“Tell me and I’ll forget, show me and I may remember, involve me and I’ll understand.”

STEAM: INQUIRY BASED LEARNING

Unit of Study: Bridges

By: Students of Pre-K 1 at P.S. # 11

Under the guidance of Mrs. Knauss and Mrs. Hale

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It all started when....

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<th>Originating idea for our study:</th>
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<td>Throughout the second quarter, I noticed that within a short period of time, several children discussed or referred to bridges. Here are several anecdotes that sparked the thought of using this topic as a study for our STEAM activity:</td>
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<td>Rayane - Work time in the Book Area - I was reading the story of the 3 Billy Goats Gruff to Rayane. He commented, “I made a bridge like that in Block Area for the cars and trains, remember? I am gonna make one today for the farm animals. Then a monster is going to eat them off the bridge”. 12-7-15</td>
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<td>Ruthvik - Work time in the Block Area - Mrs. K “Wow tell me about what you are building?” Ruthvik - “This is New York City, the Empire State Building. It is very tall and has a pointy top.” Mrs. K - “I wonder how you know so much about something that is far away.” R - “Well I go there with my daddy and mommy. You know it’s across water. We need to take a train or drive the car across the big bridge. I forgot to build the bridge so am going to do that now”. 12-18-15</td>
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<td>Leron - Lunch time discussion “You know Mrs. Knauss, I go see my daddy in Brooklyn today.” Mrs. K. “That’s great you get to visit him. How do you get there?” L - “We take the PATH train but you can go the Brooklyn Bridge too. That bridge is cool, it’s long too”. 12-11-15</td>
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So these anecdotes, combined with the popularity of building tunnels and bridges in the Block Area on a regular basis, gave me the idea to further their interest in bridges through a STEAM study.
**Materials needed:**

~ Computer access for Internet Resources  
~ Non-fiction books about bridges and building  
~ Materials to construct bridges: blocks, recycles including but not limited to cardboard boxes, popsicle sticks of varying sizes, Styrofoam, string, tape, paper, natural objects such as sticks, wood glue, paint and brushes, cars and other objects such as coins or marbles, to test the strength of the bridges, screwdriver to poke holes through cardboard (adult use)  
~ Songs and Poems related to Bridges, Tools, Shapes and Building  
~ Materials to add to areas that connect the topic to their play, such as play tools, construction dress-up clothing, blueprint paper to draw on, and various types of trucks that are found at building sites  
~ Camera for documentation
## RESOURCES

<table>
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<tr>
<th>Books</th>
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<tr>
<td>Brooklyn Bridge by Lynn Curlee</td>
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<td>Landmark American Bridges by Eric DeLony</td>
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<td>Bridges Connect by Lee Sullivan Hill</td>
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<td>Bridges 3000 Years of Defying Nature by David J. Brown</td>
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<td>Investigating Science How Do We Use Materials? By Jacqui Bailey</td>
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<td>The Golden Gate Bridge by Caroline Arnold</td>
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<td>World Book Encyclopedia Presents Building By David Glover</td>
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<td>Structures Bridges by Andrew Dunn</td>
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<td>Golden Gate Bridge Modern Wonders of the World by Jennifer Fandel</td>
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<td>~<a href="http://www.google.com">www.google.com</a> to look at images of various famous bridges</td>
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<td>~<a href="http://www.sciencekids.co.nz/sciencefacts/engineering/bridges.html">http://www.sciencekids.co.nz/sciencefacts/engineering/bridges.html</a></td>
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<td>~<a href="https://kidskonnect.com/science/bridges/">https://kidskonnect.com/science/bridges/</a></td>
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<td>~<a href="https://www.pinterest.com/rampp/preschool-engineers/">https://www.pinterest.com/rampp/preschool-engineers/</a></td>
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<td>~London Bridge</td>
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<td>~Construction Worker Song from <a href="http://www.everythingpreschool.com/themes/construction/songs.htm">http://www.everythingpreschool.com/themes/construction/songs.htm</a></td>
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<td>~<a href="http://www.youtube.com">www.youtube.com</a> Build Better Bridges - FunKids Inspiring Engineers</td>
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<tr>
<td>~<a href="http://www.youtube.com">www.youtube.com</a> Building Strong Bridges Kids AScience Experiments</td>
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<td>~<a href="http://www.youtube.com">www.youtube.com</a> Here’s How #13 Roads and Bridges</td>
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<td>~5 Little Nails Flannel-board</td>
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<td>~Individual Shape Poems: Tommy Triangle, Danny Diamond, Suzie Circle, Sandy Square, Ricky Rectangle</td>
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<td>~Introduction to STEAM and Our Bridge Study letter</td>
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<td>~Documentation Panel displayed</td>
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<td>~3 Dimensional Bridges constructed by students displayed</td>
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<td>~STEAM Study Wrap-up letter</td>
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Parents:

STEM education refers to the areas of science, technology, engineering and mathematics. STEAM education incorporates the “A” for the arts – recognizing that to be successful in technical fields, individuals must also be creative and use critical thinking skills which are best developed through exposure to the arts. So how does this apply to your child in the Preschool education setting? Well, it is never too early to introduce your children to these concepts. In fact, we are already involved in all of them throughout our curriculum on an individualized basis, but now we are going to focus on a study of Bridges, incorporating all of these aspects of STEAM. This topic comes from the interest of the children, stemming from conversations they had with us about their personal experiences with bridges, and from their creations during work time in the Block Area in which they construct bridges from various materials.

Feel free to talk to your children about this topic. You can connect any experiences they have had going across real bridges to the experiences they are having in the classroom with learning about them in depth and in building them. Send in any photos of famous bridges they may know about, or lend books/magazines you may have about bridges. Please share anything else that you think may connect to our study! We look forward to sharing our findings and creations with you as they happen!
~Experiment - Flat Paper vs. Triangular paper
~Experiment - How much weight can the bridge hold? Use cars and coins to test
~Test cardboard vs. popsicle sticks as a foundation
~Investigate how and why bridges are built differently

1. KWL Chart Bridges
2. *New* Bridge books
3. Online videos - Bridge building
4. *New* Materials to build bridges in Art and Block Areas
5. Small Group Time Activities:
   - Trial & Error - Building bridges
   - Experiment with weight on bridges made with various materials
6. Work Time - Group Project building bridges in Art Area

~Work time - create blueprints of the bridges they plan on building
~Plan, build, and problem solve with re-creating a model of the Brooklyn Bridge and a truss bridge
~Small Group Engineering challenge - BYOB “Build Your Own Bridge”

~Use planning, persistence, and problem-solving skills while working independently, or with others, during the BYOB Engineering challenge
~Use props to act out the roles of Engineers - Work Time
~Large Group - London Bridge
~Participate in Poems & Fingerplays related to shapes and building tools

Go to www.youtube.com
Type these in the search:
1. What makes bridges so strong? SciShow Kids
2. Build Better Bridges - FunKids Inspiring Engineers
3. Building Strong Bridges Kids AScience Experiments
4. Here's How #13 Roads and Bridges

~Using a scale to get familiar with the concept of weight, and to acquire vocabulary related to measurable attributes
~Popsicle stick shape building for use with building bridges
~Estimation - How many Cars / coins do you think each bridge will hold?
~3 Dimensional building of bridges
**What do you KNOW?**

Ruthvik - They are for cars to go across water.

Jasmin - They are strong to carry cars.

Sparsh - Cars can go under them.

Jesse - People can walk on some.

Rayane - Trains can go under them.

Jenesis - Bridges are strong to hold heavy, hard stuff.

Karina - They hold lots of cars at the same time.

Kabrel - Bridges can be painted.

**What do you WANT to know?**

Anthony - How big are bridges?

Gagan - How you build the bridges?

Kyrillos - How the people go on them?

Kerolls - How do you build it in water?

Leron - How do they make them so big?

Ruthvik - What are they made out of?

