Vocabulary

Angle	A figure formed by two lines extending from the same point; a corner.
Architect	A person who designs buildings and advises in their construction.
Base	The bottom support of anything; that on which a thing stands or rests.
Beam	A large, oblong piece of timber, metal, or stone used especially as a horizontal support.
Bolt	A threaded pin or rod with a head at one end, designed to be inserted through holes in assembled parts and secured by a corresponding nut.
Brace	A structural support.
Construct	To form by assembling parts; build; erect.
Diagonal	Having a slanted or oblique direction.
Form	An object's appearance or configuration.
Foundation	The natural or prepared ground or base on which a structure rests.
Function	What something is used for.
Horizontal	Parallel to the level ground.
Hypothesis	A prediction based on observation, experience or scientific reason.
Nut	A small block of metal or wood with a central, threaded hole that is designed to fit around and secure a bolt or screw.
Perimeter	The area surrounding the base of a building.
Predict	To declare or indicate; foretell on the basis of observation, experience, or scientific reason.
Rectangle	A four sided shape containing two sets of equal sides and four right angles.
Right Angle	A 90 degree angle, found in squares, rectangles and right triangles.

CHICAGO CHILDREN'S MUSEUM

Vocabulary

Sequence	A continuous or connected series.
Skyscraper	A building of exceptional height completely supported by a framework, as of girders, from which the walls are suspended.
Square	A rectangle with all four sides equal in length.
Stable	Ability to carry a realistic load; strength.
Structure	Something (as a building) that is constructed.
Strut	A bar or rod that resists pressure and supports a building.
Triangle	A shape having three straight sides and three angles.
Vertical	Perpendicular to the level ground.

CHICAGO CHILDREN'S MUSEUM

Activity: Building Investigation

In this activity you can introduce students to the basics of buildings right in your own school by hunting for building necessities like pipes, bolts, wires, braces and beams.

Materials

Notebooks
Pencils
Blackboard or Poster board to chart findings

Procedure

1. Before doing this activity with your class, take time to look around your classroom and adjacent hallways for structural objects like braces and beams and functional elements like wires and pipes. If possible, ask the building engineer to take you personally into the boiler room or another area where building basics are more easily seen, and take time to study the school's structural support by viewing it from the outside.

2. When you're familiar with your school's structure, set up a time to go on a building investigation. Ask the building engineer to take your whole class on a special behind-the-scenes school tour.

3. As a class, brainstorm a list of what might be inside a wall if you could look inside. You can start by thinking of what you can see on the outside of a wall like a faucet or light switch and then hypothesize what is inside the wall. Be sure to think about what kind of supports must be inside, too.

4. Take a walking tour of the school to try to spot some of the building basics you brainstormed. If weather allows, try looking at the building from the outside, too.

5. Have students carry a notebook and pen to sketch or record the different things they found, where they found them and even a prediction of what they think it does.

6. Regroup in the classroom and make a chart of your findings, including what you found in the classroom, halls, boiler room, etc.

7. Conclude by having students share something they had never noticed before.

Alignment with State Goals

State Goal 11
Understand the process of scientific inquiry and technological design to investigate questions, conduct experiments and solve problems.

State Goal 12
Understand the fundamental concepts, principles and interconnections of the life, physical and earth/space sciences.

Activity: Tool Test

While at the museum, students will be using a variety of real tools to build a structure. This activity provides your class with an introduction to names, characteristics, and uses of different tools. Students will explore a variety of familiar and unfamiliar tools and hardware to determine their functions.

Materials

Traditional tools like a hammer, nails, screws, wrenches, pliers, a level, tape measure, screwdrivers, and files.

Less common tools like chisels, clamps or pinking shears.

Poster board (7-9 pieces)

Markers

Procedure

1. Divide the students into groups of four.

2. Give each group a sheet of poster board, a variety of markers, 2 or 3 common tools, and an equal number of unfamiliar tools. Be careful not to name any of the tools.

3. Have the students make a chart on their poster board that includes the following headings: Tool's Name, Characteristics, Diagram/Drawing, Function/What Does It Do?

4. Encourage the students to guess or make-up names for tools or functions they do not know. Ask the groups to use available sources to research one of the tools of their choice.

5. Each group can then share with the class their predictions and findings for that tool. As an additional challenge, have the students add another category to their list called "User." Ask them to guess what trades or professions use each tool.

6. Regroup in the classroom and make a chart of your finds, including what you found in the classroom, halls, boiler room, etc.

7. Conclude by having students share something they had never noticed before.

Extension Activity: Invite a Guest!

Invite a guest to your class! Do any of the students' parents have a job that is related to construction, such as an architect, plumber, electrician or carpenter? Ask adults if they would be willing to come to your classroom and explain how their job works. Encourage them to bring in a tool or supply they use that everyone can have a chance to try out or see up close.

Alignment with State Goals

State Goal 5

Use the language arts to acquire, assess and communicate information.

State Goal 13

Understand the relationships among science, technology and society in historical and contemporary contexts.

CHICAGO CHILDREN'S MUSEUM

Activity: Architecture X-Ray

Do this activity before and after the *Skyline* workshop! Students will sketch the "bones" of a building using what they know about how structures stand up.

Materials

An example of an x-ray (images can be found online)
Pictures of buildings and skyscrapers
Paper
Pencils

Procedure

1. Show students an example of an x-ray. Ask if anyone has ever had an x-ray done on their body. Explain that an x-ray machine takes a picture of bones on the inside of someone's body.

