What's the BIG Idea?™
Making Math and Science Come Alive for Children and Families in Your Library

Librarian Manual

www.mothergooseprograms.org
bigidea.mothergooseprograms.org
What’s the BIG Idea?™
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What's the BIG Idea?™

The What's the BIG Idea?™ program was developed by Mother Goose Programs™ with funding provided by the National Science Foundation. During its pilot phase, the project provided professional development and materials to help librarians incorporate math and science into their programming for pre-K and Kindergarten children and their families. Librarians spent four years focusing on the “big” ideas critical to children’s acquisition of basic math and science skills and concepts: Numbers and Operations, Patterns and Relationships, Change Over Time and Geometry and Spatial Sense.

Using the What's the BIG Idea?™ Math & Science Librarian Kit, these librarians converted what they learned into hundreds of library programs. In addition, they enriched their circulating collections and outreach initiatives with What's the BIG Idea?™ Family Kits.

Making Math and Science Come Alive for Children and Families in Your Library

The What’s the BIG Idea?™ Librarian Manual is organized into five chapters as follows:

• The first chapter includes frequently-asked questions, education standards, working with community partners, building discovery centers, working with parents and much more.

• The next three chapters — More Than Counting (Numbers and Operations), Patterns and Relationships (including Change Over Time) and Shapes and Spaces (including Building and Construction) — contain hands-on, standards-based investigations, program ideas, book suggestions, examples of data collection and graphic representation, and math and science concepts and skills. Each investigation begins with a goal and a list of what’s needed and includes suggested open-ended questions to help spark discussion.

In addition, each chapter includes these components:

- Blue boxes contain more programming ideas from librarians.
- Green boxes feature Discovery Center suggestions.
- Orange boxes consist of math and science skills, concepts and vocabulary.

• Following the content areas is a complete bibliography with more book suggestions relating to the math and science topics included in the preceding chapters.

• The final section is for trainers. It contains useful information for anyone who plans to train other professionals in the What’s the BIG Idea?™ method of programming.
It’s Not Rocket Science!

If you’re reading this, you’re probably interested in trying out some science and math activities in the programs you do with children and families but...there are always a lot of “buts” with new ideas and programs. Some of those are addressed below.

This What’s the BIG Idea?” Librarian Manual will help you make science and math connections to the programs you are already doing and help you bring science and math content, skills and processes to almost any interaction you have with young children and their families.

Isn’t it a lot of extra work?
No and NO! You are already doing math and science, you just need to be more intentional in what you say (vocabulary) and the activities you do (What’s my goal? Is this a meaningful activity for young children?) .

I’m a librarian. I don’t do anything with Education Standards.
When you read a book to children, do you hold it up and show the cover? The endpapers? Do you talk about the author/illustrator and do you show them that text moves from left to right? Do you ask children to talk about the illustrations?

These practices are included in the language and literacy standards for early childhood. Whether you realize it or not, you are practicing those standards. There are equally basic standards in math and science.

I don’t understand my state/local standards.
Standards and Outcomes are ways of thinking about what we’re doing: Is it age appropriate? Is it important for children to know? Are we helping parents and other caregivers encourage children’s cognitive (brain) development?

The Standards practiced in the What’s the BIG Idea?” program, found on pages 9-16, are based on state and local standards including Head Start Outcomes. They will be a close match to your state’s education standards for preschool through first grade.

“Reaching children in unconventional ways through the public library is working...to observe even the youngest children learning by investigating is exciting.”
—Ellen Campos, Houston Public Library, TX

“I just loved watching the kids trying to make their towers as tall as they could (to the point where they stood on chairs and stools). Even the parents got involved in the building challenges.”
—Cheryl Cox, Springfield Town Library, VT

“My biggest pleasure has been observing each child taking the ideas and shaping them into their own patterns and ideas. It’s a real learning process for everyone.”
—Cindy Pytlak, Paine Library, Willsboro, NY
I don’t do any science.
Oh yes, you do! Did you solve a problem today? Sort anything? Make a prediction? Notice the changes in the weather? Use your senses? Observe the color, sound or size of anything? Estimate, compare or measure something?

Check out the information on pages 14-16 to find out what science you already do in your program. You’ll see that you do science all the time, you just haven’t named it and/or been intentional about it.

Math was my worst subject in school.
Can you count? Add simple numbers? Recognize a pattern? Sort? Make a chart? Write a number sentence (equation)? If so, you can introduce math concepts to young children.

Check out the information on pages 10-13 to find out if you ever do any math in your programs. You’ll see that you do math all the time, you just haven’t named it and/or been intentional about it.

My library is small/I’m a one-person library.
As you read through the manual and try the science and math activities you’ll see that it takes no more energy or space to do math and science than it does to do any book-based program and activity.

I already have all my programs planned. And I don’t want to give up some of my favorite themes!
The What’s the BIG Idea?” Librarian Manual will help you make math and science connections to any program you already have planned. This manual includes activities that will help you incorporate math and science concepts, while using your favorite picture books.

I like to have fun with the children.
Who says math and science aren’t fun? Who says learning isn’t fun? A group of children plus a good book plus a science or math-based activity all equal FUN!

From one librarian:

Whether you realize it or not, you use math and science every day. Children learn math and science by doing math and science. They need to ask questions, have discussions, explore using a variety of materials, collect data and talk about what they’re doing. Picture books are a powerful tool to help introduce children to math and science!
Why Use Picture Books to Introduce Math and Science?

Stories are a powerful way to introduce math and science to children. Researchers recommend using picture books to develop math and science skills and understandings because picture books:

- Provide a story context for math and science content.
- Suggest manipulatives for a variety of math and science investigations
- Encourage children to recreate stories in their own way, as well as to practice math and science skills
- Pose problems that can be solved using varied strategies
- Develop math and science concepts
- Encourage the use of math and science language
- Help children make sense of their world

Many favorite story hour books lend themselves to discussion of math and science concepts. For example: When you read *The Three Little Pigs*, you can explore same and different, size and shape, building and problem solving.

In addition to using picture books to introduce a math or science idea, you may want to delve further into the facts by using non-fiction books. For instance, you could pair Chris Van Allsburg’s *Two Bad Ants* with a good non-fiction book about ants.

Non-fiction books present facts and photographs or scaled drawings about a subject. Here are some things to consider when using non-fiction books:

- Non-fiction books are not meant to be read out loud from cover to cover. Before you use a non-fiction book, do as you would with a picture book and read it from cover to cover. Choose the parts of the book that reinforce, extend or otherwise add to the concept you and the children are exploring.
- Give the children time to look closely at photographs and illustrations. Read the captions to them to help explain what they are looking at.
- Stop reading after a few facts and talk about them.
- Use the non-fiction book to compare and contrast with the picture book. Do the ants in the photo look like the two bad ants? How are they the same? How are they different?
How to Organize a Program

As you plan any math and science program, think about the following:

• What math or science topic or process will we explore and how will we do it? When you have your answer, review the standards, activities and questions in this manual pertaining to your topic.

• What are the children’s ages/developmental levels?

• How many children and/or adults will attend?

• What are the program elements? Picture books, non-fiction books, fingerplays or songs? Refer to this manual for math and science vocabulary, questions and standards.

• What activity will you do with your group? Try it first before doing it in a program. Decide whether your group will have the fine motor or cognitive skills to be successful. Modify the activity to fit the needs of your group.

• What materials will you need?

• What kind of meeting space or set-up do you have? Will everyone work together with the same materials? Will there be stations with different materials on each table?

• Do you need parent or volunteer helpers?

• How long will the program last?

• Will there be older children there? If so, set up a discovery center with age-appropriate challenges related to the concept you are exploring, e.g. if exploring shapes, create a discovery center with tangram or other puzzle challenges.

• Will there be toddlers there? Children under age three can learn by having opportunities to explore materials such as shapes, blocks, crayons and paper.

Science and math can be integrated into almost any library program. Select your favorite story hour books, looking for math and science concepts that will connect to What’s the BIG Idea™ activities:

Fingerplays: Counting, following directions, sequences, patterns.

Books and stories: Talking about, describing and asking questions about shapes, change over time, cycles, patterns, structures—all the math and science skills, processes and content in this manual.

Activities: Basic math and science skills, processes or content, which can be incorporated into conversations, directions and explanations:

Can anyone estimate the number of pennies?

Let’s use the dots to make a pattern.

Before we begin, let’s sort all the crayons by an attribute. How about color?
How Do Children Learn About Math and Science?

Young children learn by exploring in hundreds of different ways. Learning takes place everywhere and all the time. You can observe children using the process skills of science and math when they:

**Repeat actions over and over:**
   - Brianna works on the same puzzle every time she visits the library.

**Lift things up and look underneath:**
   - Emily turns over the rocks in the park and asks “What’s that?”

**Ask questions:**
   - Jacob asks: “Why does the fish make bubbles?”

**Use materials and tools in creative ways:**
   - Sophia uses a piece of rope to measure a tower of blocks.

**Watch things intently:**
   - Christopher likes to watch the hamster running around and around on its wheel.

**Make predictions:**
   - Kayla guesses that a raccoon might live in a hollow log.

**Solve problems:**
   - José adds one more block to the base of his tower to make it stronger.

**Represent real objects:**
   - Maria draws two parallel lines, connects them and says, “It’s a train track!”

**Make comparisons:**
   - William uses the small blanket to wrap up the smaller of two dolls and a bigger blanket to wrap up the larger doll.

**Sort objects:**
   - Isabella separates a collection of buttons into two groups: metal ones and plastic ones.

**Make connections:**
   - Ava tells her friends to make playdough pies that look like the pies in a book they listened to in story hour.
Asking Open-Ended Questions

As we all know, much learning for young children happens during social interaction. Asking open-ended questions is how inquiry begins and understanding develops. Good questions allow children to develop vocabulary, make sense of what they are doing and learn to communicate their ideas. If every discussion question you ask elicits a “yes” or “no” answer, then you are not asking open-ended questions. It takes extra time and effort to ask only open-ended questions. Here are some examples:

**Connecting questions**
- What does that remind you of?
- What do you notice about this character that reminds you of someone you know?

**Predicting questions**
- What do you think will happen next if…?

**Evaluating questions**
- What do you like about this? Why?
- What don’t you like? Why?

**Attention-focusing questions to call attention to significant details**
- What do you notice about...?
- What is it doing?
- How does it feel?

**Measuring and counting questions to generate more precise information**
- How many?
- How much?
- How heavy?

**Comparison questions to foster analysis and classification**
- How are they alike?
- How are they different?

**Action questions to encourage exploration of properties and events**
- What would happen if…?

**Problem-solving questions to support planning and trying solutions to problems**
- How could we…?

**Reasoning questions to encourage reflection and to construct new ideas**
- What do you think?
- Can you explain that?
- What makes that happen?
Adaptations

Always try the activity before doing it in a program. Decide whether your group has the fine motor or cognitive skills to be successful. Modify the exploration to fit the needs of your group, keeping in mind that the basic math and science skills, processes or content should be incorporated into your conversations, directions and explanations of what you and the group are doing.

Visual:
Older children, volunteers or parents may assist and help with investigations by helping children touch and explore materials. Provide materials such as stuffed animals, plastic models, beads, clay and other hands-on manipulatives. Children can dictate stories, ideas and solutions to a helper.

Auditory:
For children who communicate through signing, an interpreter is needed to sign the program. For children who can read, provide visual aids such as written instructions, charts, graphs and pictures. Children with auditory challenges will be able to participate in all aspects of the program.

Motor:
Older children, volunteers or parents may assist children in moving about the room. Help will be needed in collecting materials from different locations. For hands-on explorations, an accessible work place should be available. Participation in a given exploration will depend on the child’s abilities. Partners, parents or volunteers can assist in fine motor activities.

English Language Learners:
Older children, volunteers or parents who speak a child’s native language can translate and work with the child. Encourage children to say shape names, numbers, etc. in their native language.
Math and Science Standards: What are They? Why are They Important?

Education standards help librarians and other educators bring focus and intention to their work with children. More and more, any professional who works with children is being asked to learn about standards and incorporate them into their practice. When used appropriately, standards have a positive effect on children’s learning. Standards are designed to answer these questions:

What should children learn?
When should they learn it?
What outcomes can be expected?

Young children need experiences that allow them to explore over and over. They need to use a variety of materials and tools, talk about what they are doing, ask questions and try to find answers.

We use the processes and skills of science and mathematics every day because they’re actions that help us explore the world in a meaningful way. Mathematical Problem Solving and Scientific Inquiry are both processes we use to find answers to the math and science questions we ask.

Professional organizations such as the National Council of Teachers of Mathematics (NCTM), The National Academy of Science (NAS), as well as most state departments of education, have created and published sets of standards for a range of age and grade levels. State and local standards can be easily accessed online.

