

Q405 Saturday Science Teaching – Fall 2017
Lesson Plan Week #1

We Will Huff and Puff. Will your design blowdown?

Establishing Curiosity and Wondering
Grades: 2nd-3rd

A) LEARNING OBJECTIVES and CRITERIA FOR DETERMINING IF OBJECTIVES ARE MET:

1. Students will be able to conduct investigations on the strength of their structures as they explore the different materials presented.
2. Students will be able to identify and classify different types of materials they will be using to build structures.

B) STANDARDS (see <http://www.doe.in.gov/standards/science>)

● **Science and Engineering Process Standards:**

- SEPS.2 Developing and using models and tools
- SEPS.3 Constructing and performing investigations
- SEPS.6 Constructing explanations (for science) and designing solutions

● **Content Standards:**

- 2.PS.4 Analyze data obtained from testing different materials to determine which materials have the properties that are best suited for an intended purpose.
- K-2.E.2 Develop a simple sketch, drawing, or physical model to illustrate and investigate how the shape of an object helps it function as needed to solve an identified problem
- 3-5.E.1 Identify a simple problem with the design of an object that reflects a need or a want. Include criteria for success and constraints on materials, time, or cost.

C) MATERIALS (**asterisk (*)** = any materials that may be a **safety concern**)

- Popsicle sticks (300)
- Straws (200)
- Bamboo skewers (300)* pointy
- Marshmallows (6 bags of mini marshmallows)* potential allergy
- Play doh (6 normal sized containers)
- 2 pieces of butcher paper

D) TEACHER CONTENT KNOWLEDGE

- Teachers will need to know what materials will create the strongest structures.
- Teachers will need to be able to explain why some of the materials work better than the others.

E) REFERENCES (list **ALL** references that you borrowed ideas from to develop this lesson – including any handouts you may distribute)

- Go Noodle

F) TENTATIVE TIMELINE

1. Ice Breaker game: **(15 minutes) 9:30am**
 - a. Name, fav. Color, If you had 1 million dollars what are 3 things you would buy, what do you like about science?
2. Grouping of children: Two second graders with two third graders at each table. With their partner (2nd with 3rd), come up with a group name: For example, Taco Eaters **(10 minutes) 9:45am**
3. Introduction of folder concept with the worksheets/pass out the folders **(5 minutes) 9:50am**
4. Introduce the stations and our expectations of how they should treat the materials/ what the materials are/how they will be working with their partners **(10 minutes max) 9:55am**
5. Students will explore the materials with their partners and fill out a worksheet about which materials they will potentially use in their creation. Before they build at each station, they will draw their goal on paper (blueprint). **(20 minutes each station, 1 hour total) 10:05am**

Station 1: bamboo and clay

Station 2: spaghetti and marshmallows

Station 3 straws and play-doh

15 minute snack break - Brain break video while eating 11:05am (GoNoodle: <https://app.gonoodle.com/channels/the-kidz-bop-kids/feels-so-close?s=Channel&t=The%20KIDZ%20BOP%20Kids>)

6. Group discussion about questions from hat (child will pull out a question and call on a student to answer - anchor chart to summarize information) **(20 minutes) 11:20am**

- 1) Which tower will hold the most weight? How do you know that?
- 2) Which station gives you the strongest tower?
- 3) Why do you need to build a strong tower?
- 4) How will you know that your tower is not strong? What happens if your tower is not strong?

7. Summarize and discuss next week **(10 minutes) 11:40am**

8. Have students put their folders in the middle of each station

9. Get ready to go home **11:50am**

10. Dismiss the kiddos

G) DESCRIPTION OF YOUR LESSON

ENGAGE:The engage portion starts out with the icebreaker game where students are engaged with getting to know their teachers as well as their peers. The engage portion of our lesson will also take place when we introduce the different materials and stations to the students.

Focus Question: How can you create a strong structure with the materials provided? How do you know it is strong” does it move, or is it sturdy? (Strong to them will be defined as could hold most weight and not fall apart?)

EXPLORE (each teacher will be at a station): The students will be working with their partner at 3 stations to create The same structure at 3 different structures using different materials. Each station will have marshmallows, masking tape, and play-doh to hold their structures together. We Will have students build a tower, or bridge, or whatever they want to so that they can spark creativity in the room

At station 1, students will be exploring with bamboo and clay

At station 2 they will explore with spaghetti and marshmallows

At station 3 they will explore with straws and play-doh

By exploring the materials and building, students will be coming up with different perspectives on what makes a structure strong on their handouts such as how many of each material they used, what materials were used, drawings of their structure, and why they used what they used to make their structures.

These steps will be filled out at each station so 3 handouts should be filled for each new structure built.

EXPLAIN: During a group discussion after building, students will be sharing the structures they built as well as what materials they used and why they used them as well as why they used as many resources. Predict which structure you think is the strongest and why (design, materials, etc)? Which will hold the most weight? There will be a hat with questions for discussion that we come up with (already prepared) where students will draw a question. Said student will read the question and can answer, or call on someone to answer. Multiple students will be able to add to the question.

ELABORATION: We will have students attention and ask students who build a similar structure, like a tower to get in a group and discuss which tower worked best, or what design or materials did they find to be strongest. The goal with this is that if we have time the goal will be to have them build another structure with what they have talked about as a group. We will also have them draw their structure in their folder and we will save it as well for week 2 to continue their investigation on strength.