2. Pass out pictures of buildings and explain that they are going to draw what they think a building x-ray would look like. Explain what you wouldn't see, like bricks or wood on the outside. Instead, the picture should show the "bones" of the building—what is holding the building up. This includes beams, struts and braces. Define or review these terms.

3. You can expand the activity by encouraging them to also "x-ray" the ground directly beneath the building to reveal a foundation.

4. After students draw their building x-ray, they can be displayed side-by-side with the original picture of the building.

5. Doing this activity before and after the *Skyline* workshop will give you an opportunity to document students' increased understanding of how buildings stand.

Extension Idea: See-through Skyscrapers!

To further explore how structures stand up, construct see-through buildings. Use dried spaghetti noodles connected with marshmallows to build the frame of a building. Add the walls on last using plastic wrap. This is a great way to visualize how, with taller buildings, the walls don't support the building, but instead are added on last. This is called a curtain wall.

SKYLINE

Alignment with State Goals

State Goal 11

Understand the process of scientific inquiry and technological design to investigate questions, conduct experiments and solve problems.

CHICAGO CHILDREN'S MUSEUM

Activity: Roller Coaster Construction

Planning is an essential step to building a structure. In this activity students will design a plan for a roller coaster and then try building it.

Materials

Construction paper	Tape
Glue	Flattened cardboard boxes
Plastic cups	Scissors
Pipe cleaners	Other handy materials

Roller coaster planning worksheets

Procedure

1. Start with a discussion of roller coasters and carnival rides. Talk about what rides the students have been on and list what attributes make the ride especially fun, like loops, dips and drops. Explain that, as a class, you will be planning and building a new amusement park. You can even brainstorm and vote on a name for the park. Assign students to work in pairs or in small groups. Show them the building materials they will have the option to use.

2. Pass out a roller coaster planning sheet to each group. Ask students why they think it is important to make a plan before building. Discuss what a building plan might include, like the potential size and shape of a structure, and details of what materials will be used to build it.

3. Have students work in their groups to brainstorm what kind of coaster they might build. To organize their ideas, they should complete the first half of the roller coaster planning sheet.

4. Once everyone has a plan completed, pass out the construction materials and have them work in a group to design the roller coaster.

5. When groups have finished building, have them complete the second half of the planning worksheet. Then, have groups present their roller coasters to the rest of the class. Ask them to explain how their roller coaster varied from the original plan and why they needed to make adjustments.

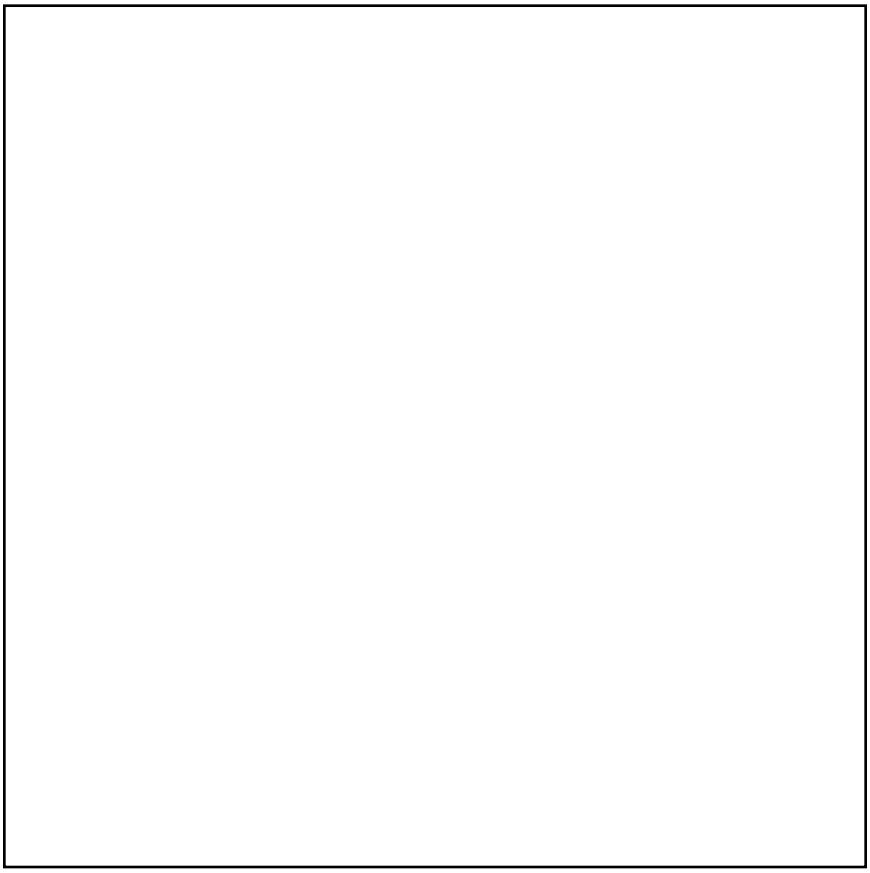
6. Conclude by discussing why groups made adjustments; possible reasons might include increasing stability, the materials worked differently than anticipated or a new idea occurred to them while they were building. Discuss how architects and construction workers might face similar challenges and would problem-solve and adjust plans just like the students did.

