications.

The Key here is **problem solving**.

REFERENCES

To learn more, check out this site:

http://www.instructables.com/id/Popsicle-Stick-Bridge/

Instructors should always make more research to stay updated and become more proficient.