As the discussion is in progress, a teacher will fill out an anchor chart with the students' ideas, information and questions that the students come up with during the explore/explain phase to elaborate on the focus question (what do you think makes structures strong). We will summarize the information as a class before we clean-up for the day. Potentially use the structures built week 1 to test the strength.

H) EMBEDDED FORMATIVE ASSESSMENT (the 5th "E")

- To assess our students we will be monitoring their discussion as they answer the questions from the hat. We will add anything necessary to the answer if there is information missing. We will also assess them on their anchor chart ideas as well as the worksheets that they will be filling out during each station.

I) GEARING UP/GEARING DOWN

1. Gearing up:

To gear up the lesson we could provide students with a set number of each material they have to use to create their structure. This would make it a bit more challenging for the students because they wouldn't have the freedom to use however many of each material they want to.

2. Gearing down:

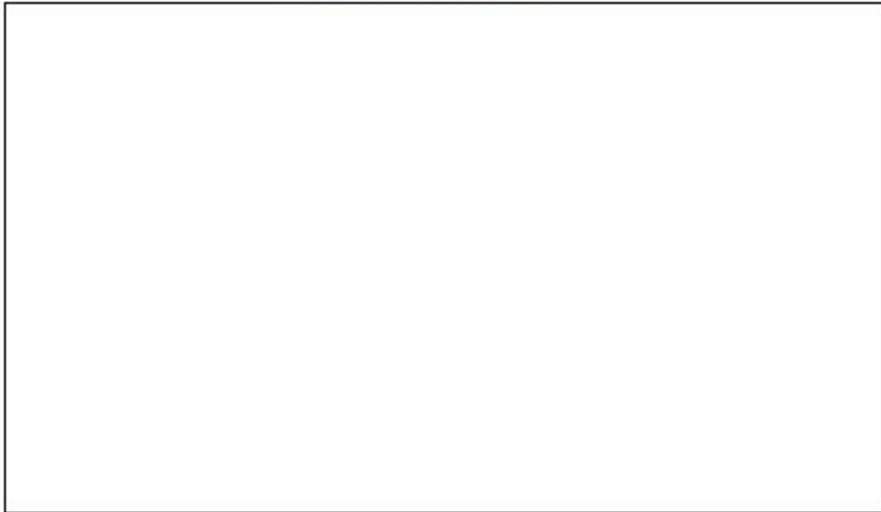
To gear this lesson down we could sit with the students who are struggling and facilitate the worksheet and talk them through it. For ELL students we can encourage drawing instead of writing.

Name
Date

Week 1

How can you create a strong structure with the materials provided?

Draw the structure in the box



Circle the station that gives you the strongest structure

Station 1	Number used	Station 2	Number used	Station 3	Number used
Bamboo Skewers		Spaghetti Noodles		Straws	
Clay		Marshmallows		Clay/ playdough	
Masking Tape		Masking Tape		Masking Tape	

Which station gives you the strongest structure? How do you know that?

Name
Date

Week 1

CLAIM-

TO MEASURE STRENGTH WE USE _____

Q405 Saturday Science Teaching – Fall 2017

Lesson Plan Week #2

We will Huff and Puff. Will your design blowdown?

Facilitating “Productive Discussions”

2nd and 3rd grade

- A) LEARNING OBJECTIVES and CRITERIA FOR DETERMINING IF OBJECTIVES ARE MET
- Students will be able to explain the importance of strong structures as they test their houses in simulated natural disasters.
 - Students will be able to explain why their structures were strong enough to withstand a simulation of a natural disaster.
- B) STANDARDS (see <http://www.doe.in.gov/standards/science>)
- **Science and Engineering Process Standards:**
 - ❑ SEPS.2 Developing and using models and tools
 - ❑ SEPS.3 Constructing and performing investigations
 - ❑ SEPS.6 Constructing explanations (for science) and designing solutions
 - **Content Standards:**
 - ❑ 2.PS.4 Analyze data obtained from testing different materials to determine which materials have the properties that are best suited for an intended purpose.
 - ❑ K-2.E.2 Develop a simple sketch, drawing, or physical model to illustrate and investigate how the shape of an object helps it function as needed to solve an identified problem
 - ❑ 3-5.E.1 Identify a simple problem with the design of an object that reflects a need or a want. Include criteria for success and constraints on materials, time, or cost.
- C) MATERIALS (**asterisk (*)** = any materials that may be a **safety concern**)
- ❑ Bamboo skewers (12 packages)
 - ❑ Modeling clay (12 sticks)
 - ❑ Play doh from last week (6 regular sized tubs for backup purposes)
 - ❑ “Hurricane” by David Wiesner
 - ❑ Plastic bins from E328 (deep enough to put water in with a structure/ 2 of them)
 - ❑ Water pitchers (2)
 - ❑ Strainer (2)
 - ❑ Box fan (1)
 - ❑ Aluminum foil (2 rolls)
 - ❑ Seran wrap (2 rolls)

- Masking tape (3 rolls)
- Gravel (1 large bag)(we are going to use the tubs in the materials room)
- Construction paper (1 package)
- Printer paper (6 sheets)
- Gram weights (6 sets: 1 for each table)
- Baby Pool (in the materials room)
- 30 pencils

D) TEACHER CONTENT KNOWLEDGE

- Teachers need to have knowledge on the use of different angles, interlocking, and shapes of structures can provide strength and stability.

