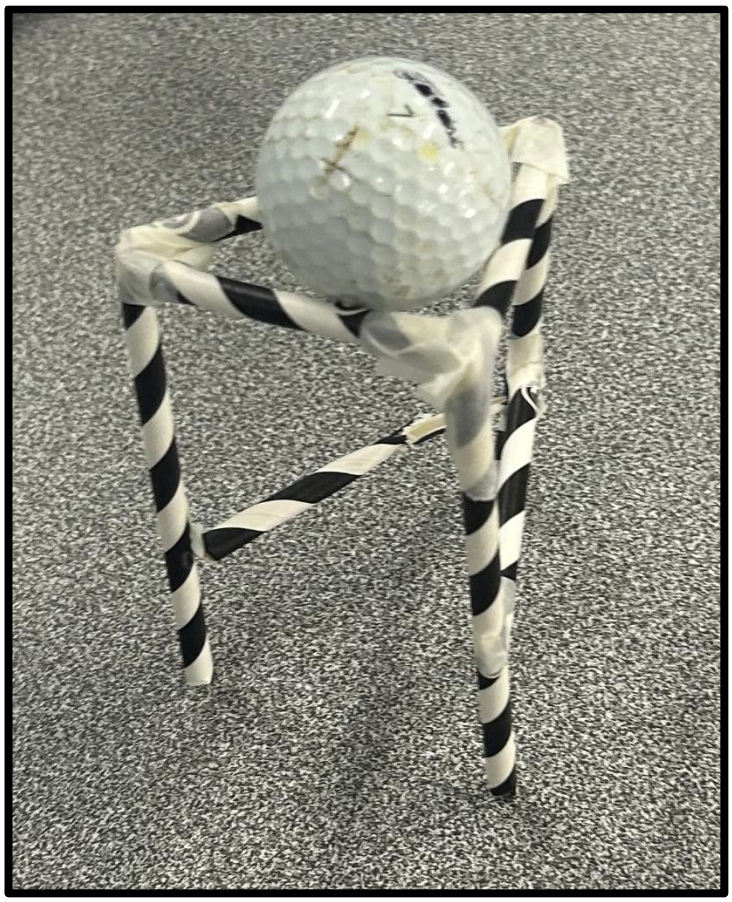


Design and Construction of a Structure to Support a Golf Ball

Subject: iSTEM

Student Name: Finnegan Neal

Introduction

Context

This report documents a hands-on classroom engineering challenge that required the construction of a lightweight structure capable of supporting a golf ball using 6 x paper straws and paper masking tape.

Statement of the Problem

The model of the strongest Straw Water Tower is to hold a golf ball securely using the least amount of paper straws inspired by truss structure that hold heavy water tanks.

Aims of the Project

The main aims of this project were to:

- Develop a stable structure using the bare minimum of materials
- Apply basic principles of engineering and physics
- Encourage problem-solving, critical thinking, and creativity
- Test the load-bearing capabilities of lightweight materials

Purpose of the Report

The purpose of this report is to document the entire design process from planning and research to construction and evaluation. It is also reflection on the effectiveness of a Straw Water tower model in solving the problem involved designing a structure using only basic materials like paper straws and tape that could support the weight of a golf ball.

Main Body

Methodology

The goal was to design and build a structure using paper straws that could support a golf ball.