The following pages detail pre-K and Kindergarten standards for mathematics and science used in the What’s the BIG Idea?” program. You can easily make connections between these standards and your own state or local standards, as well as the Head Start Child Outcomes Framework.

From one librarian:

As a children’s public librarian I never thought much about standards until I started doing outreach to our local elementary school’s Kindergarten class once a week. I began to notice that when I did activities based on the What's the BIG Idea? program, and talked about math and science concepts with children as we read books and did the activities, the teacher started to pay attention more and more each time. After one class I talked with her specifically about the standards I planned to cover in the following week’s activities. I think it helped to show this teacher, in particular, that we’re doing “real” learning in the public library!
Mathematics Standards

The Process Standards

Problem Solving
For young children, this includes...

Reasoning and Proof
For young children, this includes...
• Learning to explain how they solved a mathematical problem: describing the steps taken verbally, in a drawing, or with concrete objects.

Communicating
For young children, this includes...
• Telling others about their math-related work: using language, pictures or other symbols, or concrete objects.

• Beginning to use some math language: numbers, shape names, size words, names of math materials, etc.

Making Connections
For young children, this includes...
• Using math skills in a variety of situations, not just when prompted by an adult.

• Linking their own math experiences to those of other people, in real life or in books.

• Recalling previous math experiences when engaged in current ones.

Representing Data

How we represent, organize and communicate the data we collect depends on the amount and type. We may take notes, make drawings, write down measurements. We might organize the data into charts and graphs in order to analyze it more carefully and look for patterns and relationships. A computer is an excellent tool we use to store, organize and represent large amounts of data in graphs and charts in a variety of styles.

Representing
For young children, this includes...
• Using simple pictures, graphs, diagrams, or dictated words to represent their mathematical ideas.
The Content Standards

Numbers and Operations
*For young children, this includes...*

- Recognizing and naming some written numerals.
- Having a sense of quantity: knowing that the number name “three” and the symbol “3” mean three of something.
- Counting: learning the sequence of number names (1, 2, 3).
- Counting objects: learning to count an object only once, using one-to-one correspondence in counting objects and matching groups of objects.
- Beginning addition: Adding two groups of concrete objects by counting the total.
- Beginning subtraction: Taking away one group of concrete objects from another by taking some away and counting the remainder.
- Comparing: understanding ideas such as more than, less than, and the same as and having a general idea that some numbers stand for a lot and some numbers mean a little.

*Number sentences (equations) can be represented in many ways.*
Geometry and Spatial Sense
For young children, this includes...
• Matching, sorting, naming, and describing shapes: circles, squares, rectangles, and triangles.

• Naming and describing shapes found in everyday environments.

• Combining shapes to make new shapes.

• Making shape designs that have symmetry and balance.

• Understanding and using words that describe where objects are located: over, under, through, above, below, beside, behind, near, far, inside, outside.

Patterns, Functions and Algebra
For young children, this includes...
• Identifying, making, copying and extending simple patterns: sequenced or repeated organization of objects, sounds, or events.

• Using patterns to predict what will come next in a sequence.

• Recognizing single number patterns such as “one more.”

• Noticing, describing, and explaining mathematical changes in quantity, size, temperature, or weight.

Can you copy this pattern? Can you extend this pattern? What comes next?
Measurement
For young children, this includes...

- Understanding and using words referring to quantities: big, little, tall, short, long, a lot, a little, hot, cold, heavy, light.

- Understanding and using comparative words: more than, less than, bigger than, smaller than, shorter than, longer than, heavier than, colder than.

- Showing an awareness of and interest in measuring: imitating the use of measuring tools and measuring with non-standard units.

- Comparing objects: Which of these two sticks is longer?

- Beginning to use measurement words, such as inches, feet, miles, pounds, minutes, and hours.

Data Analysis, Statistics and Probability
For young children, this includes...

- Sorting objects to answer questions.

- Collecting data to answer a question: keeping track of simple information gathered from a group of people or over a short length of time.

- Making lists or basic graphs, with adult help, to organize collected data.

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Data from our shape search: What do you notice about our block graph? Which shape did we find most frequently in our school?
Science Standards

In the National Science Education Standards, the National Research Council sets forth standards in eight areas that cover a broad range of science skills and understandings for children in kindergarten through grade 12. These standards—Science as Inquiry, Physical Science, Life Science, Earth and Space Science, and Design Technology—have been adapted to apply to young children. Science as Inquiry standard is addressed in this manual.

The process skills of science are the Science as Inquiry standard, listed below in alphabetical order. Children need to practice the process skills of science so that they learn to ask questions about the world and then study the world in special ways to find answers, just like scientists do.

Science as Inquiry includes:

**Asking Scientific Questions**
*For young children, this includes...*
- Questions such as: *What’s that?  How did it happen?  What if...? and How many?*

**Collecting and Using Data**
*For young children, this includes...*
- Thinking back on what they have observed, sorted or measured, in order to explain their ideas about the world around them.

**Communicating Information and Ideas**
*For young children, this includes...*
- Using conversations, drawings, and/or simple charts to tell others about what they have learned and to offer explanations, even though they might not be scientifically accurate.

**Designing and Making Models**
*For young children, this includes...*
- Planning and creating models.
- Building from plans.

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**Asking Questions**

A good question comes from the curiosity of the asker and relates to the subject being investigated. We can’t investigate unknowns in a logical way unless we ask questions. Scientists and mathematicians are professional question-askers who ask both how and why questions. For more information about open-ended questions, see page 7.
Estimating and Predicting

For young children, this includes...
• Using clues to make informed guesses about quantities, causes and effects, or unknown information.

Predictions do not always require quantities. Predictions can be about what we think is likely to happen. Some examples: I predict the hawk will land on that tree because it is the tallest and they like high places. I think the sunset will be red and orange because it was like that yesterday.

Estimating and Predicting

Estimation is an informed guess about quantities in standard and non-standard units of number and measure. We estimate when we answer questions such as: How many? How far? How cold? The more we estimate, the more we improve our skills of observation and spatial visualization.

From one librarian:

We checked the seeds between the moist paper towels we did one week ago today. We saw quite a bit of change and are planning to plant those seeds in cups of potting soil next week. I think that the two groups have learned a lot in keeping track of the progression of the root growth with our chart and predicting what may happen in two days’ time or over the weekend.

Experimenting

For young children, this includes...
• Pursuing answers to questions through controlled investigations.

Finding Patterns

For young children, this includes...
• Noticing repeated sequences and organized arrangements in the world, seeing and understanding how one thing influences another.

Measuring

For young children, this includes...
• Making comparisons of sizes, temperatures, and weights, as well as using numbers to quantify measurement. For young children, measurement can rely on non-standard units of measurement such as spoons, straws, shoes, etc., not just feet and inches.

Noticing Change Over Time

For young children, this includes...
• Recognizing and describing how objects and living things change—either quickly (an ice cube melting) or more slowly (a plant growing).
Observing
*For young children, this includes...*
• Using our senses to explore and learn about scientific objects and events.

Recognizing Relationships
*For young children, this includes...*
• Comparing sizes, shapes, quantities, colors, and events.

Sorting and Classifying
*For young children, this includes...*
• Noticing similarities and differences and putting objects into groups based on shared attributes (characteristics).

Using Simple Tools of Science
*For young children, this includes...*
• Using tools, such as magnifiers, eyedroppers, water pumps, balances, sieves and binoculars to explore and investigate.

Observing
We use all of our senses to observe the world. The information our senses give us adds to our understanding. Observation in all of its forms can be done quickly with little information collected or with patience and purpose so enough information is collected to solve a problem or make an inquiry. Learning to observe closely promotes curiosity in young children, along with the desire to know answers.

Sorting and Classifying
Understanding the concept of Same and Different helps us organize our world of objects and ideas into sets of patterns and relationships. Grouping by recognized characteristics or attributes improves our observation and measurement skills.
Charts and other graphic representations are useful tools that help young children organize, analyze and understand information in a visual form. For young children, graphic representation can be simple drawings. Data can be collected in a variety of ways and these representations help children answer questions, visualize data, and make comparisons and predictions. Some examples:

**T- Charts** help us analyze same and different between two objects or events.

**Bar graphs** help us compare things. We easily see less than, more than and same as.

**Block Bar Graphs:** 3-D bar graph made from building blocks or linking cubes can be arranged on paper, allowing each column of blocks to be identified in writing.

**Pictographs** are like bar graphs but pictures are used instead of bars.

**Pie or circle graphs** show how the whole collection of data is divided into parts or fractions having specific attributes.

**Sorting Loops** are shoelaces, yarn or string used for grouping sets of items.

**Tally chart:** Each mark on a tally sheet represents one object.

**Concept maps:** A diagram that shows the relationships among themes and ideas.

Many measuring devices display information in a graphic manner: thermometers, calendars, schedules, clocks and auto dashboard displays are all visual representations of data being collected in a different way and place.

Examples of graphic representation follow on the next two pages and throughout the manual.
Examples of Graphic Representation

When Are Our Birthdays?
Children participate in making a pictograph, placing a figure in the column next to the month in which they were born. Suggested questions:

What do you notice about our pictograph?

Which month has the most birthdays?

Which has the least? How do you know?

Is there a month when no one has a birthday?

Are there months with the same number of birthdays?

Let’s count and write the numbers, telling us “How many?” for each month.

What’s Our Favorite...

Children discover the group’s favorite and least favorite pizza topping (or anything else) by asking a question and making a block bar graph. Suggested questions:

What do you notice about our graph?

What is our favorite pizza topping?

Which is the least favorite?

How do we know?

Let’s count and write the numbers, telling us “How many?” for each topping.
Where Were We Born?

Children make a “live” pie graph to see who was born in their home state, who was born in other states and who was born in other countries.

To make the graph: Sort the group. Everyone born in Our (your home state) State makes a set (group), everyone born in Other States makes a group and everyone born in Other Countries makes a group.

Everyone joins hands to make a circle with each of the sorted groups standing together (see illustration).

A piece of colored yarn is placed around the entire group so that each group is standing together on the edge of the circle.

Make the graph by placing yarn from the center of the circle to the edge of the circle, dividing the groups (see illustration above left). Ask:

What do you notice about our graph?

Where were most of us born? How do you know?

What else can we tell from looking at our graph?

How Many...?

Children collect data and see how many times it rained on their story time day. Ask:

What do you notice about our T-chart?

Did we have more days with rain or without rain? How do we know?
Building Discovery Centers

Discovery Centers offer librarians an opportunity to engage children of all ages in hands-on exploration whenever they visit the library. Centers provide families with opportunities to talk, explore, and interact with each other. Children will experience centers at their different skill levels.

Attract children and parents to the Discovery Center by building it in an area with high visibility. Try different parts of the library. You might also create a portable center on a tray, wagon or cart to move from one place to another or to take on a visit to a Head Start or child-care center. Here are more quick tips:

• Feature one activity per Discovery Center.

• Post simple clear directions as needed.

• Provide hands-on materials including manipulatives, natural objects and everyday materials that encourage creativity, experimentation and learning.

• Exhibit related fiction and non-fiction books nearby.

• Expand the visuals by using pictures, labels, and questions or ideas to think about.

• Post a question or a challenge for children and adults to think and talk about.

• Post questions that are appropriate for children at different developmental levels, from simple to more complex.

• Offer different ways for children to record their responses such as drawing, retelling, graphing, recording on take-home sheets, and photographing results or processes.

Encourage parents to join their children for activities in your Discovery Center.

If you have a small library, build a portable Discovery Center that you can move easily.
• Provide pencils, crayons, plain paper, lined paper, graph paper, or even disposable or digital cameras to help children record their observations, data, measurements, findings, or questions.

• Change the center often—at least monthly. Change the center over time by posting a new activity or challenge that can be done using the same materials.

The Discovery Center can be a place where you can post bibliographies or encourage parents to take home circulation materials such as take-home kits, cards, or other science or math manipulatives.

Refer to this handy checklist (see box, left) as you plan your library’s Discovery Center.

From one librarian:

I began the “Seeds” program by reading *The Carrot Seed*. We talked about seeds and plants. I was surprised to find that many children knew a lot about planting seeds. We read *One Little Seed* and I asked if anyone had learned new facts about planting seeds.

We planted onion, radish and carrot seeds in the Root Vue Garden™ and put it on display. We made plans to observe and make drawings about the changes we might see as the seeds grew. The nice thing about the Root Vue is that you can see both in-the-soil and above-ground growth.

We’d had practice at this with our Amaryllis Bulb Discovery Center. A meter stick was attached to the wall next to the growing bulb to encourage measuring. Kids were encouraged to write and draw their observations using paper and clipboards.

Since I set up this Discovery Center many of the library’s books about seeds, growing and gardening are flying off the shelf!
Connecting With Community Partners

Community partners can enrich and enliven library math and science programs.