E) REFERENCES (list **ALL** references that you borrowed ideas from to develop this lesson – including any handouts you may distribute)

- “Hurricane” by David Wiesner
- Spotify/YouTube for music/natural disaster sounds

F) TENTATIVE TIMELINE

- Check in **(9:15-9:30)**
- Review classroom procedures from last week (“class class”, no swiveling in chairs) **(9:30-9:35)**
 - Have three to five classroom procedures written on large post-it paper before the class comes in to quickly review.
- Review last week **(9:35-9:50)**
 - Bring out structures from last week and put one on each table. The students will have the ability to test “strength” of these structures with gram (cube) weights and printer paper as a base and easier to place weights on. One student will hold the paper so it doesn’t fall through as a partner places the weights on the paper.
 - Discuss what we did, which materials were easy and hard to build with, what makes a structure strong (gear discussion towards angles, the amount used, etc.), and why it is important to have strong structures.
- Ask students “What damage could a natural disaster have on a house?” (Ex: flooding, wind damage, etc) **(10:00-10:10)**
 - Write ideas on board
 - Using the structures from last week, ask students if they think these structures would survive a natural disaster. Why or why not? (gear conversation towards the actual structure, **not the materials used**)

- ❑ Ask students “How can you make a house to withstand the damages of a hurricane?
(10:10-10:15)
 - ❑ Go through ideas and write them on board -collectively come up with a structure that the classroom will agree on: a 3D cube, which we can have represent a building/house/tower.
 - ❑ Explain what we will be doing today, go over expectations for lesson, introduce stations, explain worksheet, stress the importance of creating a structure to survive natural disasters, have students get with partners assigned to them **(10:10-10:15)**
- ❑ The students will only be using bamboo skewers and clay to create their design. However, they have the freedom to put these materials together however they see fit so long as they use only those materials and somehow build a structure that is similar in shape to the one we (the class) decide on and is on the front board.
(10:15-10:50)
- ❑ Snack/bathroom break **(10:50-11:10)**
 - ❑ “To infinity and Beyond” attention grabber
 - ❑ Fran reads “Hurricane” with Dory hat **(9:50-10:00)**
 - ❑ Discuss the students’ take aways from the book and what they enjoyed.
- ❑ Test houses when finished --- 2 ways: **(11:10-11:25)**
 - 1) the weight test again --- like in the first half of the class and the students record how many weights they can put on before the structure begins to bend. If they reach the maximum # of cubes available (say 200) then they just write that.
 - 2) natural disaster test ---
 - ❑ Rain/Flood - water pitcher, strainer, gravel
 - ❑ Hurricane - water pitcher, strainer, gravel, box fans
 - ❑ Earthquake - gravel
- ❑ Answer questions on worksheet to prepare for discussion**(11:25-11:40)**
- ❑ Group Discussion **(11:40 - 11:50)**
- ❑ Get ready to go home (put folders in middle of table, grab belongings)

G) DESCRIPTION OF YOUR LESSON

ENGAGE

-We will begin class by going over the three to five classroom procedures we came up with. We will also touch on our attention grabbers.

-We will bring out the structures from last week and have the students test the “strength” of these structures with the gram weights and copy paper to make it easier to weight. We will continue into a discussion about what truly makes a structure “strong” (no focus on the materials, but focus on how the materials are put together)

-Teacher will read the book “Hurricane” to the class to introduce the topic of natural disasters for this week’s lesson. Before moving on to the explore phase, we will go over the reading and see what stuck out to them the most (takeaway).

Explain the worksheet for today’s lesson and give instructions going over what the students will be doing.

Focus Question:

Is it the design or the materials that makes a structure stable (strong)?

EXPLORE

-Before building, students will fill out the first page of their worksheet by drawing the collective structure we came up with as a class (provided up on the board..

-Then, students will spend 30-40 minutes building the structure in partners. We will walk around and have productive discussion with the students about how they are making their structure strong.

-After the students finish their structures, they will have the opportunity to bring their structures to the natural disaster test sites. At the sites, students will be asked general questions about the strength of their structures. This will further their knowledge on the components that contribute to strength. For example, at the flood site if their structure sunk, came apart, or blew away, students could be asked, “What is something that you could do to reassure your structure could not break apart?”

EXPLAIN

-The explain portion will come from the questions on the back of the worksheet the students will be filling out. Last week, the students had differing views on which materials created the strongest structure, so

this week we want the students to realize the materials don't matter, rather the way the materials are put together matter.

ELABORATION

- The elaboration portion of our lesson plan will be the discussion held after our students fill out their worksheets. We want to discuss the findings our students had. Were any of the students' structures able to survive all three natural disasters?
- **Discussion Questions:**
 1. Why did we only provide you with one type of material this week? (gear their answers towards how the structure was put together, not the materials making up the structure)
 2. If you could re-design your structure again, what would you do differently? Or would you keep it the same?
 3. What can we conclude from our findings? How is this applicable to real life? (materials don't matter, engineers)

H) EMBEDDED FORMATIVE ASSESSMENT (the 5th "E")

Engage: During the engage portion of our lesson, Fran will be reading a book and we will assess them through questions about the book.

Explore: The students will be assessed during the explore portion of the lesson plan by the structures they are creating with their partners.

Explain: During the explain portion of our lesson the students will be assessed based off their answers to the questions on their worksheet.

Elaboration: Students will be assessed during this time based off of the discussion we hold as a whole group.

I) GEARING UP/GEARING DOWN

1. Gearing up: If the students finish all of the questions on their worksheet early, they can work on adding something to their house that will make it even stronger and more able to withstand the natural disasters.