Vobronya - How can they paint them so high?

Mrs. Knauss - Which shaped bridge is the strongest?

**What did you LEARN?**

Ruthvik - "I think the middle falls down because we have no block under it. Let me get another big rectangle one".

Rayane - "You can use anything to make a bridge, in all the areas".

Leron - "My favorite bridge is the Brooklyn one. I love the lines on it".

Gagan - "My daddy said he going to take me on bridges in New York so I can be up high over the waters".

Jasmin - "I love bridges with houses. I liked making bridges that make houses go together".

Jenesis - "Bridges are so long and I can build them to fit so many things on them. They are really strong".

Jesse - "Bridges are beautiful. I made a sparkly one that holds big trucks."

Kyrillos - "Bridges are good with triangles for fast cars."

Kabrel - "I love bridges for trains for New York."

Kerolls - "Bridges are to make things go to the other side, like the goats in the book that crossed away from the troll".

Lee - Maya - She built a bridge that she put a train under and cars on top of during our challenge. (She is non-verbal, based on observation)

Anthony - "You need to have a strong bridge because if there is water under it, you don't want to break and fall in".

Sparsh - "You need the top to have no bumps so the cars can drive on it."

Vobronya - "Bridges take a long time to make; you have to make a lot of parts."

Karina: "Tape is hard to stick for bridges, you need lots of glue."
Activity – Work Time:
Introduction to NEW books on Bridges and using them as a reference to explore with building

**Originating Idea:** After deciding on a STEAM study of Bridges, I provided a multitude of books that had pictures and sketches of bridges during work time in the Block Area. My objective was to engage the students in conversation about bridges and to explore building with materials they already have.

**Standards / COR item:** English Language Arts-Integration of Knowledge and Ideas RI.PK.7 With prompting and support, tell how the illustrations support the text (information or topic) in informational text.

Science Standard 5.1: Children develop inquiry skills.

5.1.1 Display curiosity about science objects, materials, activities, and longer-term investigations in progress (e.g., ask who, what, when, where, why, and how questions during sensory explorations, experimentation, and focused inquiry).

**Materials:**
1. Non-fiction books that contain illustrations of bridges and information about them
2. Graphing paper that resembles 'blueprint' paper and writing utensils to sketch their plans
3. Building materials in the Block Area that can be chosen and used in an open-ended manner by students who show interest: multitude of shapes of wooden blocks, foam blocks, and cardboard blocks, recycles, such as boxes, cardboard strips, string and tape

**Beginning:** At Greeting time, note that there will be NEW books about bridges to the Block Area today to use as a reference for creating their own designs of bridges, both on paper and with Block Area materials.

**Middle:** Sit alongside students that are book browsing and ask them open ended questions about what they are reading/looking at. Observe how some children are drawing their bridge before building and ask them to tell me about their picture. Pose a question...I wonder how we can use the block area materials to create bridges of our own? Problem solve with students as they build regarding the materials they choose, how they hold the weight of the cars and trains, and how we can connect the bridges to the ground.

**End:** Remind children that these books are going to be here for several weeks as a reference, and that they should think of new materials we need to create our bridges that we can add to the Block Area.
**Higher Order Questions / Scaffolding Technique:**

I wonder how they built that bridge over the water. (in the book) We followed up their discussion with looking at online pictures of how bridges are built in the water. Why do you think your bridge keeps collapsing? How do you think we can keep the bridge from falling down in the middle? Why do you think the ends do not fall, but the middle does? Do we have any other materials that are stronger than the cardboard?

**Child Anecdotes:**

1. R was building a bridge with support on the ends and it kept falling down when he put cars on it. I asked, "How do you think we can keep the bridge from falling down in the middle?" R - "I think the middle falls down because we have no block under it. Let me get another big rectangle one". He tries it and it holds his car. R - "I did it. The block holds the car. I just needed more under my bridge."