Many people in your community may be able to conduct or help with one of your math and science programs. Here are some ideas:

• Carpenter or a representative from a building supply store
• Quilter
• Science or nature museum educator
• Retired engineer, science or math teacher
• Birder, collectors (stamps, coins, shells, etc.)
• Local weather person
• Veterinarian, doctor or nurse

Keep in mind that many parents and other adults have skills that may translate into a science or math program.

Before inviting someone to help with or conduct a program think about the following:

**Program topic or goal:** What math or science processes, skills or content do you want children to explore? Shapes? Sorting? Building?

**Talking with your partner:** Communicate your goals and what you’d like children to experience keeping in mind that this is your program and you’re in charge. Discuss whether this will be a one-time program or a series of programs.

Be clear about the anticipated audience: ages, number of adults, prior experiences with the topic.

Discuss materials needed for hands-on activities.

**At the program:** Be an active participant. Graciously help your volunteer connect to the audience keeping in mind that some volunteers have had little or no experience with young children.

From one librarian:

I invited our local nature museum educator to come to a dinosaur program I had planned. I told her that I planned to practice math and science skills such as sorting, same and different, and comparing and measuring.

We first looked at Steve Jenkins’ *Prehistoric Actual Size*. After our partner talked, kids and parents visited activity stations. Included were a sorting station, a dinosaur skeleton puzzle, nesting box, and lengths of strings that were the same measurements as certain dinosaurs.

Working together, we made a graph of these strings. Children talked about biggest, smallest and same as.
Connecting With Families

Family involvement is very important! Families add depth to children’s experiences with math and science learning in the library when they:

• Check out math and science books to take home with their children.

• Borrow What’s the BIG Idea?™ Family Kits. These kits offer families another way to experience math and science learning at home. Each contains one or two books, a manipulative and most importantly a mini-manual to get families started.

• Participate in What’s the BIG Idea?™ programs, including story hours and family programs. These programs give parents a venue to participate actively with their children. Families feel free to explore in a supportive atmosphere. Parents and children become mathematicians and scientists as they observe, question, plan and solve problems together. And when parents hear you using math and science vocabulary as you lead activities, they might feel more comfortable using that language with their children.

• Take home What’s the BIG Idea?™ family cards and simple handouts that connect activities with math and science to help parents not only understand how children learn, but also the value of play. Not all families understand that informal science and math experiences and activities can take place in the home every day.

• Experience Discovery Centers that encourage interaction with their children. They explore together, ask questions, and begin a dialogue sparked by math and science concepts.

Families have busy lives! Outreach programs allow the librarian to enter their world with math and science books, materials and activities. Child-care centers and family child-care homes offer the perfect setting for What’s the BIG Idea?™ family nights. What a great way to introduce the library to parents and children!

Libraries and families are perfect partners.
Concept Map

MORE THAN COUNTING: NUMBERS & OPERATIONS

ASSESSING NUMBER KNOWLEDGE: COUNTING FINGERS

MAKE A COUNT TO FIVE BOOK

HOW MUCH DOES IT WEIGH?

HEAVY OR LIGHT?

COUNT AND COMPARE CARGO

MEASURE ME!

FUN WITH ESTIMATION

MEASURING WITH THE LIBRARIAN’S FOOT

PART-PART-WHOLE: ADDING FEET

PART-PART-WHOLE: ADDITION

PART-PART-WHOLE: MAKING SETS OF 5

PART-PART-WHOLE: MAKING SETS OF 7

HOW MANY IN MY CHAIN?

FIX MY MISTAKE!

DOGS OR CATS?

COUNTING AND SORTING WITH DOMINOES

COUNT AND MATCH NUMERALS

WHAT’S MISSING?

COUNT AND MATCH SETS

COUNT AND MATCH NUMERALS

COOL WAYS TO ADD

ADD IT UP!

COOL WAYS TO SUBTRACT

SUBTRACT IT OFF!
More Than Counting:
Numbers and Operations

At every story hour you do a fingerplay. Usually it’s counting down as in “Five Little Ducks”—One flew away and then there were four. You always pause before saying the number and all the children say: “Four!”

Today you decide to use five large objects to extend this counting. Sitting on the floor together, you place five puppets in front of the children. Several children take turns counting the puppets. You notice that some children touch the puppets as they count, some just say the numbers out loud. You ask one boy who hasn’t participated if he would like to count the puppets and indeed he touches and counts to five.

You realize that even though several of the children are not yet four, everyone in the group understands one-to-one correspondence. You can build on this mathematical knowledge with stories and activities in future programs.

For young children, number sense is about understanding the different uses for numbers. Number sense is the ability to count, to be able to continue counting—or count on—from a specific number as well as to count backwards, to count an object only once, to see relationships between numbers, to be able to take a specific number apart and put it back together again. It is about making sets, adding and subtracting.

Research has shown that young children are sophisticated mathematical thinkers. Children as young as age two develop oral counting skills and use number words. They acquire many more math skills and concepts before they enter kindergarten. Acquiring these skills and concepts provides an important base for future math learning.

Story hours and other library programs provide opportunities for children to explore numbers and operations, while developing their math skills, concepts and vocabulary.

Reading picture books and doing hands-on activities strengthen children’s math concepts and skills as you ask open-ended questions, encourage children to explain what they’re doing and provide many experiences with the same number or operation, such as doing many different activities using one number or making and counting sets with a variety of manipulative materials.
Exploring More Than Counting

Number sense is the ability to think and work with numbers easily and to understand their uses and relationships.

In the past, learning mathematics focused on memorizing number facts, shape names, how many inches in a foot, algebraic formulas and so on. Today, the emphasis in mathematics is on using mathematical information to think through a great variety of problems.

Every day, even very young children love to talk about and explore numbers. They:

- Begin to notice numerals everywhere: on clocks, clothing, books, signs, houses.
- Hold up four fingers and say *I’m four years old*.
- Count how many cookies are left on the plate.
- Share their candy with a friend (*One for you, one for me*).
- Line up for lunch and say *I want to be first*.
- Tell the librarian: *I’m taller than my sister*.
- Say to a friend: *If you add two rocks to my collection, we’ll have four rocks all together*.

Math and Science Skills and Concepts

When children explore numbers, they:

- Count and learn the sequence of numbers.
- Learn to count an object only once, using one-to-one correspondence.
- Develop a sense of whole numbers by composing and decomposing numbers.
- Count with understanding and recognize “how many” in a set of objects.
- Recognize and name written numerals.
- Develop a sense of quantity: know that the word “three” and the symbol “3” mean a quantity of something.
- Begin to understand addition and subtraction by counting groups of objects.
- Use comparative terms such as more than, less than and the same as or equal to.
- Begin to make number sentences (equations) with concrete objects and written numerals.
- Understand how to measure, using non-standard units of measure.
- Use repetition of a single unit to measure something larger than the unit.
- Estimate, compare and record data.
Books About More Than Counting

*Anno’s Counting Book* by Mitsumasa Anno

*Ten, Nine, Eight* by Molly Bang

*How Do You Count a Dozen Ducklings?* by In Seon Chae

*My Numbers / Mis Numeros* by Rebecca Emberley

*Feast for 10* by Cathryn Falwell

*Two of Everything: A Chinese Folktale* by Lily Toy Hong

*1, 2, 3: A Child’s First Counting Book* by Alison Jay

*Zin! Zin! Zin! A Violin* by Lloyd Moss

*How Many How Many How Many* by Rick Walton

*Seven Blind Mice* by Ed Young
More Than Counting: A Typical Program

Books: *Jamberry* by Bruce Degan  
*Mama Don't Allow* by Thacher Hurd  
*Mr. Gumpy's Outing* by John Burningham

What’s needed: Paper with a drawing of a boat (canoe, barge, etc) and anything that can be glued onto the boat as cargo: stickers, cut-out animals, people, circles, etc.

Opening fingerplay: “Five Little Monkeys Jumping on the Bed”

At some point, sing and act out “The Ants Go Marching, One by One.”

Read the books in any order. After reading a book, go back and do a picture walk talking about and counting the animals on the different boats.

Have children touch the animals as they count them.

Activity: Give each child a piece of paper with the drawing of the boat on it.

Have children select and count the number of cargo/passengers they’d like to put in their boat.

An adult helper can write the correct numeral next to the boat.

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**Vocabulary**

One-to-one correspondence: Verbal-object counting skill (counting an object only once). Most children develop this skill at age three or four.

Cardinal number: Identifies “how many” in a group or set.

Ordinal number: Indicates the place or position of an object (first, second, third, etc.).

Part-part-whole: Recognizing part-part whole relationships (composing and decomposing numbers) is a basic in developing number sense.

Set: A collection of items.

Numeral: The written symbol referring to a number. Most children develop an understanding of numerals between the ages of three and six.
From one librarian:

I decided to plan a “Count on Mother Goose Family Night” because I’d noticed that very few children in my story hours knew traditional Mother Goose rhymes. I took this opportunity to introduce and talk about basic counting skills and traditional rhymes at the same time.

We began the program with families and children talking together about the nursery rhymes they knew. I asked if anyone knew a rhyme with numbers or counting in it. WOW! Did they ever! Children and adults said rhymes in English and Spanish and to my delight, three other languages were represented and those families told us their rhymes.

Next, we looked at the books and found many rhymes that were new to us, and families read, counted and acted them out.

We did some of the simple activities mentioned on the What’s the BIG Idea? family cards—Counting 1, 2, 3 and Part-Part-Whole—and I gave each family a card to take home and use.

Children were asked to take a plate and select one cookie for each family member (one-to-one correspondence!).

I’d displayed over 20 books—Spanish, bilingual and English titles and all were checked out at the end of the program!

Assessing Number Knowledge: Counting Fingers

Goal: This activity will help you assess children’s number knowledge.

1. Hold up three fingers and ask:

   **How many fingers am I holding up?**

   **Can you each show me three fingers?**

2. Randomly ask children to count out loud the number of fingers they are holding up.

3. Repeat this with four fingers and then with five fingers.

Plan further activities working up to and including only those numbers that children understand.

It’s important to know what children understand about numbers and counting before doing number activities with a group.

Oral counting skills may begin as early as age two, although very young children often say the numbers out of sequence or with some numbers missing.

Most kindergarteners are able to count in a sequence from one to 10 and understand one-to-one correspondence.
Make A Count to Five Book

Goal: Children make and talk about their own counting books.

What’s needed: A blank book for each child and materials such as stickers, pictures, markers, scissors and glue sticks.

1. Talk together about how a counting book can be made:

   **If you start with one object in your counting book, what comes next?**

   **What comes after two objects?**

2. Brainstorm a list of counting book ideas: cars, cookies, children, trees, houses, flowers, shapes, etc.

3. Show children the different materials with which they can illustrate their books.

4. After everyone has made a book, help children share their counting books with the whole group.

5. If possible, have an adult helper write the corresponding numeral on each page.

6. Older children might want to make a counting book up to a higher number, or a book, counting by 5s or 10s, up to 100.

From one librarian:

I began my program by doing fingerplays and counting fingers. Every child at the program (ages three to six) was to touch and count from 1 to 5.

We read and talked about two books: *My Two Hands* (Walton) and *Hands* (Kroll).

I told the children that we were going to make a print of our hands. We talked about how many hands each of us would need and how many fingers we would have total. The older children helped with this counting.

We’d drawn handprints when we did measuring activities so children were familiar with making these prints (adult helpers did some of the cutting).

When each child had two handprints we talked about how we might decorate them: rings on every finger, rings on some fingers, painted nails, each finger a different color, matching colored fingers for each hand (this from an older sibling).

After children decorated their handprints I asked for children to tell us how many on each hand/finger. There was a lot of counting, correcting and laughing.
Discovery Center
Make a Number Creature

What’s needed: One number die, paper towel tubes, cut out paper shapes, stickers, feathers, toothpicks, craft sticks, chenille sticks, yarn, tape, glue sticks, scissors.

Roll the die and choose materials based on the number rolled on the die.

Use a paper tube for the base. The tubes can be used horizontally or vertically for a “creature.”

Create your creature by attaching the correct number of materials to the tube-base. For example, if you rolled a 3, you might attach three feathers, three wings, three strips of paper for stripes, three stickers for eyes, etc. BE CREATIVE!

Make a label for the creature that includes your number.

(From NCTM’s Showcasing Mathematics for the Young Child, 2004.)

How Many in My Chain?

Goal: Children count and represent numbers with objects and paper chains.

What’s needed: Counters, paper strips in a variety of colors and tape or glue sticks.