Alignment with State Goals

State Goal 5
Use the language arts to acquire, assess and communicate information.

State Goal 11
Understand the processes of scientific inquiry and technological design to investigate questions, conduct experiments and solve problems

Sketch your idea for a roller coaster



List the materials you plan to use

_____

_____

_____

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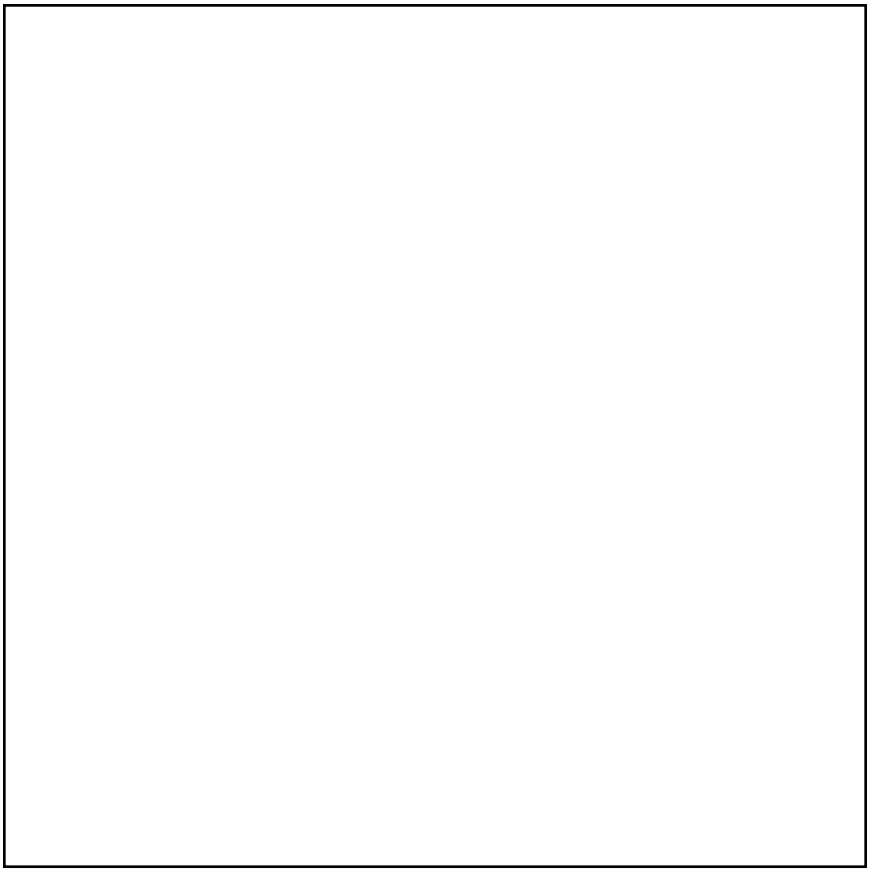
_____

Sketch your completed roller coaster



How is the finished coaster different from the plan?

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Coaster name: _____

Activity: Chicago Connections

Chicago is home to many architecturally influential buildings. Students will research different famous buildings to learn more about Chicago's architectural history as well as think about the ideas of form and function as they relate to structures.

Materials

Books about skyscrapers and architecture
Books about Chicago
Optionally, access to the internet

Procedure

1. Start this project by discussing form and function. Form is what something looks like and function is how something is used. Brainstorm different functions of buildings like being a place to live, a place to work or a place to sell things.

2. Assign students to research landmark Chicago buildings in groups to find answers to some of the following questions:

- When was it built?
- Who is the architect?
- How tall is it?
- What was it originally used for? (what was its original function?)
- Is it still used for that today? (what is its function today?)
- What does it look like? (what is its form?)
- Do you think its form help its function?

Students can peruse reference books to find a building of interest to them, or you can suggest one of these landmark Chicago buildings:

The Sears Tower
Marina City
The Carbide & Carbon Building
The Tribune Tower
The John Hancock Building
Merchandise Mart
The Wrigley Building

3. Have the groups find or sketch a picture of their assigned building and then create a fact sheet about it.

4. Bind the sheets together to create a book. Add this to the class library!

SKYLINE

Alignment with State Goals

State Goal 13
Understand the relationships among science, technology, and society in historical and contemporary contexts

CHICAGO CHILDREN'S MUSEUM

Activity: Stable Shapes

Students will have an opportunity to test whether a triangle or square is more stable. Using squares and triangles is essential to building a stable skyscraper in the workshop.

Materials

Drinking straws (7 per group)
Paper clips (14 per group)

Procedure

1. Ask students to predict which shape is more stable, a triangle or square. Why? Record the answers.

2. Divide the class into small groups. Give each group a set of straws and paper clips, and instruct each group to build a triangle and a square. To connect the straws, place the wide end of a paper clip into the end of one straw. Attach a second paper clip into the first. Insert the wide end of the second clip into a second straw.

3. Ask students to compare the stability of the shapes by standing each up and pressing down on the top corner. Next, bend each shape and press down until it collapses. Have students identify and record the differences.

4. Brainstorm why the straws arranged into triangles are more stable shapes than squares. Note: when compression force is pressed on the joints, a triangle does not change shape as much as the square. The compression in the two sides is balanced by the tension in the cross-piece at the bottom, which pulls the sides back together. This balancing of forces results in a more stable structural form.