Material List

- 6 paper straws
- Paper Masking Tape
- 1 golf ball

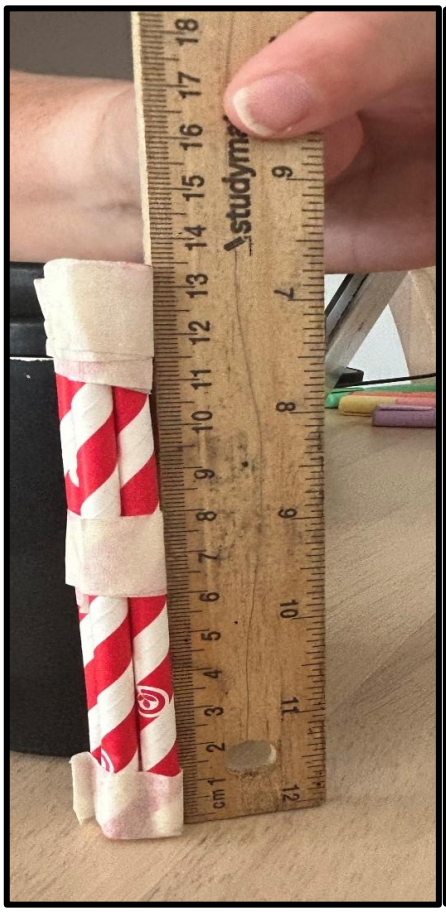
Evidence of Research

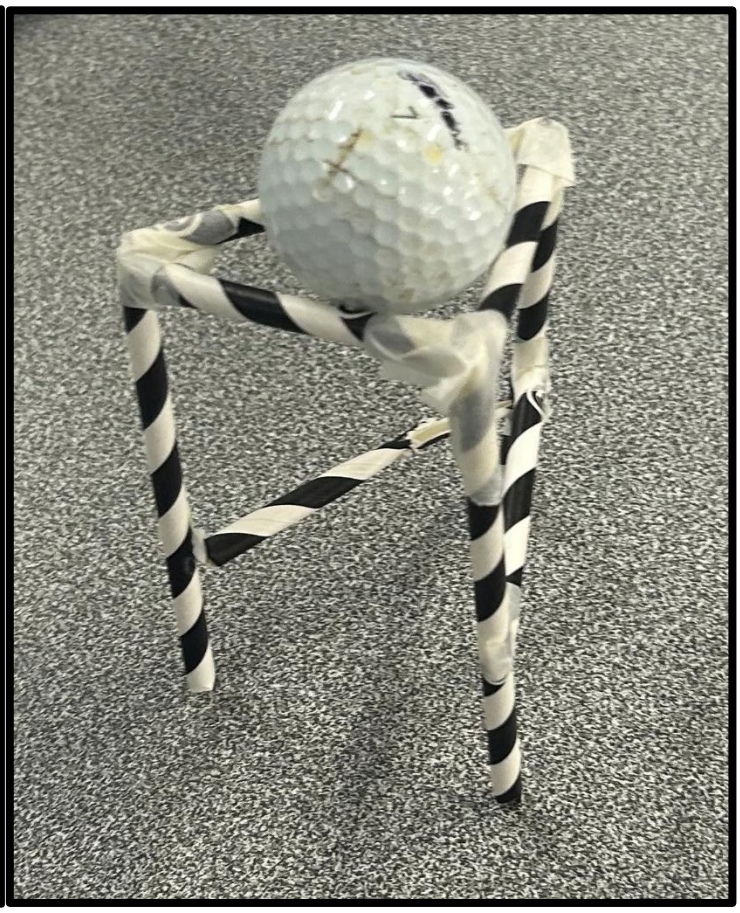
Research was conducted on basic structural engineering concepts of:

- **Triangles for stability:** Triangular shapes distribute weight.
- **Centre of gravity:** Keeping the ball centred and balanced.
- **Weight distribution:** Equal-length legs and symmetrical designs help prevent tipping.

Previous studies and experiments have shown the importance of shape and structural reinforcement in engineering. For example:

- Triangular supports are commonly used in bridge and tower design due to their ability to evenly distribute forces
- Structures with a low centre of gravity and symmetrical weight distribution are more stable



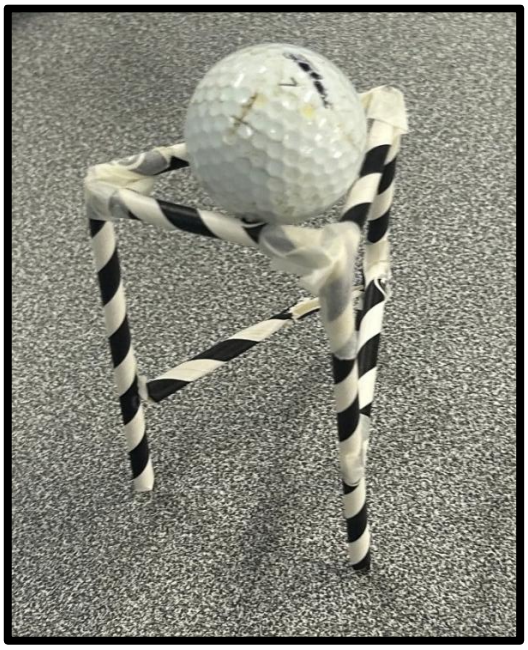


The **image on the left** is a failed project: The tower is built with 8 x 13cm vertical straws taped together, but there are no supports to stop it from bending or collapsing sideways.

The **image on the right** with the golf ball: The golf ball is pushing down, and the structure is pushing back up to keep it in place.

Evidence of Completion

This photo shows the model paper straw water tower successfully supporting the golf ball weighing 45.93 grams and 42.97mm circumference. The structure used 3 x 13cm main legs with 2 x 5 cm diagonal support straws secured with a masking tape. The equilateral triangular platform is also secured with masking tape.



Procedure Recount

1. Gathered all materials.
2. Brainstormed and sketched three basic structural ideas were researched
3. Prototypes were built and tested
4. Tested structure with golf ball initially unstable.
5. Chose the triangular-style design for balance and simplicity.
6. Cut straws to even 13 cm lengths for the legs.
7. Used masking tape to secure joints and build a stable equilateral triangular top platform.
8. Reinforced legs with additional straws taped diagonally.
9. Final structure held the ball securely and stood independently.

Scope and Limitations

The project was limited to materials provided in class were paper straws, masking tape and a golf ball (45.93 grams and 42.67 millimetres).

Evaluation

Conclusion

Successes

The Straw Water Tower model was successful because it met its original aim of designing and constructing a stable structure capable of supporting a golf ball using paper straws and masking tape. Drawing from basic engineering principles such as weight distribution, the use of triangular support, and balance; the final structure proved capable of withstanding the load while maintaining upright stability. The use of triangular bracing provided essential lateral support by preventing the legs from spreading outward, as triangles are a strong structural shape that resists deformation. Equal leg lengths ensured the top platform was level, which helped maintain balance and kept the golf ball from rolling off. Strong taping at the joints secured all parts of the structure, allowing it to withstand shear forces and hold its shape under pressure. Several features of the final straw tower design contributed to its success in meeting the aim of building a tall and stable structure using as few materials as possible.

Recommendations

The Straw Water Tower model needs the following modifications:

- **Additional Triangular Bracing**:
  Adding more diagonal straws to form triangles on all sides of the structure would increase its overall stability. This would help prevent the legs from shifting or collapsing under uneven pressure, especially if the golf ball isn't placed exactly in the centre.
- **Wider Base**:
  Increasing the distance between the legs at the base would lower the centre of gravity and provide better balance. A wider base makes the structure less likely to tip over, especially as height increases.
- **Bundled Straw Legs**:
  Reinforcing each leg by taping two or three straws together would make the vertical supports stronger and more resistant to compression.