2. Gearing down: If there is not enough time to fill out all of the questions on the worksheet, we can just ask them during discussion and have them write as everyone is sharing their ideas.

NEW WORKSHEET QUESTIONS TO BE USED

1. What part of YOUR structure (building) do you think helped it the most to pass some or all of the tests?
2. Can you explain why you decided to include this as part of your structure when building it?

NAME: _____

Our focus question we are trying to answer:

Is it the design or the materials that makes a structure stable (strong)?

Our data we will collect to answer to help us answer our focus question:

Test 1 - Holding weight	
Our structure held a total of _____ gram weights before it started to bend or completely broke.	
Test 2 - Natural Disasters	
Flood (water power)	Our structure stayed together (Circle One): <p style="text-align: center;">YES NO</p>
Hurricane (wind power)	Our structure stayed together (Circle One): <p style="text-align: center;">YES NO</p>
Earthquake (ground shifting)	Our structure stayed together (Circle One): <p style="text-align: center;">YES NO</p>

NOTE: If your structure breaks at any point during these tests, you can go back and fix it to continue testing it. You CANNOT change the design, only fix what is broken.

Reflecting on our designs:

What part of YOUR structure (building) do you think helped it the most to pass some or all of the tests? You can draw a picture if it is hard to write it in words. :-)

Can you explain why you decided to include this as part of your structure when building it? *Ask one of the teachers for help if you can say what you think, but are struggling with writing it. :-)*

Q405 Saturday Science Teaching – Fall 2017

Lesson Plan Week #3

We will huff and puff. Will your design blowdown?

Integrating “STEM”

2nd and 3rd grade

A) LEARNING OBJECTIVES and CRITERIA FOR DETERMINING IF OBJECTIVES ARE MET (minimum of 2/ lesson)

- Students will be able to explain how different shapes can provide stability in structures.

B) STANDARDS (see <http://www.doe.in.gov/standards/science>)

● **Science and Engineering Process Standards:**

- SEPS.2 Developing and using models and tools
- SEPS.3 Constructing and performing investigations
- SEPS.6 Constructing explanations (for science) and designing solutions

● **Content Standards:**

- 2.PS.4 Analyze data obtained from testing different materials to determine which materials have the properties that are best suited for an intended purpose.
- K-2.E.2 Develop a simple sketch, drawing, or physical model to illustrate and investigate how the shape of an object helps it function as needed to solve an identified problem
- 3-5.E.1 Identify a simple problem with the design of an object that reflects a need or a want. Include criteria for success and constraints on materials, time, or cost.

C) MATERIALS (**asterisk (*)** = any materials that may be a **safety concern**)

- Masking tape (**6 rolls---one per table**)
- Pipe cleaners (**300**)
- Toy cars (**as many as possible from what we already have**)
- Pencils with erasers (**30 count**)
- Electronic balances (**2---**)
- Geometric shapes for discussion and inspiration --
- <https://sciencing.com/geometric-concepts-found-bridges-8711435.html>

D) TEACHER CONTENT KNOWLEDGE

- Teachers need to know how different shapes have different geometric properties.
- Teachers need to know why certain shapes are stronger than others.

E) REFERENCES (list **ALL** references that you borrowed ideas from to develop this lesson including any handouts you may distribute)

- <https://sciencing.com/geometric-concepts-found-bridges-8711435.html> (for images)

F) TENTATIVE TIMELINE

- Check-in **(9:30-9:35)**
- Review last week/anchor chart from last week/review our classroom rules **(9:35-9:40)**
- Discussion about other structures that need to be stable to transition students into the idea of bridges.
- Ask students about different structural designs for bridges. For example, “What are different ways that would make your bridge stable?” “Are there other ways to create strength besides connecting materials side by side or layering?” ...this is leading to the ideas of different shapes, squares, triangles, etc **(9:40-9:45)**
- Show real life examples of pictures of bridges using the different shapes **(9:45-9:50)**
 - Which bridge do you think is stronger and why?
- Conversation about shapes (What makes a triangle strong? What makes a square strong? What makes a circle strong?) **(9:50-9:55)**

Activity 1

- Introduce 3 stations - assign a shape to each table (a shape is a station). Therefore, two tables will have the same shape.
 - Draw a picture of what their bridge will look like
 - Construct with pipecleaners and tape (if needed)
 - Test strength of bridge --- weigh with toy cars at each station to see which bridge hold the most and then weigh the total cars used to get an actual measure in grams. **(9:55-10:45)**
 - Station 1: Triangles
 - Station 2: Squares
 - Station 3: Circles
 - These will be represented by hanging a picture of the shape above each lab station.
- This activity above is ongoing so students test/weigh as they finish building their designs. If it doesn't work as planned they can go back and fix to get the best version of their design in the time allotted. Goal is to get their design to hold as many cars as possible.

