

MeTEOR Learning Modules

STEM MEA (Model Eliciting Activity)

Building a Tower



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MeTEOR
CONNECTING THE DOTS



Cups and Sticks: Who can build a tower?

Reflective Planning

Description/Summary of Lesson:

In this activity students will use two materials provided to build the tallest tower possible. What will make this a bit challenging are the constraints of the task. With very little instruction kids will get right to work trying to determine a way to follow the task rules and create the tallest structure.

Essential Questions:

- What are the specific qualities that go into engineering and design of a tower?
- How is math used in the planning stages of designing a tower?
- What type of bases and supports will maximize the height of a tower?

Suggested Grade Level: Grades 1-2

Approximate Time: One day (30-50 minutes)

Teacher's Role: Facilitator

Class Set-Up: Groups of two-three students at tables or desks put together

Success Standards:

- Students can define a simple design problem reflecting a need or a want that includes specified criteria for success and constraints on materials, time or cost.
- Students can generate and compare multiple possible solutions to a problem based on how well each is likely to meet the criteria and the constraints of the problem.
- Students can recognize the importance of communication among scientists.
- Students can recognize that scientists question, discuss and check each other's evidence and explanations.
- Students can develop and use models.

Learning Purpose:

- Students will plan and conduct a demonstration to provide evidence of the effects of balanced and unbalanced forces on the motion of an object.

Vocabulary:

- Tower
- Base
- Support
- Balance
- Gravity
- Height

Math Practices:

- MP 1: Make sense of problems and persevere in solving them.
- MP 3: Construct viable arguments and critique the reasoning of others.
- MP 4: Model with mathematics.
- MP 6: Attend to precision.

Depth of Knowledge:

- DOK Level 3: Strategic Thinking

Materials: (per group)

- 50 Popsicle Sticks (jumbo size is best)
- 50 Cups
- Constraint Cards

Summary of Tasks/Experiences

Spark Activity:

- Have students view this eight-minute video that depicts the tallest buildings in the world: <https://www.youtube.com/watch?v=YSR31tWe0kc>.
- Discuss the purpose and mechanics of the catapult.
- Tell the students they are going to make a tower and compete for the title “Tallest Tower.”

Lesson Descriptions:**Introduction:**

The teacher will:

- share with students that this challenge will test their group's ability to work together in building a tower that will have specific constraints.
- distribute the materials.
- allow students time to “play” with their materials, as vocabulary is being discussed: balance, base, support, etc.

Construction

The teacher will:

- distribute the constraint cards to groups.
 - The cards are labeled E M D, for Easy, Medium and Difficult. Students must complete one challenge before getting the next. The final challenge is the tallest tower.

The students will:

- work in groups to build the towers at the different challenge levels.

Teacher facilitates class asking guiding questions as students work in groups:

- Did your design work?
- Show me your base. Why did you design it that way?

Student Engagement

Social/Emotional Engagement: Students will use social, interaction skills for completing projects with peers.

Physical Engagement: Students will design, create and build the tower while working in small groups.

Cognitive Engagement: Students will work together using communication and design to implement the best design under the given constraints.

Evidence of Learning

Checks for Understanding/Expected Outcomes:

- Students will build their towers.
- Students will complete the Lab Sheet for project reflection.
- Students will articulate how support and balance were used in this activity.
- Students will be evaluated using the included Rubric.

Teacher Notes

- Through this STEM activity, students should be exposed to the engineering process of design, build and modify.
- See answer sheet for expected Lab Sheet responses.

<p style="text-align: center;">Constraints for Craft Stick Towers 1 E</p> <ul style="list-style-type: none"> • The cups cannot touch each other. • Rows of cups and sticks CAN look the same. 	<p style="text-align: center;">Constraints for Craft Stick Towers 1 E</p> <ul style="list-style-type: none"> • The cups cannot touch each other. • Rows of cups and sticks CAN look the same.
<p style="text-align: center;">Constraints for Craft Stick Towers 2 M</p> <ul style="list-style-type: none"> • The cups cannot touch each other. • Adjacent rows of cups and sticks CANNOT look the same. 	<p style="text-align: center;">Constraints for Craft Stick Towers 2 M</p> <ul style="list-style-type: none"> • The cups cannot touch each other. • Adjacent rows of cups and sticks CANNOT look the same.
<p style="text-align: center;">Constraints for Craft Stick Towers 3 D</p> <ul style="list-style-type: none"> • The cups cannot touch each other. • Rows of cups and sticks Must all look different. 	<p style="text-align: center;">Constraints for Craft Stick Towers 3 D</p> <ul style="list-style-type: none"> • The cups cannot touch each other. • Rows of cups and sticks Must all look different.

**Building a Tower
Rubric**

Category	4	3	2	1
Problem Solving	Actively looks for and suggests solutions to problems.	Refines solutions suggested by others.	Does not suggest or refine solutions but is willing to try other's solutions.	Does not try to solve problems or help others solve problems. Lets others do the work.
Contributions	Routinely provides useful ideas. Leader.	Occasionally provides useful ideas. Strong team leader.	Rarely provides useful ideas. A satisfactory team member.	Provides no useful ideas or refuses to participate.
Attitude	Never is publicly critical of the project or others. Positive attitude.	Rarely is publicly critical of the project or others. Often has a positive attitude.	Occasionally is publicly critical of the project or others. Sometimes has a positive attitude.	Often is publicly critical of the project or others. Has a negative attitude.
Focus on the Task	Constantly stays focused on task.	Mostly stays focused on task.	Hardly stays focused on task.	Rarely stays focused on task.
Working with others	Almost always listens and shares with others.	Mostly listens and shares with others.	Occasionally listens and shares with others.	Rarely or never listens and shares with others.
Comprehension of Concepts	Demonstrates understanding of concepts.	Demonstrates understanding of most concepts.	Demonstrates understanding of a few concepts.	No demonstration of understanding of concepts.

Total _____/24 Points

**Cups and Sticks: Who can build a tower?
Lab Sheet**

1. What are some things you need to remember as you build the tower?
2. Sketch your plan.
3. What did you try first?
4. Did your first plan work? Did you have to make changes as you went?
5. How did you work together as a team?
6. How tall was your tower/towers?
7. Describe your building experience? What was the hardest part? What was your favorite part?

Cups and Sticks: Who can build a tower? Lab Sheet Expected Responses

- 1.** What are some things you need to remember as you build the tower?
Possible answers: A tower needs a good base and balance is important.
The top can be skinny but not the bottom.

- 2.** Sketch your plan.
Answers will vary: picture of cups supported by sticks

- 3.** What did you try first?
Possible answers: We tried just stacking first. Pyramids weren't the best way to get tallest.

- 4.** Did your first plan work? Did you have to make changes as you went?
Possible answers: Everyone just started stacking, but we needed to work together. We started over with everyone having a specific job.

- 5.** How did you work together as a team?
Possible answers: After we started talking about why it fell, we each had a job.

- 6.** How tall was your tower/towers?
Answers will vary: Any tower over 50 cm will be considered successful.

- 7.** Describe your building experience? What was the hardest part? What was your favorite part?
Possible answers: First plan wasn't as good as the final. The tower crashed. The taller it went the happier we got. But we were also nervous.



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