County Implementation Award Program (CIAP) Math and Science Lesson

Unit Title:
Forces and Interactions (Adding Weight to a Structure)

Lesson Title:
Post it Note Tower
(Beginning of the year/ engineering foundations/ group work foundations)

Author: Julie Hansell

Grade Level: Third Grade

Time Frame: Up to 2 lesson periods ~ 45 minutes each
Lesson can be stopped after individual exploration, if time requires.

Targeted Standard(s):

Math- Measurement Geometric measurement: recognize perimeter.
CCSS.MATH.CONTENT.3.MD. D.8

NGSS K-2 Engineering. 3-5-ETS1-2. Generate and compare multiple possible solutions to a problem based on how well each is likely to meet the criteria and constraints of the problem.

ELA Speaking and Listening Comprehension and Collaboration: **CCSS.ELA-LITERACY.SL.3.1**

ELD Interacting in Meaningful Ways Exchanging information and ideas with others through oral collaborative discussions on a range of social and academic topics.

Targeted Phenomenon:
Show students the video of the human tower of Barcelona competition:
https://www.barcelona.de/en/barcelona-castellers-human-towers.html

Ask students to note what they notice and wonder as the tower is built. Have students share questions.

Introduce the engineering problem that will engage them with the practice: You are going to be entering the tower competition. Your team has decided to plan out a stacking strategy to help you create the tallest tower you can.

Three Dimensions of NGSS

Science & Engineering Practice/s (SEP): Constructing Explanations and Designing Solutions
Constructing explanations and designing solutions in 3–5 builds on K–2 experiences and progresses to the use of evidence in constructing explanations that specify variables that describe and predict phenomena and in designing multiple solutions to design problems.

- Generate and compare multiple solutions to a problem based on how well they meet the criteria and constraints of the design problem.

Crosscutting Concept/s (CCC): Influence of Science, Engineering, and Technology on Society and the Natural World

- Engineers improve existing technologies or develop new ones to increase their benefits, decrease known risks, and meet societal demands.

Disciplinary Core Idea/s (DCI):ETS1.B: Developing Possible Solutions

- Research on a problem should be carried out before beginning to design a solution. Testing a solution involves investigating how well it performs under a range of likely conditions.
- At whatever stage, communicating with peers about proposed solutions is an important part of the design process, and shared ideas can lead to improved designs.

Language Supports:
Activate prior knowledge- Names of 3D Shapes
Collect words that describe what a structure need
Provide opportunities to support student talk and writing using academic language and sentence starters, as needed.

Materials Needed: 5 Post It notes and one ruler per student

Objective(s): Once given the engineering problem:

Given 5 post it notes student will accurately measure perimeter of one note paper. Students will predict possible height using 15 note papers.
Given time to build individually, student will create shapes with their 5 note papers.
Using norms for group work, student teams of 3 will work together to share ideas and create a post it note tower that is a tall as possible.
Students will be able to articulate how they worked together and whether they were or were not able to create a tower.

How Math and Science concepts/skills/practices were integrated in this lesson:
Students expected to accurately measure perimeter of Post It Note.
Student expected to predict possible finished height of their tower given a measurement of a single Post It.
Student expected to connect an object's shape to its function.

Possible Challenges /Misconceptions:

Creating 3-D shapes, Group work, sharing materials, making wild predictions, giving up

Formative Assessment:
During individual materials exploration – Teacher observation: Can students make 3D shapes? Are they willing to make multiple attempts? Do they need additional scaffolding after struggle?