- ❑ Talk about the data from the first activity (Let's look at the numbers. What did we learn about this? Which shape had the highest number, why do you think so---what about that shape might contribute to it giving strength or stability to the bridge?)
- ❑ Snack/bathroom break **(10:45-11:05)**

Activity 2

- ❑ Students will have the opportunity to revise their own design by adding another shape to their bridge---testing these too**(11:05-11:35)**
- ❑ Students will record their group's data on the whiteboard and a teacher will go over the class data and analyze it **(11:35-11:50)**
 - ❑ What do we notice about our designs now---the combination of shapes. Were there combinations that seemed to be stronger than others...and how does our data tell us this?
- ❑ Put away worksheets, get belongings, and go home

G) DESCRIPTION OF YOUR LESSON

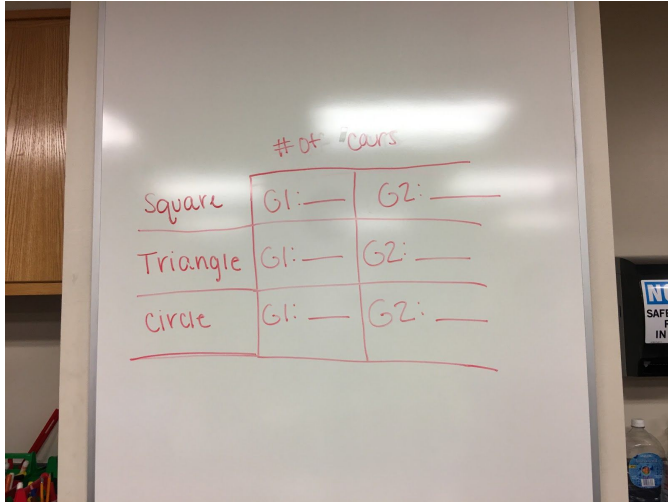
ENGAGE

- ❑ We will start a discussion about bridges to see what the students know about bridges. We want to get them thinking about other structures, that aren't houses, that still need to be strong.
 - ❑ Do shapes of the bridges matter when it comes to determining weight?
- ❑ We will show our students a PowerPoint of the different shapes found in bridges.
- ❑ We will build off the PowerPoint by showing the students three dimensional examples of the shapes they will be incorporating in their bridges.
- ❑ **Focus Question: How do different shapes influence the stability of structures?**

EXPLORE

- ❑ Students will be designing a bridge with their assigned geometric shape using pipe cleaners and masking tape (if needed). First students will think about a design and then draw their design. Two tables will build a bridge using triangles, two tables will build a bridge using squares, and two tables will build a bridge using circles. Students will be working in partners. The bridge cannot be longer than a piece of paper (provided to students to build their structure on) and at least 2 inches above the table. After building, students will test their bridges strength by using

toy cars. The students will see how many toy cars their bridge can hold before it bends or breaks. Students will then record how many cars their bridge held on the whiteboard chart provided by us.



(also adding the weight of the cars)

EXPLAIN

- ❑ After the students finish and test their bridge, we will discuss the data based on their bridges they build with their partners. Questions we would ask would be, **“How many cars did your bridge take?”** **“Which design or shape indicates that was able to hold more weight?”** **“Why do you think this? Was the bridge higher, or shorter than the other same shape groups?”**
- ❑ After the students revise their bridges or revise another group’s bridge, we will be able to lead a discussion about what they concluded from their designs.
 - ❑ **What contributed to the strength of the bridge? (shapes, length, etc.)**
 - ❑ **Would you do something differently, but keep the same overall structure (if used tape, would you use more)**

ELABORATION

- ❑ Students will redesign their bridge. They can choose to redesign their bridge by adding another shape of their choice to their bridge (ex: triangles and squares, triangles and circles, or squares and circles)
- ❑ Students will complete the blueprint part of the worksheet for their second design.
- ❑ Whole class discussion based off of findings on how shapes can contribute in bringing stability to a structure

H) EMBEDDED FORMATIVE ASSESSMENT (the 5th “E”)

- ❑ Embedded formative assessment will be found in our “explore” and “explain” portion of the lesson plan. In our explore portion, the students will be formatively assessed in their ability to create the bridges. The students will also be assessed during the explain portion in the form of the questions they will be answering.

I) GEARING UP/GEARING DOWN

- 1. Gearing up:** Have students build a bridge using more than one shape. This will have them think critically think and build a stronger structure.
- 2. Gearing down:** If the students are struggling to make a bridge out of just the assigned shape, they could just include the assigned shapes, rather than just using the assigned shape.

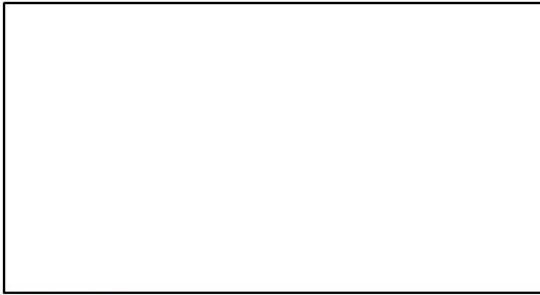
<p>Names of group members: _____</p> <p style="text-align: center;">Final Design</p> <p>Group roles:</p> <ul style="list-style-type: none"> • Architect: _____ • Spokesperson: _____ • Materials person: _____ • Project manager: _____ <p>Design and draw your group's blueprint below.</p> <div style="border: 1px solid black; height: 150px; width: 100%;"></div>	<p>Reasoning for why you chose to design your structure in this way and why you chose the materials you did <i>(teacher will write this for you)</i></p> <p>_____</p> <p>_____</p> <p>_____</p> <p>_____</p> <p>_____</p> <p>Materials list for next week </p> <p>1. _____</p> <p>2. _____</p> <p>3. _____</p> <p>4. _____</p> <p>5. _____</p>
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Name: _____

How Do Shapes Make Structures Strong?