5. Challenge the students to use two straws to make a straw square stronger. Children may use a diagonal cross-piece as a triangular brace, stabilizing the joints of the square and keeping them from changing shape when a force is applied.

SKYLINE

Alignment with State Goals

State Goal 9
Use geometric methods to analyze, categorize and draw conclusions about points, lines, planes and space.

State Goal 10
Collect, organize and analyze data using statistical methods; predict results; and interpret uncertainty using concepts of probability.

State Goal 11
Understand the processes of scientific inquiry and technological design to investigate questions, conduct experiments and solve problems

CHICAGO CHILDREN'S MUSEUM

Activity: Builder Books

Using pictures taken during the workshop and available to you online, students can make books that explain their building experience, and illuminate their specific challenges and learning.

Materials

Pictures from the workshop, printed from our website
Copies of the Skyscraper Challenge book (included)
Glue
Pencils

Procedures

1. Before starting this activity, access your class's stories online at www.chicagochildrensmuseum.org/skyline.html. You will need the building permits used during your visit in order to access your pictures. Print off each group's pictures.

2. Have students sit with the cooperative building groups they worked in while participating in the Skyline workshop.

3. Access your class's building stories online again. Have each group come up to watch their building story.

4. Give each group a Skyscraper Challenge book (included) and their building pictures. Alternatively, each student can make a book instead of working in groups. In that case, make sure to make copies of each group's pictures for every student in the group.

5. Have students arrange the pictures in chronological order and then glue them to the appropriate pages in the building book. Then, students should work as a team to answer the questions about the building process inside.

6. Have each group present their book to the class. Add the books to the class library.

Home Extension

In addition to revisiting your field trip pictures at school, students can listen to their skyscraper stories again with their parents. Included in this packet is a customizable letter home to parents that explains how to view the stories. You will need to fill in each student's building permit number.

Also included is an article titled "Experience is Never Quite Enough," that further explains how narrative and documentation, like the stories your class recorded during the Skyline Workshop, truly enhance learning and how parents can further extend that process. That article can be reproduced and sent home with the letter.

Alignment with State Goals

State Goal 4
Write to communicate for a variety of purposes.

State Goal 5
Use the language arts to acquire, assess and communicate information.

Skyline Workshop Resources

Fiction and Storybooks

- Barton, Byron. *Building a House*
- Carle, Eric. *A House for a Hermit Crab*
- Forrest, Wilson. *What it Feels Like to be a Building*
- Gibbons, Gail. *How a House is Built*
- Santora, Scott. *The Little Skyscraper*

Nonfiction and Reference

- Hyatt, Robert and Helen Clayfield. *Designing Everyday Things: Integrated Projects for the Elementary Classroom*
- Johmann, Carol and Elizabeth Reith. *Bridges: Amazing Structures to Design, Build, and Test*
- Johmann, Carol. *Skyscrapers! Super Structures to Design and Build*
- Lepik, Andres. *Skyscrapers*
- Morris, Ann and Ken Heyman. *Houses and Homes (Around the World Series)*
- Taylor, Barbara. *Structures and Materials*
- Van Der Meer, Ron and Deyan Sudjic. *The Architecture Pack: A Unique, Three-Dimensional Tour of Architecture Over the Centuries*

Websites for Students and Teachers

PBS Building Big
www.pbs.org/wgbh/buildingbig
This website has links to detailed information on famous skyscrapers and a related glossary.

Discovery Channel-Extreme Engineering
dsc.discovery.com/convergence/eti/eti.html
Detailed information on specific engineering marvels is available here.

Discover Engineering Online
www.discoverengineering.org/eweek/index.html
With links to different examples of engineering and interactive games, this website is a good resource for older students.

Great Buildings
www.greatbuildings.com
The search feature makes this website a good starting point for researching buildings.

CHICAGO CHILDREN'S MUSEUM

Dear Parent,

This week our class visited Chicago Children's Museum and took part in the Skyline workshop where we learned about skyscrapers by building them. While we built, a camera took pictures of the students at work. At the end, the students reviewed the pictures and took turns recording their skyscraper story, including the challenges and successes each team had. When students reflect on their own work, in this case by recording a narrative of their experience, they can better process and recall what they have learned.

You can see the pictures and hear the stories, too! Access them online at:
www.chicagochildrensmuseum.org/skyline.html

And enter building code _____

Also, please take a moment and read the enclosed article that further discusses how adults can help students reflect on their learning at home.

_____

Teacher

Dear Parent,

This week our class visited Chicago Children's Museum and took part in the Skyline workshop where we learned about skyscrapers by building them. While we built, a camera took pictures of the students at work. At the end, the students reviewed the pictures and took turns recording their skyscraper story, including the challenges and successes each team had. When students reflect on their own work, in this case by recording a narrative of their experience, they can better process and recall what they have learned.

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And enter building code _____

Also, please take a moment and read the enclosed article that further discusses how adults can help students reflect on their learning at home.

_____

Teacher

Experience is Never Quite Enough:
Why Reflection is So Important to Learning

By Tsivia Cohen, Director of Family Learning Initiatives, Chicago Children's Museum

Not long ago, while driving to work, I figured something out. Forgive me for not saying what it was, but this column is not about *what*, it's about *how*. How did I take a number of slightly confusing experiences, make sense of them, and then reach my not terribly earth-shattering "ah-hah"? Did I simply think about what happened and then go, oh, I get it? Well, not exactly. Instead, I had an imaginary conversation (a silent one, thank you) with a specific person, or more correctly a representation of that person—a colleague who, in real life, asks good questions and enjoys the process of talking out problems.