1. Divide the children into small groups. Each group will need counters, paper strips and an adult helper.

2. Show children how to make a paper chain.

3. Have children select the number of counters they want to represent in their chain.

4. When the chains are completed, ask children to describe what they have created by counting the number of links.

5. Help children arrange themselves in numerical order by the number of links in their chain (many numbers will be repeated).

6. At another program, challenge children to make a chain and then count out the number of counters represented by the links.
Fix My Mistake!

Goal: Children arrange picture cards in numerical order.

What’s needed: A set of Mother Goose Programs™ Math Cards.

1. Begin by laying out, in a mixed-up order, the apple or shape cards representing one apple or shape up to 5 apples or shapes.

2. Challenge children to “fix my mistake” by putting the cards in numerical order.

3. Observe how some children need to touch the cards and/or count out loud to figure out how many apples or shapes are on the card before deciding how to put the cards in order.

4. As children meet this challenge, increase the number of apples and shapes.

5. Older children can make their own set of cards to match and sort.

Discovery Center
All Mixed Up!

Gather groups of many kinds of objects and display them. Some examples: dominoes, Mother Goose Programs™ math cards, playing cards, plastic animals or counters.

Challenge families to organize the objects in numerical order first by counting up, then by counting down.

Two...one...three...fix my mistake!

Three...four...two...one...fix my mistake!
Dogs or Cats?

Goal: Children expand their number sense as they collect and represent data.

What’s needed: Chart paper and 2” x 1 1/2” post-it notes.

1. Read a book about a dog(s) and one about a cat(s). Engage children in a conversation about which pet they have or would like to have: a dog or a cat.

2. Show children the outline of your graph (see left) and tell them that you’re going to find out which pet is more popular, a dog or a cat.

3. Ask children which pet they have or would like to have and help them place a linking cube in the correct column.

4. Read the graph and ask:

   **What can we tell just by looking at our graph?**

   **Which column has more cubes? Which column has less? How do you know? Can you count them?**

   Write the correct numeral in each column.

5. If there’s time or at another program, give children stickers of dogs and cats and let them collect their data in loops.

   **5 dogs...4 cats**
Counting and Sorting With Dominoes

Goal: Children practice counting, comparing and sorting dominoes.

What’s needed: Sets of dominoes and cards with numerals.

For younger children select a smaller set of dominoes and cards for counting up to 5.

1. Show children a domino and ask for help counting all the pips (dots). Choose another domino and count the pips. Ask:

   Let’s compare: Which domino has more pips?

2. Place the collection of dominoes in a bag or box. Have each child choose a domino and count the pips. Have children compare number of pips with a partner. Which has more?

3. Ask the children to make groups of the same number of pips. Everyone with 3 pips would get together, etc. Give each group their corresponding numeral card. Which number was the most common?

4. Remix the dominoes and repeat, using larger and larger numbers.

5. Have children make a drawing of their pip groups to take home.

Discovery Center
Playing Dominoes

What’s needed: A set of dominoes, two or more players. The more players you have, the more domino sets you need.

1. Place all dominoes face down on the table and mix them.

2. Each player takes seven dominoes and stands them up with the pips facing them so that players can’t see each other’s dominoes.

   The remaining dominoes become the “draw” pile.

3. The first player places a domino (from his/her seven dominoes) in the center of the table.

4. The second player then tries to match one of his dominoes to either end or side (doubles) of the domino in play.

   Only one domino is played at each turn. If a player cannot match the pips at any open row, she must pick from the draw pile until she is able to play a domino.

5. The game continues until one player has used up all his dominoes. If no one can play a domino the player with no dominoes or the least number of points (pips) wins the round.

Note: Young children can learn to play with their dominoes face up (pips showing).
Count and Match Numerals

Goal: Children recognize numbers as they’re represented in a variety of ways.

What’s needed: One set of Mother Goose Programs™ Math Cards.

1. Sort the cards into shapes, apples, and numerals.

2. Choose numerals that represent the level your group is familiar with. For younger children choose numerals up to 3 or 4. Older children will want to count and match larger numbers.

3. Put out an array of cards to include all three types of cards for the numbers you are working with.

4. Challenge children to organize the cards into groups of like numbers (for instance, the card with two apples, the one with two circles, and the numeral 2).

5. Some children will have to count the objects – shapes and/or apples – before pairing them up with the numeral.

6. Extend this activity by using dominoes, linking cubes and the Animal Counting Collection for matching with numerals.

7. Have children make drawings of their matches to take home.
What’s Missing?

Goal: Children learn to arrange numerals in order.

What’s needed: A set of Mother Goose Programs™ Math Cards or a set of paper plates with one of the numbers 0 – 10 written on each.

1. Lay out a simple sequence of number cards with one number missing, e.g. 1, 2, 4.

2. Challenge children to find the missing number and put it in the correct place in the pattern.

3. When children can meet this challenge, make the pattern more complicated with more numbers omitted. For example: 1, 4, 6.

4. Ask children to create patterns and challenge each other by saying “What’s missing?” or “What number comes next?”

5. After children have lots of practice, challenge them by counting down the cards. For example, 6, 4, and 1. What’s missing?

From one librarian:

I usually have a large group of children and not enough number cards to do math activities, so I used paper plates to practice putting numbers in order.

On this particular day I had 22 children, so I gave each child a paper plate with a number from 1-22 on each one, out of order. I then challenged them to put themselves in a number line, in order from 1 to 22. The children were different ages so it was fun to watch the older kids working with the younger ones and helping them.

Next, I gathered the plates together again and removed one number (without showing children which number was missing.) I then repeated the first activity, but added the challenge of children figuring out which number was missing. We did this a few times with different missing numbers. At the end of the program each child took his/her paper plate home.

At other programs we counted down from the highest number. When I have older children after school we practice counting by 5s and putting paper plates in order by 5s and so on. Paper plates are an excellent way to work with numerals and lots of children. I sometimes have the older children write the numbers on the paper plates and they love to take turns being “librarian” that day.
Count and Match Sets

Goal: Children make sets, count “how many” and create matching number sets.

What’s needed: Objects for counting such as dominoes, counters, linking cubes, buttons MG Programs Animal Counting Collection, etc. and written numerals. Paper and crayons or markers.

1. Allow children time to explore, talk about and count the various objects.

2. Show how the objects can be counted and arranged in a set (group, collection). Make and count sets of three, four and more. As you make a set, ask:

   Can you make a set using different objects to match my set?

   Can you find the written numeral that matches this set?

3. Help children decide which number they want to represent. Challenge them to make matching sets of that number with as many materials as possible.

   Talk about the sets children have made. Ask them to count and describe their sets.

4. Have children make a drawing of one or more of their sets. An adult helper can write the numeral on the drawing.

From one librarian:

After the children in my group had a lot of practice learning numerals—we did many, many activities over several weeks—I asked children to look around the room and see how many numerals they could see.

They could see that there were signs on the wall with numerals, and some children were wearing shirts with numerals. I gave them a challenge: I took out my timer and said they had three minutes to find as many numerals in the library as they could. Each child had a clipboard. The older children would write the numeral they found (or where they found it) and the younger children would write tally marks so we could count them at the end. After each minute I told them how much time was left.

When we gathered back together we looked at all of our data. Which room had the most numerals? Were there any rooms that had no numerals?

“The library is full of math!” One little boy told me. I told them that on the next sunny day we would go outside and see that the whole world is full of math, too! I encouraged them to look for numerals on their way home and at home too.
Part-Part-Whole: Making Sets of 5

Goal: Children learn about sets as they compose and decompose the number 5.

What’s needed: String or yarn to create circles, a bag of pom-poms and paper and crayons.

1. Make several string or yarn circles on the floor, large enough for several children to gather around.

2. Give each child five pom-poms.

3. Have children take turns dropping the pom-poms from above the circle. After one child drops the pom-poms, ask:

   **How many are inside the circle?**

   **How many are outside the circle?**

   **Do you still have five pom-poms? Let’s count them.**

4. Have children make drawings of their sets.

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**Discovery Center**  
**It’s Five!**

Display pom-poms, linking cubes, math cards, buttons, counters and other objects and challenge families to make sets that add up to 5, using as many of the objects as possible.

Make available paper and crayons so that families can represent their sets in many different ways.
Part-Part-Whole: Making Sets of 7

Goal: Children make sets by arranging and rearranging counters.

What’s needed: 7 counters for each child and paper and crayons for representing sets.

1. Give each child 7 counters.

2. Ask children to carefully count the chips to be sure they each have 7. Which children can count without touching each individual chip? Which children need to touch them to keep track?

3. Ask the children to divide the counters into a set (group) of 6 and a set of 1. Ask:

   - How many sets do you have?
   - How many counters are in each set?
   - Do you still have 7 counters?

4. Have children remix the counters into one set of 7. Work together making sets using the 7 counters. How many different ways can you make 7?

5. Talk about and represent the variety of ways children have made sets with their counters.

6. Help children make and label a drawing of some of their sets.

From one librarian:

For my “Mouse” storytime, we read Seven Blind Mice first. When we were finished, I gave each child seven red chips. We counted them, and I asked them to arrange them into groups. I also asked if they still had seven. To verify, we counted each chip in the set and added it to the next set, etc. We then took another look at the book and examined how Young grouped the mice on various pages. The kids copied his groupings of mice with their chips. After a movement activity, we read Mouse Count, counting the mice as the story progressed and also read If You Take a Mouse to the Movies. We made mice ornaments and ate a snack of donuts (not mice).

I was amazed with how quickly the youngest boy (barely three years old) caught on to the concept of making sets. I was also pleased with how attentive the kids were when they did the activities.
Part-Part-Whole: Addition

Goal: Children begin to add, using linking cubes.

What’s needed: Linking cubes and function cards.

1. Begin by counting out five linking cubes. Ask:

   **How many ways could we make a total of 5 linking cubes?**

Work with children to make sets of two and three, one and four, etc.

2. Begin making number sentences (equations) that add up to 5. Place two linking cubes on the table and ask one child to count them out loud. As you ask this, place the plus (+) card to the right of the two linking cubes and ask:

   **How many linking cubes should I add to make five linking cubes?**

Have children count the linking cubes, then put the equals (=) card to the right of the three cubes and say:

   **2 cubes plus 3 cubes equals 5 cubes.**

Challenge children to make their own number sentences.

3. At future programs make number sentences that add up to larger numbers. Extend the activity further and use numeral cards (see below).

   ![Linking cubes example](image1)
   ![Linking cubes example](image2)

   \[2 + 3 = 5\]

From one librarian:

For a “Cookies” story time, I began by displaying a blank graph and explaining what we would do with it. There were four different cookies along the x axis, and each child and adult was asked to tape a picture of his/her favorite cookie in the appropriate spot on the graph.

When we were finished, I asked which cookie was the favorite, how many more people liked—for example, chocolate chip than snickerdoodle, etc. We then went on to read two books with a movement activity in between. As I read *The Doorbell Rang*, we talked about how many cookies each child would get (division—you can't divide cookies!). We decorated a paper gingerbread man and ate snack (gingerbread cookies, of course).
Discovery Center
Number Sentences

Display dominoes, counters, plastic animals, math cards and the function cards and challenge families to make as many number sentences as they can.

Part-Part-Whole: Adding Feet
Goal: Children count and make number sentences.

What’s needed: Mother Goose Programs™ Animal Counting Collection and function cards.

1. Have children sort the Animal Counting Collection into sets by type (pigs, roosters, etc.).

2. Ask children to count the feet on each type of animal. Ask:

**Which animal has 2 feet? 4 feet? etc.**

3. Talk with children about adding objects together, showing them the function cards as you say plus (+) and equals (=).

4. Begin making number sentences (equations) that add up to 5. Place 1 pig on the table and ask one child to count the pig’s feet. As you ask this, place the plus (+) card to the right of the pig and ask:

**What animal can I add to the pig to make 5 feet?**

Allow children time to touch and count feet. After they’ve selected the snail, use the function cards and help children say:

**4 feet plus 1 foot equals 5 feet.**

4. How many other ways can children make 5?

5. At other programs explore making sets and constructing number sentences that add up to more than 5.

Note: In this activity, we are counting the arms of the starfish (seastar). They have many projections called **tube feet** on the ventral (front) face of their arms that help them move and eat.
Measuring With the Librarian’s Foot

Goal: Children use a non-standard unit (an outline of the librarian’s foot) to measure objects and distances.

What’s needed: A cut-out print of the librarian’s foot for each child, a tally sheet for collecting data and materials for children to make their “My Foot” measuring unit.

1. Give children an outline of your foot. Select several objects in the room children can measure: chair, table, child and book, etc.

2. Show them the tally sheet and explain how to record the number of the “Librarian Foot” units long each object is.

3. Divide children into small groups, working with an adult if possible. Allow children time to measure several objects and record their data.

4. Back in the large group ask children to talk about what they measured. Remind them that to report how long an object is, they need to count their tally marks. Ask:

   Which object was the longest?  
   Which object was the shortest?  
   How do you know?