Write the shape that your table was assigned to use in your bridge: _____

Take a couple minutes to think about the bridge you will build. Draw a "blueprint" of your group's plan for the bridge. **REMEMBER: Use your SHAPE!**



DATA (Design one)

How many of your assigned shape did you use? I have _____

➤ (EX/ I have 12 circles)

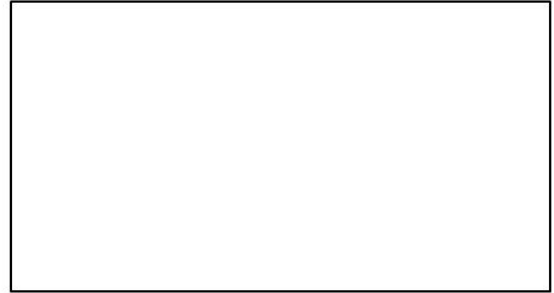
How many cars did your bridge hold? _____ cars

How many grams is that? _____ grams

DESIGN TWO

What are your two shapes in your bridge now? Triangle Square Circle

Draw a "blueprint" of your group's plan for the bridge. **REMEMBER: Use your SHAPES!**



DATA (Design two)

How many of your assigned shapes did you use?

I have _____ and _____.

➤ (EX/ I have 12 circles and 10 squares)

How many cars did your bridge hold? _____ cars

How many grams is that? _____ grams

Q405 Saturday Science Teaching – Fall 2017

Lesson Plan #4

We will huff and puff. Will your design blowdown?

Assessing for Learning

2nd-3rd grade

A) LEARNING OBJECTIVES and CRITERIA FOR DETERMINING IF OBJECTIVES ARE MET
(minimum of 2/ lesson)

- Students will be able to explain the importance of strong structures as they test their bridges in simulated natural disasters.
- Students will be able to apply their knowledge of shapes and materials and how they make structures strong to build their final structure.

B) STANDARDS (see <http://www.doe.in.gov/standards/science>)

● **Science and Engineering Process Standards:**

- SEPS.2 Developing and using models and tools
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● **Content Standards:**

- 2.PS.4 Analyze data obtained from testing different materials to determine which materials have the properties that are best suited for an intended purpose.
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- 3-5.E.1 Identify a simple problem with the design of an object that reflects a need or a want. Include criteria for success and constraints on materials, time, or cost.

C) MATERIALS (**asterisk (*)** = any materials that may be a **safety concern**)

- Piper cleaners (12 packs)
- Masking Tape (12 rolls)
- Popsicle sticks (only 6 so we can show for an example)
- Straws (only 6 so we can show for an example)
- Blue books (only 6 so we can show for an example)
- Foam shapes (triangles, squares, circles)
- Gravel (2 bags)
- Deep plastic bins (2)
- Strainer (1)

- Large Stickies to finalize their final design
- Toy cars (same as last week)

D) TEACHER CONTENT KNOWLEDGE

- Teachers need to know the properties of the shapes we will be incorporating into our lesson plan
 - Squares: 4 equal sides, 4 right angles (90 degree), exceptional strength
 - Circles: no sides, minimal strength, round
 - Triangles: 3 sides, 3 corners, 180 degrees
- How materials and shapes contribute to the strength and stability of structures
 - For example, pipe cleaners are more flexible and able to be manipulated into different shapes while popsicle sticks cannot be manipulated into different shapes because they are rigid.

E) REFERENCES (list ALL references that you borrowed ideas from to develop this lesson - including any handouts you may distribute)

- N/A: all of our work was made by us

F) TENTATIVE TIMELINE

- Check-in **(9:30-9:35)**
 - Fran Greets students and leads morning stretches
- Review class rules and last week - role of shapes (triangles, squares, circles) for strength and what makes structures strong **(9:35-9:40)**
- Reintroduce the natural disaster simulations for bridges. **(9:40-9:45)**
 - Earthquake: gravel + plastic bin
 - Flood: cups of water + sink
- Part 1:** Students will have time to either add to the saved bridges from last week using pipe cleaners and tape or use them as they are. They then test those bridges at the different natural disaster sites - students will record if their structure survived by placing tallies on the whiteboard. If they want to fix the bridges while doing the simulations and test the natural disaster again, they can. **(9:45-10:40)**
- Snack and bathroom break **(10:40-11:00)**
- Discuss results from the natural disaster sites **(11:00-11:10)**
 - Which natural disaster did your bridge survive? How did you design your bridge to make it survive the natural disasters (shape of design and materials)
- Part 2:** Start introducing the following week's lesson **(11:10-11:50)**
 - Explain the final project to the students. (Show them examples of the different materials that will be available the following week to get them to begin critically think and brainstorm) - Students will be asked to design a

structure (any structure of their choice) to hold books. Students will decide which materials and shape to use in their design

- Tell the students will be in groups of four for their final project and put them into their groups
- Have students begin designing their structure and assign roles to each person in the group - students have to decide on which geometric shapes and materials to use
- Have one student be the **architect** (make the drawing based on everybody's input), another will be the **spokesperson** (communicates with the teachers and the class during the discussion and during the planning process), another will write and gather the **materials list**, and the fourth will be the **project manager** (oversees that the proper materials are used, the drawing that is going to be built next week meets the criteria, and that everyone is staying on task).
- Groups will share out their ideas with the whole class
- Get ready to go home! **(11:50-12:00)**
 - Folders in the middle of the table and pack up belongings

G) DESCRIPTION OF YOUR LESSON

ENGAGE

Part I of lesson:

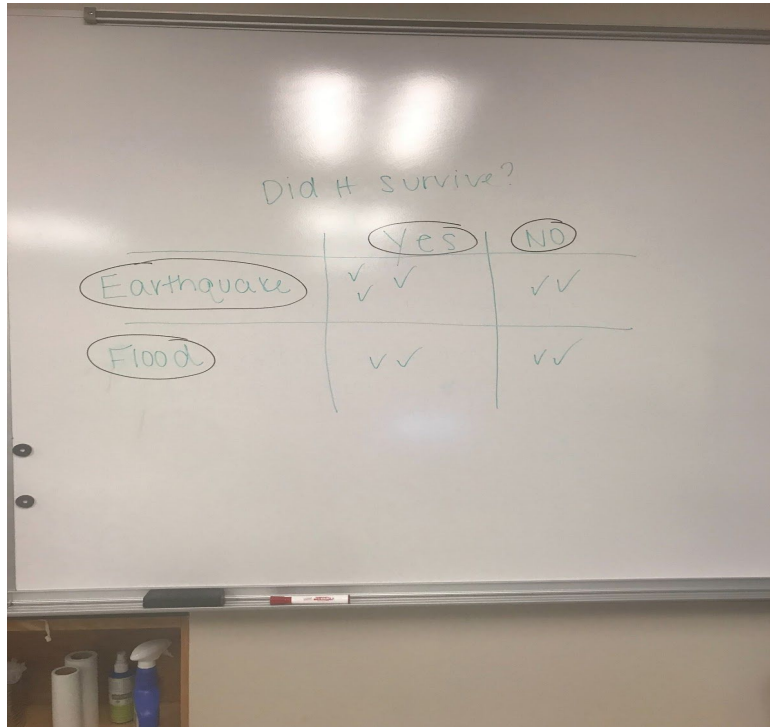
- Review the different shapes from the previous week
- Take the bridges from week three and give each table one. Have students examine the structure for a couple of minutes and then decide what shape was the most prominent and any other shapes that were utilized as well .
- Have students talk amongst themselves to determine the differences in their structures regarding the shapes they used last week and how they were able to hold more or less cars.

EXPLORE

Part I of lesson:

- Students will use the bridges from last week to test whether they survive an earthquake and flood simulation with equal number of cars given to each bridge. After each test, students will have the opportunity to fix/redesign their bridge to test in the simulations again.

- ❑ Teachers will be recording the class data from the natural disaster stations by means of tally marks.



The whiteboard displays a table with the title "Did # survive?". The table has two columns: "Yes" and "No". The rows are "Earthquake" and "Flood". The data is recorded using tally marks (checkmarks).

	Yes	No
Earthquake	✓ ✓	✓✓
Flood	✓✓	✓✓

Part II of lesson:

- ❑ In groups of four, students will begin brainstorming and planning for their final project. They will be designing a structure (making a blueprint) of their choice to hold one or more books and decide on which materials and shapes to use in their structure. Each student will be assigned a role
- ❑ **Focus Question: Using the past week's knowledge what materials, shapes, and designs best contribute to make a strong structure?**

EXPLAIN

Part I of lesson:

- We will have a class discussion about the data and why some of the bridges survived the natural disasters while others did not.
 - We will specifically focus on the shapes within the structures and why they made them strong enough to withstand the natural disasters with load (cars) on them.
 - The questions we will ask the students will be:
 - Why was your bridge able to survive the natural disaster with cars in it ?
 - What shapes did you use in your structure?

ELABORATION

Part II of lesson:

- Our elaboration portion of our lesson will be used to explain to the students what is expected for them the following week -. (Show them examples of the different materials that will be available the following week to get them to begin critically think and brainstorm)
- Students will be asked to design a structure (any structure of their choice) to hold books.
- Students will be put into their groups and start working on their plan for the last week.

H) EMBEDDED FORMATIVE ASSESSMENT (the 5th "E")

- We will be assessing our students throughout our lesson through whole group and small group discussions.
- We will also assess our students by the creation of the chart with the results from the natural disaster sites.
- We will also assess the students worksheets at the end of class to make sure that they will be on track for week 5

I) GEARING UP/GEARING DOWN

- 1. Gearing up:** We can gear up our lesson plan by talking about the actual geometric properties of the shapes we chose for our lesson. This would benefit our students who seem to finish work early and hopefully not disrupt those students who are still working.

2. Gearing down: We can assist students in completing their worksheet in the end if they are not properly acting out their roles in the group. To help them out we will have them notify their group so that THEY are still the ones that are doing the work even if we are letting them know what to say.

+

<p>Names of group members: _____</p> <p style="text-align: center;">Final Design</p> <p>Group roles:</p> <ul style="list-style-type: none">• Architect: _____• Spokesperson: _____• Materials person: _____• Project manager: _____ <p>Design and draw your group's blueprint below.</p> <div style="border: 1px solid black; height: 200px; width: 100%;"></div>	<p>Reasoning for why you chose to design your structure in this way and why you chose the materials you did (teacher will write this for you)</p> <p>_____</p> <p>_____</p> <p>_____</p> <p>_____</p> <p>_____</p> <p>Materials list for next week </p> <ol style="list-style-type: none">1. _____2. _____3. _____4. _____5. _____
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Q405 Saturday Science Teaching – Fall 2017

Lesson Plan #5

We will huff and puff. Will your design blowdown?

