Long Island Children's Museum
School Visit Program
Structure and Function—Kindergarten–Grade6

Pre-Visit Materials

Thank you for bringing your class to the Long Island Children's Museum! To help you get the most out of your visit, we have created this pre-and post-visit packet for you and your class. The pre-visit activities are designed to prepare and excite your students about the field trip, and to spur them to ask questions. After your visit to the Museum, the post-visit activities will help you to reinforce the concepts that the children explored while they were here.

Exhibits you will explore: Bubbles, Changes & Challenges, Bricks & Sticks, Communication Station

Learning standards addressed:

Math, Science, Technology: 1, 2, 4, 5, 6
Health/Family Sciences: 1, 2
English Language Arts: 1, 2, 4
Social Studies: 3

Before you come:

Have a discussion with the class about what to expect on your visit to the Museum. Begin with what students know and think about museums: What are museums? What is their purpose? How many different kinds of museums (art, science, children's, history, culture) are there? Which museums have your visited? How are you supposed to act in a museum? How is a hands-on museum (children's museum, science center) different from other types of museums? This talk will help students begin to think about their trip and prepare for what they'll be doing in the Museum. Inform your students that at the Long Island Children's Museum they will get to touch, try, explore, pretend, wonder, investigate and observe by using their senses.

Pre-Visit Activities

1. Index Card Bridges

Activity goal:

Children explore ways to create different bridges from the same material and test how much weight these structures can hold.

Materials:

For each team of two-four students:

- Four large books (old text books work well)
- Four-six index cards
- 300-600 pennies (can be rolled)

Background

A flat bridge is called a beam span bridge – it relies on the stiffness of the material that's been used for the bridge to hold it up. A log that crosses over a stream is a beam span bridge. An arch span bridge uses the strength of an arch (much stronger than a flat piece of material) to hold up more weight. Though you can't make it with a file card, a suspension span bridge relies on cable or rope to hold up the bridge, and is typically stronger than both beam and arch bridges. The Brooklyn Bridge is one of the oldest suspension bridges in the United States. The Golden Gate Bridge in San Francisco is also an example of a suspension bridge.

Procedure:

Pass out the materials. Have students make two stacks of books, about four inches apart. Stacks should be the same height. Lay one file card over the gap between the books; about one-half inch of the card should be resting at each end. How many pennies do they think the "bridge" will hold before it falls into the gap? Have students record their hypotheses and then test out their theories. How close were the guesses?

Now ask students what they could do to make their 'bridges' stronger—without adding anything to the card. How could you change it to make it stiffer? How can you fold it and still have it span the gap? What happens if you fold it in half? If you create an arch? What if they fold it back and forth into pleats like a fan? What if you make a rectangular "beam?"

Let kids explore different "bridge building" techniques, folding or changing their cards to see what works best for their team. Test the strength of each structure by placing pennies on it. Ask them to record what they did to the card,

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and how many pennies each bridge held.

Have all of the teams compare their findings, and see what design held the most pennies. Discuss why the students think that one design works better than another.

Vocabulary:

Arch span
Beam span

Extensions:

- Bring in pictures of different bridges and discuss how the design of each makes it strong.
- During your visit to LICM encourage children to build different bridges in the Bricks & Sticks gallery and test their strength.

2. Bubbles in a Bag

Activity goal:

Children are asked to observe, predict, and experiment, as well as creative thinking, fine motor and language skills.

Materials:

For each pair of children:

- two straws
- one quart size Ziploc® bag with about one inch of bubble solution in it.

Procedure:

Place a straw in the bag with one end in the bubble solution and the other extending out of the bag. Close it as much as possible. What do you think will happen if you blow bubbles in the bag? Ask one child to hold the bag while the other child blows gently into it. What are your observations? What shapes do you see? How many sides does each shape have? How does the speed that you blow affect the bubbles? What things in nature does this remind you of? Change straws and roles. Did you know the hexagon is one of the strongest shapes in nature? They can fit together without any gaps. The cells of a honeycomb are hexagons because the shape makes efficient use of space and building materials.

Vocabulary:

Hexagon
Predict
Shape
Surface area
Surface tension

Extensions:

- Add food coloring to the bubble solution. Have children blow bubbles so they land on a piece of paper on the floor to create their own bubble art.
- Make your own bubble wand out of pipe cleaners. Choose whatever shape you want and predict the shape of the bubble it would make.
- During your trip to LICM ask students to try to put their hand through a bubble without breaking it. The secret is in getting the hand all covered in bubble solution. When a wet hand passes through a bubble, it won't break the surface tension and pop the bubble.

Back in the Classroom:

Ask the children to recall their visit to LICM. What were the exhibits they explored? What was their favorite thing they did here? What senses did they use while here? What did they wish they could do more of during their visit?

Post Visit Activities:

1. Become an Inventor

Activity goal:

Children will better understand the relationship between structure and function by inventing a tool or machine that makes life easier in some way.

Materials:

Paper and pencils

Procedure:

An inventor is someone who comes up with a new product, device, or idea that helps accomplish a task or makes something easier to do.