5. With help, children can trace their own foot to use as a “My Foot” measuring tool at home.

For young children, measuring begins with the use of non-standard units of measure which can be any agreed-upon item that represents a unit of measure, such as a hand, an arm-length or the length of one step away.

Whether it’s weight, distance, volume or height, children naturally begin to explore measuring by using simple approaches that are not necessarily accurate. They ask questions like:

Which tail is longer?
Who’s the shortest person in our family?
Which glass will hold more water?

Encouraging the use of comparative words (more than, less than, the same as) helps children think about a mathematical way to analyze and understand their world.
From one librarian:

Children love to trace their hands so after we each made handprints, we measured the library. I started by reading Steve Jenkins’ Actual Size over several story hours. We compared our handprints. How was mine the same or different from yours? We learned that everyone’s handprint was a slightly different size, so we selected one child’s print (Lola’s) to use as our unit of measure. (This was a hard concept for the youngest children to grasp, because they thought all the handprints were the same.) We measured everything! How many “Lola handprints” long was the table? How tall was the librarian’s chair? Was this shelf taller than or shorter than the one next to it? We counted as we measured. In the end, children took their own handprints home so they could measure everything there.

Fun With Estimation

Goal: Children estimate and measure.

Note: This activity can be combined with any measuring investigation.

What’s needed: Shoelaces (or whatever unit you choose) and chart paper.

1. Talk with children about estimation. An estimate is an informed guess. To make an estimation we must have an agreed upon unit of measure. It’s important to look at and describe the unit before we estimate and measure.

2. Begin by going on a size hunt, looking for objects four shoelaces long (or whatever size or unit you choose).

Select an appropriate unit and tool for the object being measured. For example: If you are working with young children you wouldn’t select a paper clip to measure a table.

3. Record these estimations on your chart.

4. Using your non-standard measuring tool, measure the objects and record the information on your chart. Ask:

What do you notice about our estimations and measurements?

Which are the same? Which are different? Why do you think this is so?

Which object was longest? Shortest?
**Measure Me!**

Goal: Children measure themselves with a non-standard unit and make comparisons.

What’s needed: A non-standard measuring unit such as chopsticks or linking cubes (use large objects for younger children) and masking tape.

1. Ask one child to lie on the floor while you place a piece of masking tape to mark the child’s head and feet. Have the child stand up and see how long (tall) he/she is.

2. Hold up the object that will be used for measuring, such as a chopstick. Ask children to estimate how many chopsticks will fit between the two pieces of tape on the floor.

3. Help the child place chopsticks end to end from one piece of tape to the other. Describe how you are measuring how long the child is with chopsticks. Encourage children to help count the total number of chopsticks.

4. Pairs of children can then take turns measuring each other in the same way. Chart and compare the results. Who was the longest? How many chopsticks long?

5. If you have older preschool children in the group they may be interested in measuring with another unit such as linking cubes. Have them estimate how many cubes long they think they are, then measure and find out. Ask:

   **Why do you think the number of cubes is different from the number of chopsticks?**

Encourage children to compare the size of the measuring units for a clue.

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**Discovery Center**

**Measuring the Library**

Display a variety of standard and non-standard measuring tools and challenge families to estimate and measure objects and distances in the library. Include paper and writing utensils for recording data.

Some challenges: How far would you estimate the circulation desk is from the table? How long is the table? How tall is the children’s librarian?

Tell families to select either a unit of measure (standard unit or non-standard), find an object or distance to measure, make an estimation and then measure.

What could they measure at home?
Goal: Children build aluminum foil boats and count and compare how much cargo each boat can hold and still float.

What’s needed: Sheets of aluminum foil cut into rectangles, objects to be used as cargo (linking cubes, pennies, counters, etc.) and large plastic tubs full of water.

1. Show children a flat piece of foil. Ask for ideas of how to shape the foil into a boat. Make several boats and test them in a pan of water. (Almost any shape with the sides folded up will work.)

2. Give each child a piece of foil to make a boat. Some children may want to look at pictures of boats for ideas. Test boats in water.

3. Place a collection of the cargo on each table. Encourage children to find out how much cargo their boat can hold and still float. Ask:

   What happens when you add objects/cargo to your boat?

   How many pieces of cargo does the boat hold?

   Can you change something about the boat to make it hold more?

4. Look at the boats that were made and have a conversation about the different designs. Ask:

   Which shapes held the most cargo?

   Can we put the boats in order based on how much cargo they held?

5. Children may be interested in doing this activity again and again to try different boat designs.

From one librarian:

One of the dads in our storyhour group is a chef so I invited him to come to the library and talk about measuring and cooking. I told him that we’d been exploring measuring, and that he would be the “expert” on how important standard measurement is in cooking.

We began by reading Rosemary Wells’ *Bunny Cakes*. Our visitor then introduced all his cooking tools and the children loved it! They carefully examined the measuring cups and small amounts of flour, salt and sugar. We talked about what was the same or different in the ingredients, how to “read” the measuring cups and that a recipe is a list of instructions that need to be followed in a sequence. I know many of the children plan to help with cooking at home, after this successful program!
**Heavy or Light?**

**Goal:** Children use a balance to compare weights of objects and explore the concept of heavy and light.

**What’s needed:** A balance (often called a primary balance or a pan balance) and a collection of small objects of various weights.

1. Set up the balance so that it balances with the two containers empty.

2. Ask one child to choose an object and put it in one of the containers. Ask:

   **What happened to the container? What will happen when we take the object out of the container?**

   Do this to show how the balance works.

3. Ask another child to place a different object in the other balance container. Observe and discuss what happens. Ask:

   **Why do you think one side went down and the other side went up?**

   Use the words *heavier* and *lighter* to compare the two objects.

4. Let children repeat this comparison activity with a variety of objects, with some that vary greatly in weight and others that are more similar in weight. Repeat the words *heavier than* and *lighter than*.

5. After children have some experience with comparing objects, ask them to predict which object will make the balance go down (is heavier) and which will stay up (is lighter.)

6. Children may choose two objects that level the balance. Listen to hear if any of the children use the word *equal* or describes the objects as having the same weight. Challenge children to find objects that will balance.

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**Discovery Center**

**Balance Challenges**

Provide a pan balance and a collection of objects.

Challenge: To predict and compare the weight of objects. Choose two objects from the collection. Hold one in each hand and try to predict which is heavier. Test your prediction by placing each object in either side of the balance. Was your prediction correct?

Try another pair of objects. Can you find two different objects that will balance? Can you order the collection of objects from lightest to heaviest?
How Much Does it Weigh?

Goal: Children estimate the weight of an object with a non-standard weight unit such as linking cubes or pennies. They use a balance to investigate the question, “How many cubes or pennies does it take to balance (be equal to) this object?”

What’s needed: A balance, a collection of non-standard weight units such as linking cubes or pennies and a collection of small objects that can be placed in the balance containers.

1. Talk with children about the concept of heavy and light, using Just a Little Bit by Ann Tompert or another story about balancing animals or objects.

2. Ask each child to choose one of the small objects. Have each child hold his or her object and experience how heavy it is. Have the children pick up one weight unit and then several in the other hand. Let them feel the comparison of the units and the object. Have each child predict how many weight units she thinks it will take to balance her object.

3. Let each child test his/her prediction using the balance. Observe and discuss with the child what happens:

   The side with two units (pennies, cubes) is up and the toy horse is down. Which one is heavier? What should we do to make them balance?

4. Chart the predictions and the actual outcomes.

Any book, discussion or activity that does the following will meet the educational standards when addressing the concept of measurement with children. This will help children:

- recognize the attributes of length and time
- compare and order objects according to length and time
- understand how to measure using non-standard units and standard units
- select an appropriate unit and tool for the attribute being measured
- measure with multiple copies of units of the same size, such as paper clips laid end to end
- use repetition of a single unit to measure something larger than the unit
- use tools to measure
- develop common referents for measures to make comparisons and estimate
Concept Map

FINDING PATTERNS
- Patterns in Nature
- Patterns with Linking Cubes
- What's My Pattern?
- Making Pattern Strips
- Beginning with Patterns

CLAPPING PATTERNS
- Sound Patterns
- Movement Patterns

PATTERN WALK

PATTERNS AND RELATIONSHIPS

SORTING ANIMALS
- Sorting Animals Collage
- Sorting Animals
- Same and Different

SORTING TOOLS

SORTING A BUTTON COLLECTION

SORTING ROCKS
- Collections from Nature
- What's My Attribute?
- Sink or Float?
- Time for Bed
- Paper Gliders
- Outdoor Shadows
- Changing Shadows over Time

CHANGING SHADOWS OVER TIME

NOTICING CHANGE OVER TIME

CHANGE OVER TIME: GROWTH
- How Does Your Garden Grow?
- What's Inside?
- Germinating Seeds
- Watch it Grow! in the Library
- As We Grow

CHANGE OVER TIME: WEATHER
- Thermometers & Temperature
- Making a Weather Chart
- Cloud Exploration
- Wind Exploration

BE FRIENDS WITH A TREE
- Decomposition: Outdoors
- Decomposition: Indoors
Patterns and Relationships

It’s storytime and you’re reading *The Little Red Hen* to a group of four-and-five-year-olds. After you read, “Who will help me plant this wheat?” Brianna shouts, “Not I,’ said the goose!” Several other children chant, “‘Not I,’ said the cat” and “‘Not I,’ said the pig.” And you continue to read.

Most listeners would think this is charming: the children know the responses in one of their favorite stories. But it’s more than charming, it’s the basis of math and science skills—recognizing patterns and relationships.

If you then extended this story hour experience by talking about patterns and doing a hands-on activity you would have enriched young children’s math and science knowledge and understanding of the world around them.

If you continued to read about, talk about and engage in activities about patterns and relationships, you would be intentionally helping children practice skills and processes that lead to meaningful learning experiences.

Learning to find, create, copy and extend patterns is essential for discovering the relationships that function in our world.

While patterns are things that repeat, relationships are connected by some kind of reason. Relationships tell about how things function with each other. It is about how parts relate to make a whole and how one object or event can influence another. Relationships are important because they are the basis in understanding the underlying structure of things. Understanding them makes us feel confident and capable of knowing what comes next, even when we can’t see it yet.

Collecting and sorting, recognizing same and different, exploring balance and investigating shadows—all help us understand patterns and relationships. Children learn best through hands-on experiences. Anything they can touch and manipulate helps to further their understanding.
Finding Patterns

Children learn about patterns and relationships by observing the world around them. Pattern recognition is the first step in understanding how our world is constructed and how it functions.

Even very young children show an interest in patterns. They:

• Recognize and reproduce simple patterns (they build a tower of blocks that is red, green, yellow, red, green, yellow).

• Imitate sound and physical movements (they clap, jump, clap, jump).

• Recognize and talk about patterns in their environment (daily routines, the seasons, day and night, repeated phrases in books).

• Begin to predict what comes next.

Math and Science Skills and Concepts

When children explore patterns, they:

• Create, copy and extend repeating patterns.

• Notice organized arrangements.

• Predict what will come next in a sequence.

• Practice identifying, naming and copying patterns in their environment.

As you can see from this chart, some children need lots of practice making patterns.
Books About Patterns

Anno’s Counting Book by Mitsumasa Anno

Pattern Bugs by Trudy Harris

Pattern Fish by Trudy Harris

Max Found Two Sticks by Brian Pinkney

Jonathan and His Mommy by Irene Smalls

Stripes, Spots or Diamonds by Patricia M. Stockland

Nature’s Paintbrush: The Patterns and Colors Around You by Susan Stockdale

Lots and Lots of Zebra Stripes by Stephen R. Swinburne

The Little Red Hen by Margot Zemach
Patterns: A Typical Program

Books: *Bunny Cakes* by Rosemary Wells
*The Doorbell Rang* by Pat Hutchins

Activity: Making patterns with foam shape blocks.

As the children arrive, encourage them to explore the foam blocks and help them make a simple AB, AB pattern such as red-blue, red-blue, red-... Ask:

**What comes next?**

Continue making patterns until all the children have had some experience with the blocks. As you work together, talk about how a pattern repeats over and over.

Read: *Bunny Cakes*
After reading the book, go back and look at each page. Can children find any patterns in the pictures? Ask them to describe the patterns they find.

Sing: “This Old Man”
Did children notice any patterns in this song? What were they?

Read: *The Doorbell Rang*
Go back and look for the patterns in the book. Some are visual and some are in the story itself:

*The cookies are divided...*
*The doorbell rings...*
*Children arrive...*
*The cookies are divided...*
*The doorbell rings...*
*Children arrive...*

Activity: Beginning With Patterns on page 53.