Internal talk is often modeled on how we converse with real people. Sharing with others is one way we make sense of our experiences. By putting words to them, we perceive or construct a narrative that changes raw experience into more easily stored and processed memories. A number of researchers have studied how important this adding of narrative language is to children's learning, as well as how adults can support the process. By talking with children we not only enhance their ability to learn from their current experiences, we also help them build a model of how to learn from future experiences—including questions they might ask themselves. By listening and appreciating their answers, we become the internal audience they can "speak" to whenever they're ready to think something through.

Conversations, many experts believe, are at the heart of how people learn in museums and other kinds informal learning settings. Talking doesn't just represent the learning that has occurred; it leads us to that learning. The next time you visit Chicago Children's Museum, try out the multimedia component in our new Skyline exhibit. Using pictures of your family building a skyscraper, you can create an oral record of what you were thinking and learning as you worked. The National Science Foundation funded the museum to create this research-based component as a strategy for increasing adult-child collaborative learning and reflection. You can review your pictures and story in the exhibit and you can access your "book" the next day on our museum website.

This high-tech component is just one way to support children's ability to process and understand their experiences. Here are a few tips for some low-tech approaches to reflection:

Life is a story we tell. Experts are not in agreement about whether experience is already a narrative or if we make it one by reflecting on it, but in either case, stories, as a format, are familiar to children. When we encourage children to tell "the story" of what happened, we help them organize their experiences into a narrative.

Young children need help putting experience into words. Narratives about shared activities can be constructed together. Appreciate their contributions and elaborate on them from your own memory.

Ask specific questions to help children talk while giving them some context for their memories. Rather than, "What did you do at the museum," you might ask, "What did you dig up in the dinosaur pit?" Talk together about what your child found most interesting.

Talking with children during events can aid learning and recall. In addition to pointing out salient details, you can help them link what they're doing with earlier experiences and knowledge. "This makes me think of that day when…" Catherine Haden of Loyola University has shown that young children are better able to remember activities that were "jointly handled and jointly discussed."

Follow your child's lead. Sometimes children can't divide their attention between doing and reflecting. Be aware of your child's needs and wait for the right moment.

Documentation can make reflection easier. Whether it's pictures you snap of children at play or a take-home art project from the Artabounds Studio, a physical record helps facilitate meaningful discussion.

Reflect early and often. Talk about what happened while the experience is still fresh, but revisit it later. The trip home is a good time to discuss what you did at the museum, but later you can write a story about it or review the pictures you took. Reflecting on your own reflections can lead to deeper understandings.

Talking with children about their activities is an important way to support their ability to make sense of what happens to them. Putting language to experiences is a process we fine-tune over our lifetime, but someday, way in the future, it may be your voice in your children's heads, helping them figure something out, as they drive their heliocar to their cyber-pad.

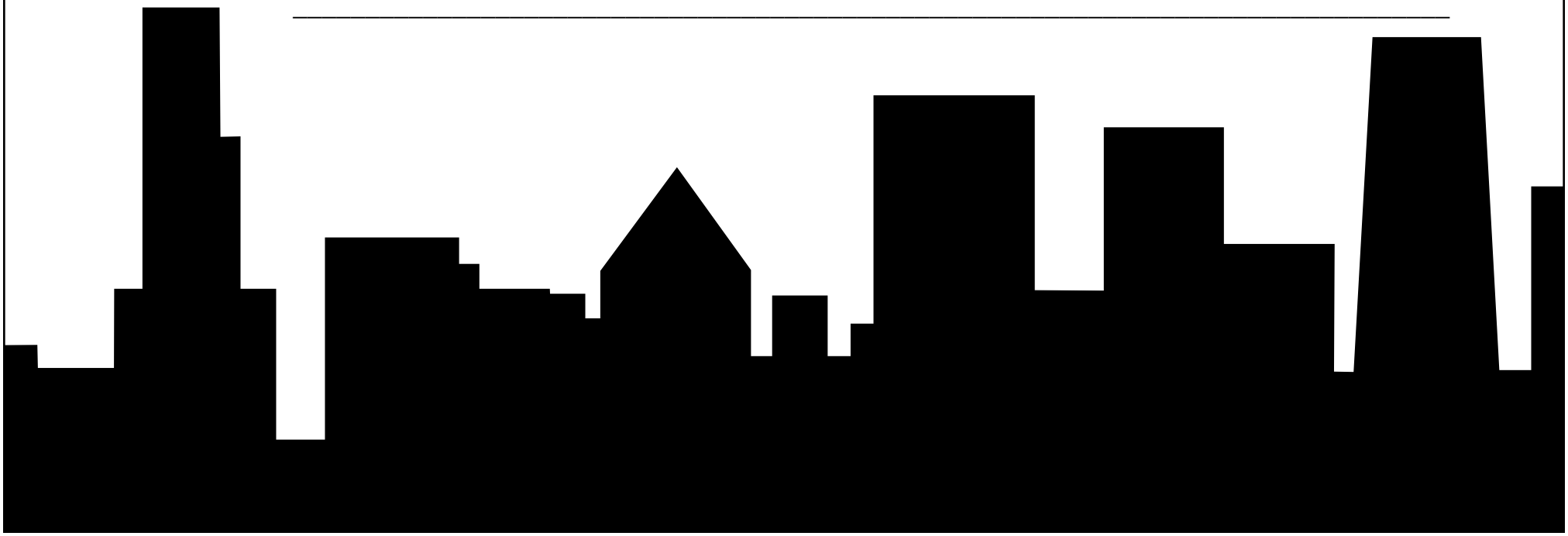
SKYSCRAPER CHALLENGE

The title of your story is:
El titulo de tu historia es:

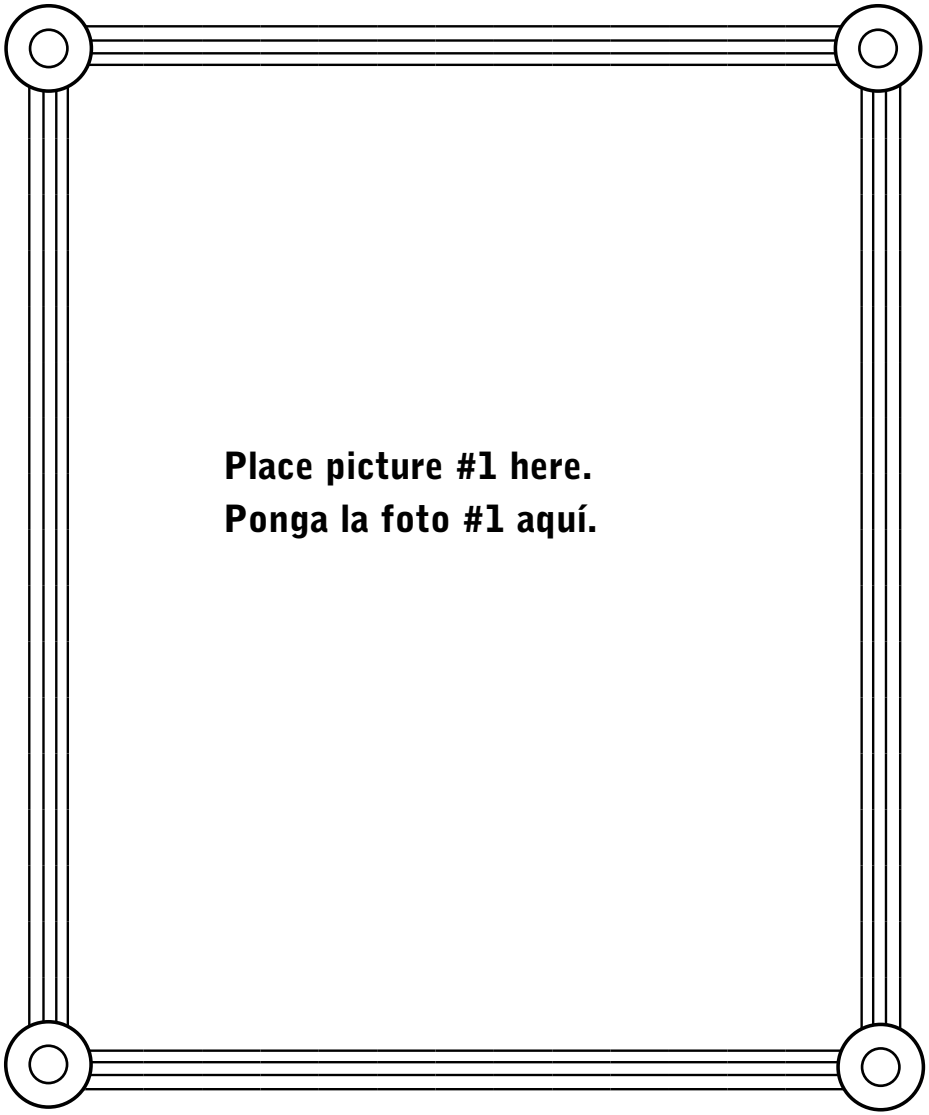
_____

The authors are:
Los autores son:

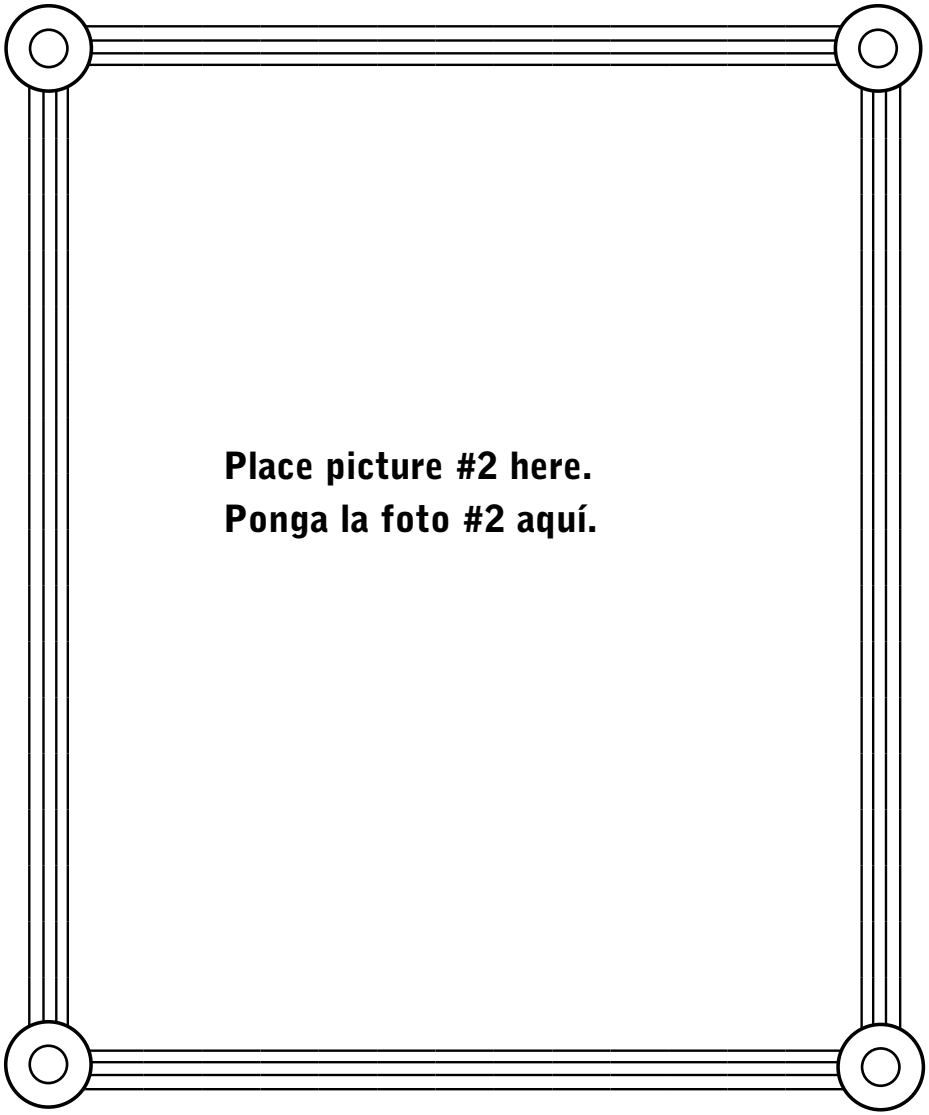
_____



How did you figure out how to start building?
¿Cómo decidieron de qué modo comenzar a construir?



What was each of you thinking as you built?
¿Qué pensaba cada uno de ustedes mientras construía?



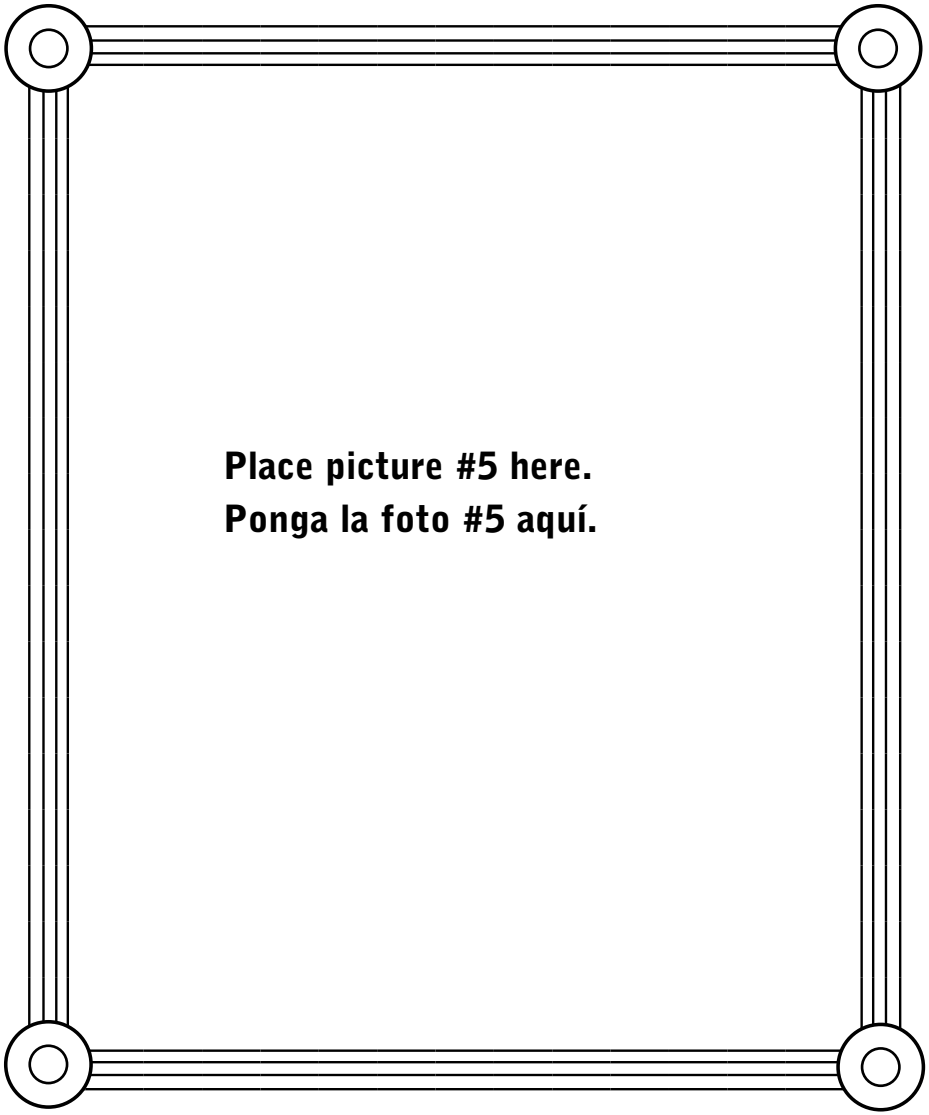
What problems did your team have as you built?
¿Qué problemas tuvo su equipo durante la construcción?