2. As we looked at a picture in a book of the Golden Gate Bridge, I asked, "How they thought it was built over the water?" L replied "I think the man was flying in a plane and dropped the bridge in the water". R replied "No it's too big to drop; it won't fit on a plane". L "Maybe it was magic". R said "maybe".

3. A child's bridge made of brick blocks fell several times after he put heavy trains on it. K - "Mine doesn't work, it's broken". I asked if we had stronger materials and he replied "I try this one, it for the trains," a piece of train track.

**Reflection / Suggestions:**

Place the books in more than one area, because it became overcrowded and hard to find the space to explore with materials.
Start drawing a sketch of a bridge before building, as many children followed what I was doing. This would even work in the art area, not just block. One child even went to writing area to fetch a few rulers to make straight lines.

**New vocabulary to introduce**

- Engineer
- Collapse
- Straight
- Supports
- Heavy
- Materials
Activity - Small Group: Experimenting to find out which shape is strongest in supporting weight on a bridge

**Originating Idea:** As I chose informational texts, I took notice to the various shapes used in building different types of bridges. I want children to observe the various shapes used when looking at a bridge, and to participate in an experiment that enables them to gain an understanding of why particular shapes are used through a hands-on experiment.

**Standards / COR item:** Math Standard 4.4: Children develop spatial and geometric sense.
- 4.4.1 Respond to and use positional words (e.g., in, under, between, down, behind).
- 4.4.2 Use accurate terms to name and describe some two-dimensional shapes and begin to use accurate terms to name and describe some three-dimensional shapes (e.g., circle, square, triangle, sphere, cylinder, cube, side point, angle).
- 4.4.3 Manipulate, compare and discuss the attributes of:
  - (b) three-dimensional shapes by building with blocks and with other materials having height, width and depth (e.g., unit blocks, hollow blocks, attribute blocks, boxes, empty food containers, plastic pipe).
Science 5.1.2 Observe, question, predict, and investigate materials, objects, and phenomena during classroom activities indoors and outdoors and during any longer-term investigations in progress. Seek answers to questions and test predictions using simple experiments or research media

**Materials:**
1. Informational text about bridges, as listed under resources above
2. Computer with Internet access to research
3. Experiment materials – Scale, wooden blocks, paper, matchbox cars, coins, paper and pen to record findings

**Beginning:**
Looking through informational texts on bridges, naming the many shapes they see that are used when building them. Bringing out the scale from Toy Area, talking about what this is used for, demonstrating its use with coins, and relating it to bridges by making the connection of how bridges have to carry heavy loads and balance them. Asking the children which shape they think might be strongest in balancing these loads and why? Watching an online video on www.youtube.com (as listed in references above) to view an experiment related to what we are discussing.

**Middle:**
Experimenting with building bridges that have flat paper versus triangular shaped paper, using the materials provided. Estimating how many cars (and then coins) each bridge will hold and recording this data. Testing the estimations by experimenting with each type of bridge, by placing the cars one by one and counting them, until it collapses.

**End:**
Discussing their estimations against what the actual number of cars (and coins) each bridge held. Talking about why they think the triangular shape is stronger, and using online references to get answers. Remind them that these materials will be available during Work Time for further exploration, and will be located in both the Toy and Block Areas.
Higher Order Questions / Scaffolding Technique:
Let’s predict what will happen when we place cars/coins on the bridge.
What is a different way we can fold the paper to make it stronger?
What do you think will happen if we place the same amount of coins on the bridge as we did cars?
Let’s compare what we saw happen to the bridge when we placed cars and when we placed coins.

Child Anecdotes:
Anthony - “I think the cars will fall down. They are bigger than the money”.
Jasmin - “The triangle shape is the strongest for bridges”.
Gagan - “The bridge holds so many monies, I think we can put all the money on and it will never break”.
Ruthvik - “Let’s fold the paper like this (folds it in half lengthwise) because then we will have 2 papers. Maybe we can get more paper from art area to make it stronger.” He gets a few more sheets and folds them in half, placing them on top of one another.
Karina - “The bridge with the flat paper only can hold a little bit of cars, but we put lots of cars and lots of money on the triangle bridge and it didn’t fall down”.
Jenesis - “The triangles are so strong, when I build my bridge I want to use triangles”.