Lesson Opening

Teacher Actions	Student Actions
Questions to create interest Have you ever built a tall tower? What did you use? How can we use post it notes to build a tower? How tall do you think it might be? **Connect to Phenomena** Buildings and objects (such as a student desk) are stable in order to hold people and objects safely.	Recall past experience Connect to shapes we know for buildings and items all around us SEP: Generate and compare multiple solutions to a problem based on how well they meet the criteria and constraints of the design problem.
Lesson Introduction	
Teacher Actions	**Student Actions**
Guidelines shared –no other items or tools can be used. Include all group members for group time. Try it a different way if it's not working	Individual students explore building with post-its Group work together to meet expectations DCI: At whatever stage, communicating with peers about proposed solutions is an important part of the design process, and shared ideas can lead to improved designs.
Body of Lesson	
Teacher Actions	**Student Actions**
Remind students of limitations with materials Encourage multiple attempts, using ideas from others Model making 3D shapes, as needed, or in Part 2, if lesson is divided into 2 periods	After making multiple attempts with post its- on their own join into teams of 3 for group building of tower Communicating with others In groups talking, using language stems: ● I think_____ ● I want to try _____ ● I wonder _____ Sketching ideas to show others Hands-on –create model
Lesson Closure	
Teacher Actions	**Student Actions**
Teacher charts to record process and results: Group work *What did your group do to be successful*? (Examples below) ● Took turns ● Included everyone ● Listened to each other ● Talked to each other ● Didn't give up	CCC: Engineers improve existing technologies or develop new ones to increase their benefits, decrease known risks, and meet societal demands. Answer questions: What is important when working in a group? Did you get it right the first time- or- try and try again?

• Built it different ways *What math thinking did we use*? • We measured • We sketched (model drawing) • We looked for patterns *Engineering words the teacher heard today*: Rotate Sides Strong base cube	What math thinking did we use today? Which scientific words did we use today? Additional opportunity for closure: Students can view other teams Post It Towers Answer question: What do you notice? What will help you/ your group next time?

Summative Assessment:
At the end of lesson (s)

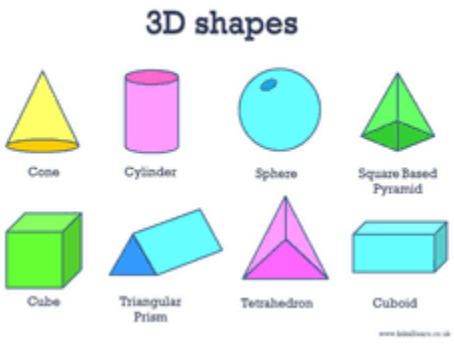
- Students are able to measure and predict a reasonable height
- Students are able to individually create a 3D shape with 5 Post it Notes
- Students are able to create a viable tower with their team

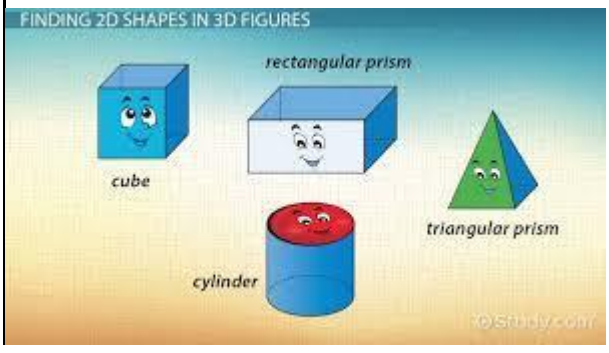
Lesson Evaluation:
Students may need further support or modeling at the individual or group level if unsuccessful in: measuring/ predicting/creating shapes/ creating tower/ working together

Photos can be taken to record group work in progress and finished models- Photos are a helpful assessment tool for measuring growth in all areas over time.

Save charts or take photos if lesson closure is written on whiteboard
Save written responses, track student growth trends over time

Other Teaching Resources:
3D shapes work mat





Lab Safety:
Keep all materials on your desk. Use ruler only to measure. (No sword fighting)

Extensions (if any):
This lesson provides an opportunity for students to work in collaborative groups: putting ideas on the table and working together to test out possible designs using simple materials and 3D shapes to

create a structure up to 12 inches in height. The extension lessons can lead to using other materials and working collaboratively to build structures. The expectation at End of Unit: Force and Motion: Balance - will be to ultimately test their structures by adding a predetermined weighted object to test for balance.