Place picture #3 here.
Ponga la foto #3 aquí.

How did your team try to solve these problems?
¿De qué modo intentó su equipo resolver estos problemas?

Place picture #4 here.
Ponga la foto #4 aquí.

What did you learn from making your building?
¿Qué aprendieron al construirlo su edifico?



What do you think you'll remember from doing this?
¿Qué creen que van a recordar de todo esto?

Place picture #6 here.
Ponga la foto #6 aquí.

If you come back to this exhibit, what will your team do differently?
Si regresen a esta exhibicion, ¿qué cambios haria su equipo?

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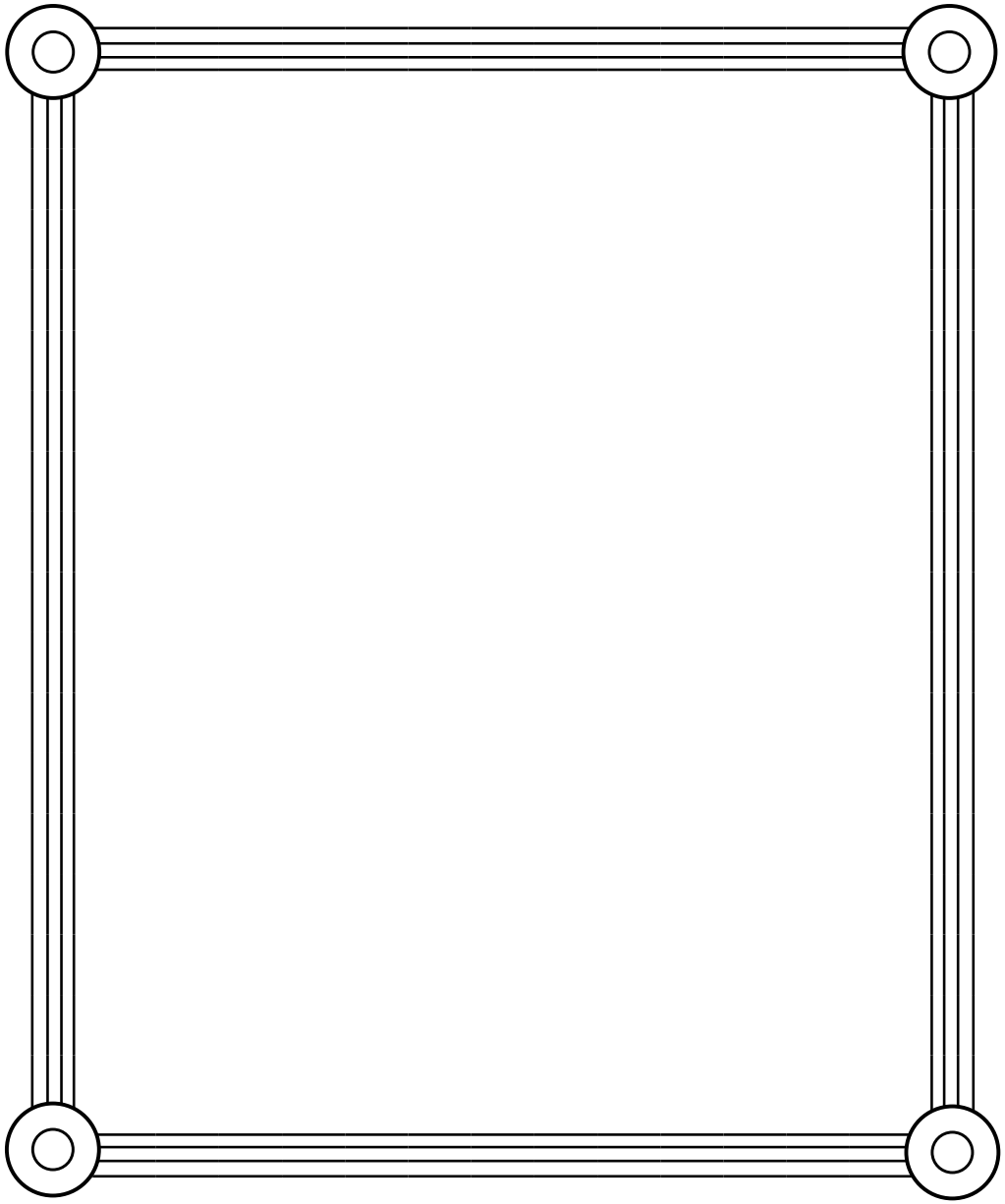
The End
El Final.

Use the box below to draw a picture of your next skyscraper.
Use la caja de abajo para dibujar su proximo rascacielo.



Thank you for visiting Chicago Children's Museum.
Visit our Web site for more fun activities.
www.chicagochildrensmuseum.org/skyline.html

Gracias por su visita al Chicago Children's Museum.
Visite nuestro sitio Web para más actividades divertidas.
www.chicagochildrensmuseum.org/skyline.html