Including All Learners

2nd-3rd grade

A) LEARNING OBJECTIVES and CRITERIA FOR DETERMINING IF OBJECTIVES ARE MET
(minimum of 2/ lesson)

- Students will display their understanding of what makes a structure strong (materials, geometric shapes) in a final cumulative project.
- Students will display their ability to collaborate in groups when constructing their final project.

B) STANDARDS (see <http://www.doe.in.gov/standards/science>)

Science and Engineering Process Standards:

- SEPS.2 Developing and using models and tools
- SEPS.3 Constructing and performing investigations
- SEPS.6 Constructing explanations (for science) and designing solutions

Content Standards:

- 2.PS.4 Analyze data obtained from testing different materials to determine which materials have the properties that are best suited for an intended purpose.
- K-2.E.2 Develop a simple sketch, drawing, or physical model to illustrate and investigate how the shape of an object helps it function as needed to solve an identified problem
- 3-5.E.1 Identify a simple problem with the design of an object that reflects a need or a want. Include criteria for success and constraints on materials, time, or cost.

C) MATERIALS (**asterisk (*)** = any materials that may be a **safety concern**)

- Popsicle sticks (500)
- Packing Peanuts (big bag)
- Straws (500)
- Masking tape (6 rolls)
- Pipe Cleaners (4 packs)
- Modeling clay (whatever is available)
- Blue books (2)

D) TEACHER CONTENT KNOWLEDGE

- Teachers need to know the properties of the shapes that some students will be incorporating into their final projects.

- Squares: 4 equal sides, 4 right angles (90 degree), exceptional strength
 - Circles: no sides, minimal strength, round
 - Triangles: 3 sides, 3 corners, 180 degrees
- Teachers need to have the knowledge of how to put the materials together and show that it is not how much is used, but how they put it together.
- E) REFERENCES (list **ALL** references that you borrowed ideas from to develop this lesson - including any handouts you may distribute)
 - N/A
- F) TENTATIVE TIMELINE
 - Check-in **(9:30-9:35)**
 - We will tell parents when they walk in that they need to meet by the tables at 11:30am for presentations.
 - We will also include a sign at the door just in case we have parents coming to the classroom.
 - Fran does warm ups **(9:35-9:40)**
 - Review and reintroduce the final project **(9:40-9:50)**
 - Hand back worksheets, place students in their groups of four from last week, and have students remind themselves and finish their design
 - Based off their design from the worksheet, students will begin building their structure **(9:50-11:30)**
 - Pass out snack: work and eat
 - Their goal is to create a structure that is strong enough to hold textbooks available in the classroom. Students chose the structure, materials, and shapes to use for their design last week so they are simply putting them together this week.
 - We will have students fill out the worksheet
 - Bathroom break/Pass out SS t-shirts **(11ish)**
 - 2 or 3 teachers will go prep the presentation area (hang up blueprints, organize tables and chairs)
 - Walk students down to the common area by the stairs for the presentation. Once completed, each team will share their design and test it. Each team will share what structure they made, what materials and shapes they used and why, and how they know their structure is strong **(11:30-12:00)**
 - Parents are welcome to come watch their kids test their final structures in front of the class.
 - Take a Group picture!
 - Get ready to go home
 - Take folders home and pack up belongings

G) DESCRIPTION OF YOUR LESSON

ENGAGE

- The engage portion of our lesson will be used to reintroduce the final project to our students.
- We will have the students get back into their groups from last week
 - We will pass out their big “blueprints” and materials they requested for their final structures.

EXPLORE

- The explore portion of our lesson will be when the students have the time to construct their final projects.
- We will be walking around to make sure that students are incorporating some of the strategies that they learned from prior weeks.
 - Emphasis on how the structure is built, not on what materials are used.
 - Incorporating different shapes into their final structure
- Focus Topic: Students will incorporate their knowledge from previous weeks to collaborate and come up with a final structure able to hold a heavy object.

EXPLAIN

- The explain portion of our lesson will be fairly easy. The students have worked hard in building their structure. We want them to tell us and their audience why they built it the way they did. Explaining their thoughts is the ultimate goal.
- We will want to make sure the students are able to tell us how and why they built their structure the way they did so encourage them to take notes while building it so it is easier to explain it to their audience.
 - This will be done by having them fill in their worksheet we provide them with and they can use it when they present.
 - The questions include: What structure did you build, What materials did you choose and why?, Why did you design the structure the way you did?

ELABORATION

- The elaboration part of our lesson will be extension of the explain phase the students filling out the worksheet we provide them with so

that they don't lose track of their reasoning on why they did what they did when building. This will make it easier for them when it comes to explaining their structures to their audience.

- ❑ For any student who is not comfortable with speaking, like our ELLS we can have them hold the structure, or serve as the pointer when their group members are explaining. This will make sure everyone is participating.

H) EMBEDDED FORMATIVE ASSESSMENT (the 5th "E")

- ❑ We will be assessing our students while they create, share, explain, and test their design.
 - ❑ We will be looking to see if our students use their prior knowledge from our other lessons to complete the design and construction of their final project.

I) GEARING UP/GEARING DOWN

- 1. Gearing up:** We could gear up this lesson by providing students with assigned materials. Instead of allowing them to pick their own materials we would give them materials and they would have to make their final structure with whatever they were given.
- 2. Gearing down:** If the students are struggling to come up with a structure that can withstand the weight of textbooks, we could have them test the strength with something lighter than the textbook.



Name of Group Members:



What structure did you build?



What materials did you choose and why?



Final Design!