Ask students to think of an invention that would make their life easier. It might be something that helps them eat, move, do homework or play. Discuss the structure of the invention. It's not easy to talk about how something will look before you decide what it will do! This is what we mean when we say that structure follows function – how something looks usually depends on what it does. Once you decide on what you want something to do, then you can start developing a plan of what it will look like and how it will work. A lot of new inventions are adaptations or improvements of old inventions, like the cellular phone or the electric wheelchair. Applying knowledge of how things work to create practical tools, objects or projects is called technology.

Have students write two paragraphs on their invention. The first paragraph describes the invention. The second paragraph explains how the invention will make life easier for them. Students may want to spend some time brainstorming this topic before starting, so that you don't have two inventions that do the same thing. Students should make a drawing of their invention and attach it to their paragraphs.

Vocabulary:

Invention
Inventor
Technology

Extensions:

- Have students brainstorm ideas of how they would actually go about creating their invention for real. What materials would they need? How much would it cost? Collect materials, recyclables and found objects for students to construct a model of their invention.
- Hold an Invention Convention and have students present their ideas/model to the class.

2. Toothpick Structure

Activity goal:

Children will understand that in the design process, one has to design, test, observe, analyze, redesign and retest. They will also develop their skills of team work and problem solving.

Materials:

For each group of three or four

- 30 toothpicks
- Stale mini marshmallows
- Ruler
- Paper and pencil

For class

- Heavy book (object to support)
- Stopwatch or clock/watch with second hand

Procedure:

Inform the class that they are being given the challenge to build a structure out of toothpicks and marshmallows that will support the book. The structure must be at least 5 centimeters (or 2 inches) high and strong enough to hold the book for at least 10 seconds. They will only be given 30 toothpicks to build, but can have as many marshmallows as they would like.

Ask students to discuss within their groups how they want to build their structure. What shapes will they start with? How high do they want it to be? How wide? Why? Have them write their ideas and their explanations down. They can draw diagrams with labels if they choose.

Have each group start to build with the materials given. Encourage them to work together to find a solution. It is also acceptable for them to observe how other groups are approaching this challenge. They are welcome to test the strength of their structure at any time. With what shape or shapes are you building? Are you building with all of the same shapes? How high are you trying to make it? How wide do you think it has to be in order to support the book? Will you use all of the materials given to you?

When participants feel they are ready to test the strength of their structure, place the book on top and time it. Was your structure successful in supporting the book? If not, what happened? What do you observe? What did you learn from this? How will you redesign your structure based on what you observed?

Remind them that there are no failures, just learning experiences. Ask the class to record their observations and the results of their first test. Students should also record their thoughts on the redesign.

Invite them to continue building, using the results from the first test as reference. When they are ready, allow them to retest the design. It is not uncommon for a design to go through many revisions and retests. Scientists and engineers go through this process all the time.

Bring the class together to discuss their solutions to the challenge. You will find that the groups will have come up with different designs. Have the children take a look at all the structures and ask each group:

- How did you go about designing and building your structure?
- What challenges did you have and how did you overcome them?
- What surprised you most as you went through this process?

Vocabulary:

Analyze
Design process
Observation

Extension:

- Make a chart of the materials used by each group. How many toothpicks? How many marshmallows? Which group used the least amount of toothpicks? Least amount of marshmallows?
- Take a look at the buildings in your neighborhood and observe the different shapes used to support the structure.

Resources for Teachers:

The Power of Play: Learning What Comes Naturally, David Elkind, Da Capo Press, December 25, 2007.

Teaching About Disabilities Through Children's Literature, Tina Taylor Dyches and Mary Anne Prater, Libraries Unlimited; annotated edition, February 28, 2008 .

Einstein Never Used Flashcards: How Our Children Really Learn—and Why They Need to Play More and Memorize Less, Roberta Michnick Golinkoff, Kathy Hirsh-Pasek Ph.D., Diane Eyer, Rodale Books, August 12, 2004.

Fun With Water and Bubbles, Heidi Gold-Dworkin and Robert K. Ullman, McGraw-Hill; 1 edition, November 19, 1999.

PBS Building Big Educator's Guide
http://www.pbs.org/wgbh/buildingbig/educator/index.html

Resources for Students:

Twizzlers, Shapes and Patterns, Jerry Pallotta, Cartwheel Books; 1st edition, November 1, 2002.

Building Big, David Macaulay, Sandpiper, May 10, 2004.

Everyday Structures from A to Z, Robbie Kalman, Crabtree Publishing Company, 2000.

Pop! A Book About Bubbles (Let's-Read-and-Find-Out Science, Stage 1), Kimberly Brubaker Bradley, Margaret Miller (Illustrator), Collins, September 4, 2001.

In Jesse's Shoes, Beverly Lewis, Bethany House, October 1, 2007.

We All Communicate (Disabilities and Differences), Rebecca Rissman, Heinemann Library, February 15, 2009.

The Bubblesphere
http://www.bubbles.org