Most of the world, both natural and human made, is constructed of units that repeat themselves into patterns. If you look closely at living things and human-made things, you will see many examples of single or core units making a simple repeating pattern (A-A-A-A-A-A and so on).

The core of patterns can be more complex when different units are added, such as A-B, A-B, A-B and so on, or A-B-C, A-B-C, A-B-C and so on.

When listening to music, children can identify rhythm patterns and word patterns in lyrics. Poetry is full of metrical patterns and dance can contain motion patterns.
**Beginning With Patterns**

**Goal:** Children learn to describe, create and extend patterns using shape blocks.

**What’s needed:** A collection of foam shapes, colored paper cut into shapes and strips, pencils or crayons, glue.

1. Engage children in a discussion about patterns by looking for patterns on clothing, in the room or in a book. Begin by pointing out a pattern. You might say:

   **I see a pattern on Madison’s shirt:**
   *red square, yellow circle, red square, yellow circle...what comes next?*

2. Begin by helping children make and extend a simple pattern such as *orange square, green triangle, orange square, green triangle*. Ask:

   **How can you describe this pattern? What comes next?**

3. Provide sets of shapes so children can work together to create and extend patterns. One child can start by beginning a pattern and asking another child what comes next. Encourage children to describe the patterns they create. As they become more proficient children can add a third and fourth shape to create more complex patterns.

4. Children can represent one or more of the patterns they created by drawing the pattern on a strip of paper to take home.
Making Pattern Strips

Goal: Children make patterns using two and three colors.

What’s needed: Many 3” squares of different-colored construction paper, glue sticks or tape. Each child should have a strip of plain paper (9” x 3” or something similar).

1. Put all the colored 3” squares into a container in the middle of a table. Give each child the 9” x 3” strip of plain paper.

2. First, challenge children to make a pattern strip using two different colored squares.

3. As children make their patterns, ask:

   **How did you start your pattern?**
   **What color will you use next?**

4. When a child is satisfied with his or her pattern, glue or tape the small squares to the base paper.

5. When the individual pattern strips are completed, place them on a table. Ask:

   **What do you notice about the patterns you made? How are they the same or different?**

After children become proficient with two colors, challenge them to add a third color and make more patterns. Display the pattern strips or allow children to take their pattern strips home.
What’s My Pattern?

Goal: Children use buttons to create and describe patterns.

What’s needed: Button collections.

1. Spread out and take a look at the collection of buttons. Ask children:

What do you notice about the buttons? How are they the same? How are they different?

2. The similarities and differences of the buttons can be used to make patterns. Tell children you will make a pattern based on the buttons’ characteristics (attributes) and that they should try to identify your pattern.

Line up buttons in a simple pattern such as buttons with two holes, four holes, two holes. Ask:

How can you describe this pattern?

3. Allow children a chance to make their own patterns with the buttons and take turns finding the patterns. What kinds of patterns did children create?

4. Leave the patterns intact and discuss the individual patterns with your group.

5. Have children make drawings of the button patterns to take home.

Striped, white, metal, striped, white...what comes next?
Patterns With Linking Cubes

Goal: Children create, extend and copy patterns using linking cubes.

What’s needed: Sets of linking cubes, cut-out colored paper squares to represent cubes.

1. Begin a simple color pattern with linking cubes such as yellow-blue, yellow-blue. The cubes can be stacked or connected in a row. Ask children:

   **Can you copy my pattern?**

2. After they’ve practiced copying patterns you make, encourage children to make their own patterns using the linking cubes. Children can take turns copying each other’s patterns.

3. Show a pattern that includes an amount of cubes as well as color such as one red-two yellow, one red-two yellow. Ask:

   **What’s the pattern? What comes next?**

4. There are many variations of patterns possible with linking cubes. Children will have many ideas of how to create interesting and challenging patterns.

5. For a take-home activity, use cut-out color construction paper squares glued to a larger sheet of paper. Children can make their own paper square patterns to take home.

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**Discovery Center**

**Linking Cube Patterns**

Display the sets of linking cubes and challenge families to make, copy and extend each other’s patterns.

Provide paper and markers for families to use in representing their patterns.

Include a display of books that feature patterns.
Patterns in Nature

Goal: Children look for and describe patterns on animals and sort and compare characteristics of animals.

What’s needed: Mother Goose Programs™ Animal Cards or other pictures of a variety of animals.

1. Spread out the collection of animal cards. Ask:

Does anyone see an animal with a pattern?

Ask children to describe the patterns they find. You might say:

I see you have a butterfly. How would you describe the pattern on the butterfly?

2. Spread out the cards that have been identified as having a pattern for an “I Spy” game. Give a series of clues to identify a specific animal. Pause after each clue so children have time to look at all the cards. For example, you might say:

I spy an animal with black stripes. I spy an animal with black and orange stripes. Which animal is it? How might its pattern help the animal?

(Some patterns help an animal blend into its surroundings either when resting or in motion. Find out more about animal protective coloration or camouflage.)

3. See if any of the children would like to try giving clues to identify an animal with a pattern. Giving descriptive clues builds observation skills and vocabulary.

4. Use all the animal cards to sort and create patterns based on characteristics such as how animals move, where they live, type of animal (mammal, bird, insect) or how many legs they have. One example: rabbit-fish, raccoon-shark, dog-whale. What’s the pattern?

Discovery Center

Where’s the Pattern?

Ask families to bring in objects from the natural world such as leaves, rocks and shells. Challenge families to find as many patterns as they can in these objects.
Pattern Walk

Goal: Children look for and describe patterns they find while out for a walk in the neighborhood.

What’s needed: Clipboards and pencils, pens or markers.

1. Engage children in a discussion about patterns. Remind them that a pattern is something that repeats.

2. Look around the room and ask:

   **What patterns do you see in this room?**
   **Can you describe this pattern?**
   **What comes next in the pattern?**

3. Go on a Pattern Walk. Tell the children they will be looking for patterns on buildings, in nature, on the ground, etc.

4. As you walk, stop frequently and talk about the patterns you see. Ask:

   **How would you describe this pattern?**
   **What comes next in the pattern?**

Have children draw or make notes about the patterns they see. When you return from your Pattern Walk, children can take their “pattern notes” home.

If children have found and noted many patterns they could make a Patterns Book to take home.

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Discovery Center

**Where's the Pattern?**

Challenge families to find as many patterns in the library as they can. Provide paper and markers and ask families to make a list of all the patterns they find. They can use words or drawings to describe the patterns.
From one librarian:

We had been making lots of patterns during our Discovery Hours so I decided to combine visual, sound and movement patterns.

I put my “pattern materials” on a big table—construction paper squares in different colors, glue sticks—and asked children to make patterns. As they worked, I reminded them that a pattern is repetitive. Then I asked one child to describe her pattern, which was red-blue-red-blue, etc.

I then asked if anyone could make a sound pattern of this red-blue pattern? One child did; he clapped his hands once, then clapped his hands on his knees once.

I then asked if anyone could make a movement pattern and yet another child eagerly showed us hop-step-hop-step and so on.

Everyone in the group took a turn creating sound and movement patterns that corresponded to their visual patterns. With 15 children, that’s a lot of patterns! When they were done I told them that they represented their patterns, just like mathematicians!

Clapping Patterns

Goal: Children will repeat and extend clapping patterns and create new patterns.

What’s needed: Hands.

1. Clap a simple rhythm for the children. Talk about the elements of the pattern, for example, one loud and two soft, or two fast and one loud. Ask them to repeat it. Add another rhythm to the sequence. Ask children to repeat it.

2. Ask children to volunteer to create a clapping pattern. Have one child demonstrate the pattern and describe it. Ask the other children to repeat the pattern.

3. When children can repeat a simple pattern, you might ask one child to clap a pattern and another child to add to it. Continue adding on patterns as long as the children can follow the clapping patterns, probably no more than two or three extensions.

4. Show children how to represent a clapping pattern. Explain that if we want to write down and remember our patterns we can use foam shapes to show our clapping patterns. For example, one loud and two fast claps could be represented as one square and two triangles.

Encourage children to make a picture of a clapping pattern and then clap it. You can explain that music is written with a pattern of symbols.
Sound Patterns

Goal: Children will learn to describe and repeat sound patterns using sticks.

What’s needed: Spoons, chopsticks, dowels or other sticks with blunt ends.

Special note: Let children know what your “stop” signal is, like raising your hand or putting your sticks on the floor. Let them know how they can tap with the sticks such as tapping the sticks together, gently tapping the floor or a table.

1. Demonstrate a pattern of taps and have a child describe it. You can do this a few times. One pattern might be: two fast taps, two slow taps, etc.

2. Hand out sticks to children and allow a few minutes for them to practice tapping them together.

3. Tap a simple rhythm and have the children repeat it. Start very simply. You might want to just start with tap-tap and have the children repeat back tap-tap. You can then add on more taps, or vary the speed of the taps. You could work up to a variety of fast and slow: tap-tap, tap-tap……tap…tap.

4. Let children take turns creating a tapping pattern that the other children repeat.

5. Talk with children about sound patterns they hear everyday—the patterns of rain on a window, the ticking of a clock, birdcalls or a train whistle. Have children create a pattern as a sound effect to accompany your reading or playing some music.

6. As children become comfortable with repeating a pattern, try extending a pattern. For example: One child does tap-tap. The next child repeats tap-tap and adds tap…tap. This can go on as long as children can remember the sequence, perhaps up to three or four extensions.

Website Resources

Percussion music: www.musictogether.com

Sound effects: www.findsounds.com www.stonewashed.net

From one librarian:

The children in my group really enjoyed Pattern Fish and I wanted to show them that we could represent visual patterns (there are so many in this book) with sound. So—we made a Pattern Orchestra! Children paired up and one child represented (tapped or clapped or moved) one page while his or her partner displayed the book and recited the text: Yellow-black...yellow-black...A fish swims in the ocean. It has stripes upon its back. Yellow-black...yellow-black...yellow... Then all the children got to say, all together for the call and response: “What comes next?” in VERY loud voices. It was so successful that we’re looking for other books we can “perform” with moms and dads at a Family Night Pattern Orchestra!
Goal: Children create and copy movement patterns.

What’s needed: Paper and markers for recording patterns and a book such as *Jonathan and His Mommy* by Irene Smalls, *Hop Jump* by Ellen Stoll Walsh or any book in which the characters move in one or more patterns.

1. Talk with children about the movement patterns in the book you’ve selected. Describe some of the movements, such as one big step, two small steps, jump, skip.

2. Ask one child to create and demonstrate a movement pattern such as one BIG step, three small steps, one BIG step, three small steps. Have the children follow each other around the room using this pattern.

3. Show children how you can record the movement pattern to be able to do it again. Represent the movement pattern using symbols for each type of movement. For example, a hop can be a triangle and a jump can be a circle (see below).

4. Ask children to create another movement pattern.

5. As children become comfortable with two-part movement patterns, extend the patterns, e.g. step, hop, hop.

Movement Patterns

When we walk, when we sway to and fro to music or when we learn to dance, we are engaged in a movement pattern. We are repeating a movement or a combination of movements. The pattern of movement may relate to the music we are moving in time to or the pattern may relate to a set of directions, such as “Hop, hop, skip.”

Many children’s games involve movement and rhythm—following steps to a dance, learning a skipping song, bouncing a ball and counting, clapping to a song. Children love to repeat a physical skill over and over in the process of learning and internalizing a pattern of movement. Repeated experience with movement helps children build more elaborate and increasingly flexible skills that can be applied to new situations.

Combining movement and rhythm is an effective way of engaging children in learning because it is an active and fun way to internalize patterns. All of this helps children recognize movement patterns in the world around them and adds to their understanding of the way things work.
Recognizing Relationships

For young children, learning to recognize, manipulate and create patterns is essential for discovering relationships in the world around us.

Relationships can be found within patterns and are a bit more difficult to recognize, describe and understand. While patterns are always things that repeat, relationships are formed when two or more objects, events or parts are connected.

Recognizing Same and Different is a skill necessary to understanding relationships. Whenever we say same and different we’re making comparisons. To do this, a basis for comparison must be established—it can be a single attribute or multiple criteria. Therefore, it’s possible that two objects may be the same in one way and different in another. Two buttons may be the same because they are round, but different—one has two holes and one has four. Whether they are the same or different depends on the attributes we’ve chosen.

Children learn about relationships when they:

• Sort and re-sort their toy collections.

• Look at pictures of animals and make comparisons among them.

• Follow directions to make something.

• Talk about their bedtime routines.

• Recognize and talk about change in their environment.

Math and Science Skills and Concepts

When children explore relationships, they:

• See and understand how one thing influences another.

• Learn to understand changes in quantity, size, temperature or weight.

• Compare sizes, shapes, quantities, colors and events.

• Begin to understand comparisons such as more than, less than and the same as.