Reflection / Suggestions:
Make a chart with their guesses on which shape might be strongest during the discussion. I only charted their estimations but it would have been great to have one for the shapes as well.
Research a way to explain why the triangles are stronger than the other shapes. It was difficult to explain it on a level that they comprehended. Demonstrating helps, but the explanation was hard to put into words.

New vocabulary to introduce
3-Dimensional
Scale
Weight
Heavy/Light
Load bearing
Predict
Estimate
Compare
Collapse
**Activity - Building a Truss Bridge from Materials Provided During Work Time in the Art Area**

**Originating Idea:** Children showed an interest in the Truss Bridge, especially after the small group experiment that showed how a triangle shape is strongest when building a bridge. They wanted to build a big one to use in Block Area.

**Standards / COR item:** Science 5.1.2 Observe, question, predict, and investigate materials, objects, and phenomena during classroom activities indoors and outdoors and during any longer-term investigations in progress. Seek answers to questions and test predictions using simple experiments or research media.

Technology 8.5.1 Use the Internet to explore and investigate questions with a teacher’s support.

Math 4.4.3 Manipulate, compare and discuss the attributes of:
(b) three-dimensional shapes by building with blocks and with other materials having height, width and depth (e.g., unit blocks, hollow blocks, attribute blocks, boxes, empty food containers, plastic pipe).

VPA 1.4.5 Demonstrate planning, persistence, and problem-solving skills while working independently, or with others, during the creative process.

**Materials:**
~Photographs of Truss Bridges, from the internet and in books
~Materials to build with: cardboard boxes, popsicle sticks, paper, wood glue

**Beginning:** Start off by putting this activity on the message board during Greeting Time - Engineers Wanted - Truss Bridge building challenge - Art Area Work Time. This way, children begin to think about if they want to participate in building the bridge, and then can choose this area when planning. At work time, provide the materials on the art table, along with pictures of the Truss Bridge. Pose the question… I wonder how we would begin to build this type of bridge?

**Middle:** Observe children as they talk about how triangles are strongest, and how they choose materials to glue together to make this shape. Discuss with the students that while the triangles will provide a strong frame for the bridge, we still need to think about the foundation that will support the cars. Using the book as a reference, children start gluing sticks together to build the foundation. Another child chose tissue boxes to cover in paper, to place under the sticks. Some children work independently, and others together.

**End:** Mention that while work time is ending soon, we can find a safe spot to let our sticks dry. We will continue working on our bridge, putting all of the pieces together to form the bridge and soon test out how strong it is.
**Higher Order Questions / Scaffolding Technique:**

~I wonder how we would begin to build this type of bridge?
~ I wonder what materials we should test out as the foundation that we will glue all of your triangles to?
~I notice some of you are making triangles out of small popsicle sticks and others are using large sticks. We should compare which ones would be a better fit for this bridge. How could we test that out?

**Child Anecdotes:**

Jesse - "I think I am going to glue the big sticks to make this part here (points to the triangular shaped side of the bridge in the book). I’m going to make triangles, lots of them". Vobronya - “Can I help you Jesse? It looks like a lot of triangles so I could help you.” Jesse agrees and they worked alongside one another gluing 3 sticks into a triangle shape at a time, Rayane - “I think this should be the road, here give me and I will cut it up”. He chose a long strip of cardboard and cut it in half. He got a few cars from Block Area and drove them on it. “Yup this works”. Ruthvik - “I think these boxes need paper on them, like when I made my house (tissue boxes). We could put the top of the bridge on these.” Kerolls - “We need to use the bigger sticks, because I think if they are bigger they are stronger like a cheetah”.

**REFLECTION / SUGGESTIONS:**

We ended up using the larger popsicle triangles, as opposed to some of the smaller sticks. Those were recycled into another piece of art. Maybe we could have made 2 truss bridges of varying sizes to compare and contrast how many cars each could hold.

