MeTEOR Learning Modules

STEM MEA (Model Eliciting Activity)

Building a House

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METEOR
CONNECTING THE DOTS

Building a House - The Three Little Pigs

Reflective Planning

Description/Summary of Lesson:
In this lesson students are challenged to build a house that the big, bad wolf cannot blow down (i.e., the box fan). The engineering design process is introduced and teams are given a set amount of time to build their houses. Then, testing of the houses in front of a box fan is done in front of the whole group and results are recorded to determine which materials and designs worked best.

Essential Questions:
- What are the specific qualities that go into engineering and design of a house?
- How will you know your design was effective?

Suggested Grade Level: Grades 1-2

Approximate Time: One day (for a single structure) or three days (to build all three structures) (30 minute class periods)

Teacher's Role: Demonstrator and Facilitator

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

Success Standards:
- Students can recognize that some books and other media portray animals and plants with characteristics and behaviors they do not have in real life.
- Students can compare the observations made by different groups using the same tools.
- Students can explain how scientists alone or in groups are always investigating new ways to solve problems.
- Students can develop and use models.

Learning Purpose:
- Students will ask questions, make observations and gather information about a situation people want to change.

- Students will define a simple problem that can be solved through the development of a new or improved object or tool.
- Students will define a simple design problem reflecting a need or a want that includes specified criteria for success and constraints on materials, time or cost.

Vocabulary:

- Modify
- Wind
- Design
- Structure
- Strength

Math Practices:

- MP 1: Make sense of problems and persevere in solving them.
- MP 5: Use tools strategically.
- MP 7: Look for and make use of structure.
- MP 6: Attend to precision.

Depth of Knowledge:

- DOK Level 3: Strategic Thinking

Materials: (per group)

- Copy of *The Three Little Pigs* (for teacher)
- Approximately 50 Popsicle Sticks
- Approximately 50 Small Straws (e.g. for hot drinks)
- Approximately 50 Index Cards
- Thick, Cardboard Base (5 ½" x 8" to serve as a foundation)
- Poster Board (4" x 8" to serve as a roof)
- 1 Yard of Masking Tape
- Multi-3-Speed Box Fan (for the whole group)

Summary of Tasks/Experiences

Spark Activity:

- Read the book The *Three Little Pigs* to students or show the following animated version: https://www.youtube.com/watch?v=Olo923T2HQ4.
- Discuss the character traits of each pig and the wolf.
- Tell the students they are going to make a house for each of the pigs.

Lesson Descriptions:

Day 1

The teacher will:

- divide students or participants into teams of two or three.
- show students the "Big, Bad Wolf" fan so they understand the force of the wind (i.e., huffing and puffing level) they will be trying to build the house to withstand.
- assign each team a material to work with (e.g., straw, sticks or brick). Each group can create one structure OR each group create the three structures, one per day.
- encourage students to draw or sketch a design idea first.
- have students go "supply hunting" within the tool station.
- pass out one yard of masking tape to each team.
- establish a time limit for designing, redesigning and building; and allow teams to start building (e.g., 20 minutes).

TESTING

- When time is up, have each team bring their house to the testing zone where they can share their design with other groups.
- The same distance from the fan should be used for all groups.
- Turn the fan on low (i.e., Huffing and Puffing Level 1") for 10 seconds.
- If it survives, turn to medium (i.e., "Huffing and Puffing Level 2") for 20 seconds.
- If it survives, turn the fan to high (i.e., "Huffing and Puffing Level 3") for 30 seconds.
- If the house is still standing ... SUCCESS!
- If not, it is a good opportunity for teams to think of design improvements after seeing other houses.
- Have each team discuss and document what they would do to improve their design.

Day 2 and 3 (if completing the extended project)

- Repeat Day 1's construction using the materials needed for the second or third house.
- Repeat wind tests.

Student Engagement

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

Physical Engagement: Students will design, create and test their house durability while working in small groups.

Cognitive Engagement: Students will work together using tools strategically as they define simple problems that can be solved through the development of a new or improved object or tools.

Evidence of Learning

Checks for Understanding/Expected Outcomes:

- Students will build their houses.
- Students will articulate if their structures will withstand the wind.
- Students will complete Data/Reflection Sheet.
- Students will create a structure that withstands the “Wolf.”
- Students will be evaluated by the enclosed Rubric.

Teacher Notes:

- Through this STEM activity, students should be exposed to the engineering process of design, build and modify.
- See Data/Reflection Sheet for expected responses.
- Students should learn that stronger bases and materials withstand more wind. They should articulate that design and modifications allowed them to create better structures.

Building a House
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

Building a House - The Three Little Pigs
Data/Reflection Sheet

House number	Highest fan speed without collapsing (low, med., high)	Modification house	Highest fan speed without collapsing (low, med., high)	Longest time without collapsing
1		**1**		
2		**2**		
3		**3**		

1. Based on the Data/Reflection Sheet, what materials appear to withstand the “huffing and puffing" of the “Big, Bad Wolf” the best?

2. Why do you think these materials were more effective than others?

3. Was your team able to design and build a house that survived the “Big, Bad, Wolf?”

4. What “huffing and puffing” level did your house withstand?

5. How did you improve your design?

6. What was your favorite part of your project? What was difficult?

Building a House - The Three Little Pigs
Data/Reflection Sheet
Expected Responses

House number	Highest fan speed without collapsing (low, med., high)	Modification house	Highest fan speed without collapsing (low, med., high)	Longest time without collapsing
1	none	1	low	30 sec.
2	med	2	med	45 sec.
3	med	3	high	5 min.

1. Based on the Data/Reflection Sheet what materials appear to withstand the "huffing and puffing" of the "Big, Bad Wolf" the best? Answers will vary: The materials used to build the third house

2. Why do you think these materials were more effective than others?
   Answers will vary: stronger, more secure

3. Was your team able to design and build a house that survived the "Big, Bad, Wolf?" Possible answer: Yes, but not the first time.

4. What "huffing and puffing" level did your house withstand?
   Possible answer: The third house withstood a higher level.

5. How did you improve your design?
   Answers will vary: used more tape, glue, stronger materials stronger base.

6. What was your favorite part of your project? What was difficult?
   Answers will vary: building, designing, testing