• Notice similarities and differences and put objects into groups based on shared attributes.

• Collect and examine objects such as rocks and sort them into groups based on shape, color or texture.

• Match and sort pictures of animals based on what they look like, where they live or what they eat.

• Learn to understand and use comparative words: more than, less than, bigger than, smaller than, shorter than, longer than, heavier than, colder than.

• Begin to recognize daily sequences such as going to bed, waking up, having breakfast and getting dressed.

• Begin to understand the relationship between light and shadows.
Books About Recognizing Relationships

*Moonbear Shadow* by Frank Asch

*What Makes a Shadow?* by Clyde Robert Bulla

*Five Creatures* by Emily Jenkins

*Actual Size* by Steve Jenkins

*Hannah’s Collections* by Marthe Jocelyn

*Bein’ with You This Way* by W. Nikola-Lisa

*The Button Box* by Margarete S. Reid

*Just a Little Bit* by Ann Tompert
Sorting: A Typical Program

Books: Jamaica and Brianna by Juanita Havill and Shoes Shoes Shoes by Ann Morris

Activity: Sorting shoes

Fingerplay: “Where is Thumbkin?”
Children can look at their own fingers and compare and contrast them with other children’s. What’s the same? What’s different?

Read Jamaica and Brianna. Go back and have children describe the characteristics of Jamaica and Brianna’s boots.

Ask children to describe the shoes they are wearing. Can they find another child in the group wearing a shoe that looks the same? That has a similar attribute?

Suggest an attribute (color, fastener, type, etc.) for sorting the shoes the children are wearing. Say:

Let’s sort ourselves into two groups: sneakers and not sneakers.

Allow children to sort themselves into these two groups.

Ask one of the children to select another shoe characteristic and do a new sort. Sort by as many shoe attributes as you and the children see.

Allow time for children to describe and compare their sorting groups.

From one librarian:

There are so many books about shoes! For a whole month our group read books about shoes. Then we sorted and made graphs, over and over again, collecting different data each time.

One thing I realized is that many books were about shoes, but not about attributes we could use to sort by. For example, it wasn’t possible to sort by work shoes or everyday shoes. The attribute had to be recognizable.

And what goes with shoes? Socks! So I went to the dollar store and bought lots of socks to sort, too! After reading Centipede’s 100 Shoes by Tony Ross, we sorted shoes and socks and then graphed those results.
**Vocabulary**

**Attribute:** A recognizable characteristic of someone or something.

**Set:** A group of objects with one or more common attributes.

**Sorting loops:** A flexible border for enclosing sorted items. Loops allow groups to overlap when a shared attribute is seen in two distinct sets. Shoelaces work well.

**Venn diagram:** A diagram using circles to represent sets, with the position and overlap of the circles indicating the relationship between the sets.

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**Same and Different**

**Goal:** Children learn about attributes and sort pictures.

**What’s needed:** A collection of pictures from catalogs or magazines, “sorting sheet” templates (see picture below left) and glue sticks.

1. Talk with children about same and different and show them the “red” and “not red” sort you made on your sorting sheet template. Ask:

   **Can you find more pictures with the same attributes?**

2. Working in small groups with a selection of pictures, have children select an attribute and glue the corresponding pictures onto the circles on a sorting sheet template. Remind children that the attributes might be, for example, shoes and not shoes.

3. Do this activity over and over again, each time with different attributes, depending on your collection of pictures.
Sorting Animals

What’s needed: Mother Goose Programs™ Animal Cards, animal pictures from magazines or the internet, or plastic toy animals.

1. Read any book featuring a variety of animals. Talk about the ways animals can be different or the same in terms of physical characteristics and where they can be found (habitat).

2. Allow children time to sort and re-sort the animals by various attributes—where they live, how they move, what they eat, physical characteristics, etc.

Sorting Animals Collage

What’s needed: Pictures of a variety of animals from magazines or the internet, glue sticks and paper.

Children can work in small groups with an adult helper to write down the child’s sorting attribute and help with the glue sticks.

1. Talk about the ways animals can be different or the same in terms of physical characteristics (attributes) and where they can be found (habitat).

2. Allow children time to look at and talk about the different characteristics (attributes) they might chose for sorting the animal pictures. Allow time for sorting and resorting the pictures into different sets.

3. Working in small groups, each child should chose one attribute and find the animals for his sort. Ask the adult helper to write the attribute on the child’s paper and help with the selection and gluing of the collage.

From one librarian:

I thought sorting pasta would be fun (and it was!). Several weeks before the program I asked other staff and some friends to bring in baggies of unusual pastas—shapes, colors, thickness, etc. We ended up with over a dozen different types.

I read Strega Nona and we talked about the different words we used to describe pasta: noodles, spaghetti, macaroni. Next we sang a rousing rendition of “On Top of Spaghetti.”

The children divided into 4 groups with at least one adult in each group. I gave a mixed collection of pasta and sorting loops to each group and asked them to sort and re-sort the pasta. We looked at each others sorting and were surprised at how many different attributes had been found.

I ended the program by reading On Top of Spaghetti by Paul Brett Johnson. All 14 children (ages 3-6) and adults joined in.
What’s needed: Gather a collection of tools which might include: drawing tools such as a pencil, paintbrush or marker, kitchen tools, sewing tools, personal hygiene tools, woodworking tools.

Allow children plenty of time to sort the tools by similar characteristics such as: those used for writing, for cooking, for cutting, for cleaning, to make a building, to make a dress, etc., or tools for measuring or mixing.

Children can also group the tools by which ones have numbers on them (measuring cups and a tape measure, for example), or group them by the shapes they have (the saw has a rectangle, the spoon has an oval).

From one librarian:

One of my storytime Moms does woodworking. I asked her if she would help me with a program about sorting tools. After I explained EXACTLY what we’d do she was delighted to participate.

I chose *Albert's Alphabet* as our book and she brought in her big tool box.

After reading the book and talking about the tools that Albert used, Jenny began her talk about the tools she uses. Each child got to look at (observe) and touch each tool’s shape and design, make predictions about how the tool might be used, and talk about what experiences they’d had with the tool.

We then selected the tools Albert used in the book and sorted them by shape and other visible attributes.

One child asked if they could build something at another program and we’re making plans to continue our investigation.
Sorting a Button Collection

Goal: Children learn to describe and name attributes they see in a collection of buttons and then sort the buttons by one or more attributes into “sets.”

What’s needed: A collection of buttons in a variety of sizes, shapes, designs and colors.

1. Gather the collection and spread the buttons out on a table.

2. Talk with the children about the buttons. What words can they use to describe the buttons? Talk about those descriptive words as “attributes.”

3. Ask the children to begin to sort the buttons, using one of the attributes they have named. For example, ask the children to find all the black buttons. When they have finished, put the sorting loop around the set you have made and tell the children that this shows that these are a set because they all have the same attribute.

4. Have children choose another attribute, such as all the plastic buttons and make another group or set. Place a loop around this set.

5. Allow children plenty of time to practice sorting and resorting the buttons based on various attributes. As children sort, ask them to tell you what attribute they chose to make their group or set.

6. You might use this opportunity to introduce children to Venn diagrams. For instance, if children have sorted the black buttons and the white buttons, some of the buttons might have both colors, and those would go in the overlapping part of the loops where they are not “either/or” but “both.” (See Venn diagram example on page 65.)

Everyday sorting (making a collection or set) gives children a chance to select and group objects based on common attributes. Sorting dolls, rocks or socks helps build children’s skills in identifying same and different attributes because the number of sorting attributes is less. Children’s observations and discussions during the sorting process are equally important. You can help by asking questions such as:

What do you notice about the shapes of the blocks? What makes some shapes the same? What makes them different?

I like your car collection! What attributes could we use to sort them?

A family sorts buttons together and makes a Venn diagram.
Sorting Rocks

Invite families to find at least one rock and bring it to the program.

Read any book/books about rocks or collections. Examine, talk about and sort the rock collection by various attributes: color, size, pattern shape, etc.

Ask:

What do you notice about our rocks?

What is the same about our rocks? What is different?

How many different attributes can we use to sort our collection?

Which rock is your favorite and why? How would you describe its characteristics?

Collections From Nature

Collections from nature can be made by:

- Asking families to bring in the items: leaves, shells, rocks, flowers, etc.

- Going for a walk with children and asking each child to collect the same object (leaves, rocks, etc.).

- Asking older children or volunteers to collect the items for the program.

- Sorting and re-sorting your collection as you talk about the attributes.

Discovery Center

Let’s Rock!

Announce to your patrons that you’ll be exhibiting a rock collection and encourage each person to bring a rock to the library to add to the collection.

Display the rock collection and challenge families to sort the rocks by different attributes: color, texture, size, etc.

Display books with your rock collection. Examples: If You Find a Rock by Peggy Christian, A Gift From the Sea by Kate Banks, Let’s Go Rock Collecting by Roma Gans and Rocks in His Head by Carol Otis Hurst.

Do any of your patrons already have a rock collection they’d be willing to share?
What’s My Attribute?

Goal: Children practice sorting and naming attributes.

What’s needed: Sorting loops and the Mother Goose Programs™ Sorting Collections or a collection of small objects with a variety of shapes, colors, materials, and uses.

1. Explore the sorting collections together. Look at, touch and talk about attributes of the different objects. Identify attributes that will help you sort the objects into groups: color, shape, sizes, types of material, texture, use, etc.

2. Choose an attribute to sort by. For example, all the shiny objects or all the objects made of wood or all the objects that are tools. Put your groups (sets) in sorting loops, ALL SHINY and NOT SHINY.

3. Mix the collection up and have children take turns using a sorting loop to sort part of the collection by a “secret” attribute.

4. As children create a sorted group of objects—a set—ask other children to try to guess the “sorting attribute.” Sometimes the children can guess quickly. Sometimes, the sorter has to explain the attribute.

5. Let children work individually or in groups, making sure each child has several turns at being a sorter and a guesser.

Discovery Center
Our Own Sorting Collection

Make a sign asking families to contribute to your LIBRARY SORTING COLLECTION.

Post a list of suggested items (add other objects you’d like):
Small toy animals, cars, blocks, etc
Bottle caps
Shiny objects
Objects with two colors
Objects with writing or numbers on them

Objects we can’t use:
Sharp
Dirty
Glass
Larger than 4” by 4”
Things you want returned to you

Once you have all the objects, mix them up in a box or basket and include some sorting loops.

Include instructions about how to sort with definitions of attribute and Venn diagram.
Sink or Float?

Goal: Children investigate various objects to see whether they have one of two attributes: it will sink or it will float in water.

What’s needed: A Mother Goose Programs™ Sink and Float Kit or a collection of small objects of various sizes, shapes and materials, water in a plastic tub, an area in which dripping water is not a problem, and chart paper and markers.

1. Look at, touch and talk about the objects. Ask:

   **What is the object made of?**
   **What’s its shape?**
   **What’s its size?**
   **What other characteristics do you notice?**

3. Allow children time to sort the objects, talking about the various attributes. Ask them to predict what will be a sinker and what will be a floater. Fill in your chart with the predictions.

3. Test your predictions in the tub of water. Talk about the similarities and differences between the sinkers and floaters? Ask:

   **What do you notice about the objects that sink?**
   **What do you notice about the objects that float?**

Fill in your chart with the information about which objects sink and which float.

4. Review your chart and discuss the attributes found in each group. Ask:

   **How are the sinkers the same or different from each other?**
Time for Bed

Goal: Children create a sequence for getting ready for bed and then act out the steps in the sequence.

What’s needed: Large paper and marker.

1. Ask children to think about what they do each night when they get ready for bed. (For young children, reading a book such as Peggy Rathmann’s *10 Minutes till Bedtime*, which relates a bedtime routine, can enhance this discussion.)

2. Write down what children say about getting ready for bed (in any order).

3. Reread together the list of bedtime steps. You might say:

   **Let’s put this list in order. What do you do first? What comes next?**

Children might not agree on the order of every step, but tell them you are creating a sequence that has a bit of what everyone does in it. Write down the list of steps in order.

4. Ask children to think of a simple motion or action that would demonstrate each step of the sequence. Have children practice the actions in order, either all together or one at a time, around the group. Have fun acting out this bedtime routine.

5. At another program read a book about a morning routine, such as *Froggy Gets Dressed* by Jonathan London and repeat the activity.

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In a sequence, a number of things or events are arranged in a particular order or related in some way.

Young children’s understanding of sequences usually begins by talking about everyday routines: *First I get out of bed, then I get dressed, then I eat my breakfast, etc.*

Children begin noticing their own daily sequences first, and then become aware of other sequences in their everyday lives.

In science a sequence of steps is used when conducting an experiment or solving a problem. Technology and manufacturing use sequences in getting a task completed and getting objects built.