**New vocabulary to introduce**

- Truss bridge
- Foundation
- Engineers
- Science
- Test
- Weight
Activity – Building the Brooklyn Bridge from Materials Provided During Work Time in the Art Area

Originating Idea: Leron repeatedly looked through the Brooklyn Bridge book, referring to it as “the one I go to see my daddy on”. He asked to build this one, “a big one I can drive cars on in Block Area”.

Standards / COR item: VPA 1.4.2 Create two- and three-dimensional works of art while exploring color, line, shape, form, texture, and space.
VPA 1.4.5 Demonstrate planning, persistence, and problem-solving skills while working independently, or with others, during the creative process.
Science 5.1.2 Observe, question, predict, and investigate materials, objects, and phenomena during classroom activities indoors and outdoors and during any longer-term investigations in progress. Seek answers to questions and test predictions using simple experiments or research media
Technology 8.5.1 Use the Internet to explore and investigate questions with a teacher’s support.
Math 4.4.3 Manipulate, compare and discuss the attributes of:
(b) three-dimensional shapes by building with blocks and with other materials having height, width and depth (e.g., unit blocks, hollow blocks, attribute blocks, boxes, empty food containers, plastic pipe).

Materials:
~Photographs of the Brooklyn Bridge, from the internet and the Brooklyn Bridge book
~Materials to build with: cardboard box, string, paper, paint and brushes, wooden dowels, wood glue, scissors, screwdriver to poke holes for string (teacher use), chalk

Beginning: Start off by putting this activity on the message board during Greeting Time – Engineers Wanted -Brooklyn Bridge building challenge - Art Area Work Time. Children begin to think about if they want to participate in building the bridge, and then can choose this area when planning. At work time, provide the materials on the art table, along with pictures of and the book titled Brooklyn Bridge. Pose the question...Where should we begin to build this type of bridge? It is much different looking than the Truss Bridge.

Middle: Observe children as they explore the materials laid out and as they start taking items to use. Walk around to each child, asking about what their plan with their chosen materials is. Have a group chat about how they plan on putting all of their work together to build the bridge. Observe problem solving skills, as they come across several obstacles with their materials. Some children work independently, and others together.

End: Teacher gives a 10, 5 and 1 minute warning that while work time is ending soon, we can find a safe spot to place our work so we can revisit it to complete it. We will continue working on our bridge, putting all of the pieces together and soon experiment with cars riding on it.
Higher Order Questions / Scaffolding Technique:
~Where should we begin to build this type of bridge?
~I wonder what materials we could use as the cable lines that are on this bridge?
~What type of tool would be strong enough to make holes through this thick, cardboard box?
~Now that you have cut a lot of red strings as the cables, how do you think we could attach them?

Child Anecdotes:
Kyrillos – “I want to help. I can cut the string up into lots of pieces”. I asked what they could be used for? Leron replied “we could tie them across to make all the lines like these (pointing to the cable wires that stretch along the sides of the bridges).” Jasmin said “I want to cut and tie them. I know how”.
Kabrel – “I want to do the painting, maybe red?” Jenesis replied “I could be on her team and paint, I love painting. What are these sticks for?”
Ruthvik replied “maybe they are going to hold the strings up?” I said that would be a great idea, what tool can we use to make a hole in this thick, cardboard box? Jenesis said “try the scissors”. We tried but I soon realized I needed a screwdriver!
Ruthvik – “Show me how to tie the strings under the bridge, then I can do them”. I showed him as I explained you put the string through the hole, flip the box over and pull it through the bottom. He pulled all the strings through as I demonstrated. He commented “it needs a sign, let me write that down”. He copied the words Brooklyn Bridge onto paper and taped it on.

Reflection / Suggestions:
This bridge took almost a week to complete. The only difficulty was punching the holes in the box. Maybe do this prior to setting out the materials, with no children around. It was hard to do, and the screwdriver slipped a few times. I was lucky enough to have 2 girls who tied knots on the string, which is also something to think about if you are doing this. If you do not have children who can tie, maybe use various sized dowels instead.

New vocabulary to introduce
Brooklyn Bridge
Tying knots
Solve problems
Wire cables
Screwdriver
Dowel
Activity - Small Group Time - Engineer Challenge
“Build a Bridge”

**Originating Idea:** As we are wrapping up our study of bridges, I wanted students to think about all they have learned about bridges, and to use this knowledge to create a bridge of their choice. They had the option to work with others or to work independently with a large variety of materials.

**Standards / COR item:** Approaches to Learning 9.1.4 Show persistence when faced with challenging tasks and uncertainty, seeking and accepting help when appropriate.
VPA 1.4.2 Create two- and three-dimensional works of art while exploring color, line, shape, form, texture, and space.
Science 5.1.2 Observe, question, predict, and investigate materials, objects, and phenomena during classroom activities indoors and outdoors and during any longer-term investigations in progress. Seek answers to questions and test predictions using simple experiments or research media Technology 8.5.1 Use the Internet to explore and investigate questions with a teacher’s support.
Math 4.4.3 Manipulate, compare and discuss the attributes of:
(b) three-dimensional shapes by building with blocks and with other materials having height, width and depth (e.g., unit blocks, hollow blocks, attribute blocks, boxes, empty food containers, plastic pipe).
Science 5.4.4 Demonstrate emergent awareness of the need for conservation, recycling, and respect for the environment

**Materials:**
~All books listed above as references while building as well as photographs of bridges
~Open-ended materials to build with: a multitude of recycles from cardboard boxes, egg cartons, popsicle sticks, string, scrap paper, wood glue, scissors, tape, writing materials, and wooden blocks
  in a variety of shapes
~Internet access for those who want to look up bridge pictures or information

**Beginning:** Start off by putting this activity on the message board during Greeting Time - Small Group Time - Build-A-Bridge challenge. During small group time, teachers provide the materials on each table, along with pictures of bridges, internet access to bridge information, and the books we have used throughout the study. I want you to use the materials on your table to create any type of bridge you want, using all the past few weeks of activities as a reference. Children begin choosing their materials and the challenge starts off.

**Middle:** Teachers observe an excited bunch of engineers as they explore the materials, some of them even head to the art recycle bin in search of extra resources. We walk around to each child, observing how they problem solve with their materials, how they put their plan into action, and notice how different each child’s bridge looks.

**End:** Teachers have students bring their completed work to the carpet to share with the class. We test out their durability with matchbox cars, estimating how many we think will fit on each, how many each will hold, and test out their predictions. The bridges are left on display for parents to view, and for further play in the Block Area during work time.
**Higher Order Questions / Scaffolding Technique:**

~What type of bridge do you think you can build with the materials on your table?
~How can you support your bridge from underneath so it does not continue to collapse?
~What other material would be a good fit for creating a suspension type bridge?
~How could you raise your bridge off of the table so cars can go under it?

**Child Anecdotes:**

~Lee'Maya - She placed 2 large rectangle blocks parallel to one another and stacked smaller ones on top. She cut string and added it on the top wrapped around the base.
~Rayane - "I want to make the pension (suspension) one but I need some sides". I asked him what he thought he could use? He went to art area and got pipe cleaners, "these I could tape these on the sides".
~Jasmin - I asked her how she could raise her bridge off the table so cars could go under it. She replied "let me get blocks that will make it higher up".
~Gagan - "My bridge keeps falling down, I can't do it". I asked him how he can support his bridge from underneath so it does not continue to collapse. He said "maybe I get some more big blocks, not just one under".

**REFLECTION / SUGGESTIONS:**

This activity was so exciting to watch. The students were fully engaged in the design and building process and the classroom was buzzing with lots of critical thinking and problem solving going noise! I did this as a small group, but it lasted well into the entire period of work time. So you need to either break it up into an ongoing small group activity over a period of a few days, or allot more time for it in your schedule. We also ran into work space issues at the tables, so we moved some children to the carpet to work.

**New vocabulary to introduce**

- Recycles
- Suspension
- Solve
- Lift
- Resource
- Reference
“Aha” Moments!

Moments of sudden insight, discovery, or realization!

<table>
<thead>
<tr>
<th>Students First Name</th>
<th>Students Response</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Ruthvik</td>
<td>“I think the middle falls down because we have no block under it. Let me get another big rectangle one”.</td>
</tr>
<tr>
<td>2. Rayane</td>
<td>“You can use anything to make a bridge, in all the areas”.</td>
</tr>
<tr>
<td>3. Leron</td>
<td>“My favorite bridge is the Brooklyn one. I love the lines on it”.</td>
</tr>
<tr>
<td>4. Gagan</td>
<td>“My daddy said he going to take me on bridges in New York so I can be up high over the waters”.</td>
</tr>
<tr>
<td>5. Jasmin</td>
<td>I love bridges with houses. I liked making bridges that make houses go together”</td>
</tr>
<tr>
<td>6. Jenesis</td>
<td>“Bridges are so long and I can build them to fit so many things on them. They are really strong”.</td>
</tr>
<tr>
<td>7. Jesse</td>
<td>“Bridges are beautiful. I made a sparkly one that holds big trucks.”</td>
</tr>
<tr>
<td>8. Kyrillos</td>
<td>“Bridges are good with triangles for fast cars”.</td>
</tr>
<tr>
<td>10. Kerolls</td>
<td>“Bridges are to make things go to the other side, like the goats in the book that crossed away from the troll”.</td>
</tr>
<tr>
<td>11. Lee’Maya</td>
<td>She built a bridge that she put a train under and cars on top of during our challenge. (She is non-verbal, based on observation)</td>
</tr>
<tr>
<td>12. Anthony</td>
<td>You need to have a strong bridge because if there is water under it, you don’t want to break and fall in”.</td>
</tr>
<tr>
<td>13. Sparsh</td>
<td>“You need the top to have no bumps so the cars can drive on it”.</td>
</tr>
<tr>
<td>14. Vobronya</td>
<td>“Bridges take a long time to make; you have to make a lot of parts”.</td>
</tr>
<tr>
<td>15. Karina</td>
<td>“Tape is hard to stick for bridges, you need lots of glue”.</td>
</tr>
</tbody>
</table>
PHOTO OPS
Small Group Build-A-Bridge

Jenesis

Leron

Lee’Maya
Gagan

Jesse’s Golden Bridge

Karina’s Square Bridge

Jenesis Longest Bridge
Experimenting – Triangular Bridges are Strongest

Flat paper holds 5 coins and collapses

Triangular folded paper held 26 coins before collapsing
Engineers Building The Brooklyn Bridge

Materials Needed

Jasmin

Jenesis & Leron

Leron
Presenting Pre-K 1 Engineers Model of the Brooklyn Bridge
Engineering a Truss Bridge

Anthony, Vobronya and Jasmin making triangles

Rayane helping out too

Rayane covering the boxes with paper and tape

Kyrillos gluing the large sticks
Presenting Pre-K 1 Engineers
Model of a Truss Bridge
Documentation Panel
Overall, this was a great experience for both me and the children. Even though I drive over a bridge everyday as I commute to work, I did not know much about how they are built, and the details behind the design and engineering of the building of a bridge. So it is safe to say this was a learning experience as much for the teachers as it was for the children!

I did not find much to be difficult throughout the process, but I do feel this study is not completed. I started in January, but this is one that can continue for several months. One thing I did not get to but hoped to was to connect bridges to Fairy Tales and to do some small group challenges with that. Now that they have an understanding of what a bridge is, its purpose, and how it is built, I would like to explore how it is connected to fiction books, such as 3 Billy Goats Gruff. I also came across a fairy bridge theme that looked like it would interest any little girl. So even though I did not get to these yet, we are going to continue on with exploring these other avenues of bridges. I guess my advice would be to allot a longer period of time to this study!