Following instructions requires following a particular sequence (see page 73).
Discovery Center
Following Directions

1. Take a piece of paper approximately 8” x 8” and draw as large a circle as you can.

2. Start at one edge of the circle (like the drawing to the left) and cut out a spiral. The number of coils will vary with how thick the “sides” are—feel free to experiment or make them about 1” thick.

3. At the center of the spiral, poke a hole. Tie a knot at one end of your string. Pull the other end through the hole in the spiral until the knot stops at the hole. This way you don’t tie the spiral tightly to the string (see drawing below).

4. Hold the string and move your arm up and down. What does the spinner do? Is it the same each time you pull it up or down?

5. Hold the spinner near a heat vent, a fan, or anything that might be blowing air—what happens? Try various places around your home, inside and outside.

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Paper Gliders

Goal: Children follow a set of directions (a sequence) as they create a paper glider.

1. Fold a piece of paper in half the long way (A).

2. Fold down two short edges into triangles (B).

3. Fold the triangles over two more times on each side (C).

4. Open the wings to form the final shape (D).

5. Launch the glider gently. See how it flies. Put a piece of tape across the wings to hold them together. Shape the wings so they have a slight upward curve. How does it fly now? See if you can make other changes to its flight.

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Figure A

Figure B

Figure C

Figure D
Outdoor Shadows

Goal: Children investigate the relationship between and among objects, light and shadows.

What’s needed: A sunny day, time to go outdoors, two or three large but lightweight objects to take outdoors, such as an umbrella, a broom, a hoop or jump rope. A tool for marking shadows on the ground (chalk, string, a piece of paper, pebbles).

1. On a sunny day, talk with children about investigating shadows outside. Ask:

What makes a shadow?

2. When you get outside, look around and ask children to find as many shadows as they can. Tell children that every shadow they see is made by something that blocks light. Ask:

What do you notice about the shadows?

3. Have children make a variety of shadows with their bodies or with the objects they brought outside. Talk about the shadows. Ask:

What do your shadows look like?

3. Challenge children to:

Make their shadows smaller.
Make their shadows larger.
Make their shadows touch without touching each other.
Hide their shadows.

What other ideas do children have?

From one librarian:

On the day I planned to do outdoor shadow investigations, wouldn’t you know it—it rained! So I scrambled and found flashlights and lots of small objects (stuffed animals were the best). I set up the investigation with one of the stuffed animals on a piece of paper on a table, then I turned on the flashlight to make a shadow of the stuffed animal on the wall. I asked one child to draw an outline of the shadow on the paper.

Then I moved the flashlight and asked another child to draw an outline of that shadow. We did this a few times and asked children what they noticed.

After we’d discussed our investigation, I challenged another child to make a long shadow of the stuffed animal, then a short one. One child noticed that the shadow sometimes wasn’t the same shape as the stuffed animal.

We spent the rest of our time challenging each other to make shadows smaller than the stuffed animal, then bigger. The next time our group met we tried other objects and more shadow investigations. These were so successful that I built a Discovery Center for indoor shadow investigations and made shadow challenges for families!
Changing Shadows Over Time

Goal: Children investigate the relationship between and among objects, light and shadows.

What’s needed: A sunny day, time to go outdoors (one or more hours) and a tool for marking shadows on the ground (chalk, string, a piece of paper, pebbles).

1. On a sunny day, go outside with children and find a sunny place on the grass, dirt or sidewalk.

2. Use a stick, chalk or string to mark where one child’s toes are so that he or she can stand in the exact same place later on.

3. Place a pebble on the ground on the shadow of the child’s head.

4. Return to the same location in about an hour. Have the same child put his or her toes in the place you marked. Now place a stone on the shadow of the child’s head. Ask:

   What changed?

5. If possible, repeat this as many times as you can throughout the day, each time placing a new stone where the shadow of the child’s head is. (See picture above left.) Ask:

   What do you notice about the stones?

From one librarian:

I never get to see a group of children for a long period of time, so I was looking forward to visiting a summer day camp as part of an outreach project I’m doing. I knew I wanted to explore outdoor shadows and I liked the idea of charting the progress of a child’s shadow over several times during the day.

Because I was doing this program over the entire summer we had the chance to do this activity several times over three months. We kept our data on a chart and older children wrote the data. Children noticed how the shadows changed not only throughout the day, but from June to August.

One little girl said she wanted to come to the same location over winter vacation and see if it changed even more!
Change Over Time: Growth

Children are fascinated by how things grow. By observing plants and animals, children engage in the study of change over time.

Even very young children notice how every living thing around them grows and changes, even themselves: last year’s winter jacket no longer fits, a small puppy becomes a large dog, apple blossoms become apples.

Children learn about growth and change when they:

• Discuss how children and all people change as they grow older.

• Observe how seeds germinate and grow into plants.

• Observe and measure a plant as it grows.

• Observe life cycles of common animals.

• Observe and record changes in living material during decomposition.

• Observe and record changes in one tree and the environment around it over several seasons.

Math and Science Skills and Concepts

When children explore growth, they:

• Observe and discuss life cycles and changes in size and form.

• Ask questions about the similarities and differences in different stages of growth.

• Use simple science tools to observe and measure growth.

• Represent observations and measurements with drawings and charts.

• Sort pictures of living things by physical characteristics.

• Explore and experiment with seeds of different sizes, shapes, colors and textures.

• Learn that animals need food, water, air and shelter to grow.

• Learn that plants need food, water, air and shelter to grow.
Books About Growth

All About Frogs by Jim Arnosky

Jody’s Beans by Malachy Doyle

From Seed to Plant by Gail Gibbons

Monarch Butterfly by Gail Gibbons

A New Frog by Pamela Hickman

Arabella Miller’s Tiny Caterpillar by Clare Jarrett

How a Seed Grows by Helene J. Jordan
Growth: A Typical Program

Books: *When Frank Was Four* by Alison Lester and *Now I’m Big* by Margaret Miller

What’s needed: Sheets of paper folded in half and crayons or markers.

Read *When Frank Was Four* (or any book about a child growing and changing).

Go back through the book and talk together about the changes children notice in how the characters grow and change.

Encourage children to talk about how they’ve changed as they became “big kids.”

Song: Any cumulative song or fingerplay. Talk about how the song builds and gets longer as more verses are added.

Read *Now I’m Big*. Talk about each picture emphasizing the phrases “When I was a baby...” and “Now I’m big...”

Divide children into small groups so that each group is working with an adult. Children can draw an activity they did as a baby and how they do it...now that they’re big!

Examples may be used from the book or children may think of new activities such as: “When I was a baby I rode in a stroller...Now I’m big I ride a bike.”

An adult can write the caption near or under each picture.
From one librarian:

One of our patrons is a veterinarian and he works closely with our local animal shelter. I was planning programs on growing and changing and I asked the vet to help me organize a program.

First I read *Let’s Get a Pup! Said Kate* to my group. The vet brought a mother dog and her new puppies to the program and we carefully examined the animals. I asked the children what was the same about the dog and her puppies and listed those on a chart. I then asked what was different and then listed those differences.

The vet had brought a stethoscope and children took turns listening to the heartbeat of one puppy, then the heartbeat of the mother dog, then their own heartbeat. The children were VERY excited about using the stethoscope.

The vet also talked about how to care for dogs and the importance of caring for pets in general. He asked questions such as *What must happen in order for puppies to grow into adult dogs?* and that really sparked discussion.

We’re moving on to cats and kittens next!

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**As We Grow**

**Goal:** Children describe and compare the differences between younger and older people by talking about, sorting and matching pictures of people of different ages.

**What’s needed:** Magazines and catalogs with pictures of people of different ages (babies, children and adults) and strips of paper, scissors (if children will be cutting out the pictures) and glue sticks for timelines.

1. Working in small groups with an adult, allow children time to look at and talk about the various pictures. Ask:

   **What age characteristics do you notice? How can you tell what age this person might be?**

2. What sorting groups (attributes) can children think of? Some sorting possibilities are:

   - By age: babies, children, teenagers, etc.
   - By pairs of people the same age
   - By a sequence from youngest to oldest or oldest to youngest

3. Sort and re-sort the pictures.

4. Help each child make an “As We Grow” timeline. Each child selects a sequence of pictures from the collection and glues them on a long strip of paper to take home.

   An adult can help label the timeline with the noticed changes.
Live Displays in the Library

Goal: Children observe a complete life cycle over several weeks.

What’s needed: Any kind of life cycle kit, paper and crayons or markers.

1. Gather children around the display cage or box. Take time to look at, name and discuss changes children observe. Ask:

What’s changed since the last time you looked at the display?

What else do you notice?

2. Have children make and label drawings at different stages of the cycle.

3. Keep a journal of changes with drawings (representations) and comments.

4. Display some of these representations with books and pictures of the animal you’re exploring. You can also display illustrations children have made or photos you’ve taken of your display during the different stages.

5. When the cycle is complete, put together log pages to create a “book” called “Our [Animals].”

Talking About Animals

Animals need air, water and food to live and grow.

Animals go through stages of growth and change. Some young animals look like their parents; some do not until they mature (frog, insect, butterfly).

Animals have life cycles that include being born, developing into adults, reproducing and eventually dying. Life cycles are different for different animals.

A habitat is the local environment in which a specific organism or species lives (pond, forest, etc.).

The environment is the natural world in which people, plants and animals live.

All animals depend on plants. Some animals eat plants for food. Some animals eat other animals that eat plants for food.
Animal life cycles—the cycle from birth to death—is most often a lengthy process that makes direct observation difficult. However, learning about the complete life cycle process is an important early concept for children and their understanding of life.

If one is inclined to be a bit of a zookeeper, it’s easy to set up what scientists call a controlled environment in the library for an animal with a short life cycle. This type of Discovery Center provides opportunities for children and families to observe, measure and record an example of a life cycle. These activities can be part of a regular story time, connected to both fiction and non-fiction books and at the same time be used in a Discovery Center for children and families to collect data and make representations whenever they visit the library.

Biological and nature supply sellers offer several ready-made kits with full instructions for butterflies, earthworms, beetles, shrimp, etc. Choose the animal from a local provider or from one of the following websites:

www.InsectLore.com
www.educationalscience.com
www.carolina.com

From one librarian:

I wanted to have a live animal display at the library that would show changes over a long period of time. The Butterfly Life Cycle Kit was perfect for my needs!

Most important: I timed the experience so that it would be warm when it was time to release the butterflies.

Each time I did a program I talked with children about the changes they noticed. I gave them lots of time to examine the changes very carefully. The older children made lists and the younger ones drew pictures of the changes.

The most dramatic change happened by chance one day when I had the biggest group of all. We had just read From Egg to Butterfly and one little boy jumped up and said, “Look! Look!” We all crowded around the cage just as the chrysalis shed its covering. One child said, “It’s a miracle!” and everyone said, “Whoooooa!” With all the planning I did, I could never have predicted such a dramatic learning opportunity.
How Does Your Garden Grow?

Begin by talking with children about plants, gardens and growing. Ask:

Where have you seen a plant growing?

What did you notice about the plant?

What do you think plants need in order to grow?

Have you ever eaten part of a plant? What did you eat?

If there are plants in your library, take an indoor “plant walk” and find all the plants. You can also take your group on an outdoor plant walk to see how many plants children find. Ask:

What do you notice about the plants? Are trees plants, too?

Talking About Plants

Most plants need air, water, light and food to live and grow.

Most plants make seeds for new plants.

Plants closely resemble their parents.

Plants have life cycles that include being born, developing into adults, reproducing and eventually dying and decomposing. Life cycles are different for different plants.

Many foods we eat are seeds.

A habitat is the local environment in which a specific organism or species lives (pond, forest, etc.).

The environment is the natural world in which people, plants and animals live.

From one librarian:

I invited Mike, the local garden center manager, to come to a program I had begun on plants and growing. I told him that I was planning a long-term project on growing but that first I was introducing many different kinds of plants to the children in my group. We’re in an urban area, so there was no guarantee that these children had seen many plants.

He brought a wide variety of plants to show the children. First we read Jody’s Beans and talked about what plants needed to grow and what kinds of plants we could grow in our climate.

I’m planning a return visit from Mike after we’ve planted our seeds so that we can discuss the plants’ progress.
**What’s Inside?**

**Goal:** Children observe and compare the variety of seeds inside fruits.

**What’s needed:** Fruits such as an apple, pepper, cucumber, tomato, orange, banana, peach, plum, cherry, pumpkin. Also, paper plates, paper towels, a cutting board and a knife (for adult use only).

1. Display the fruits on a table. Allow children time to look at, touch and talk about the fruits. Ask:

   **What are these fruits called?**
   **What do you think the inside of the fruit will look like?**
   **Will there be any seeds? If so, how many?**

2. After making some predictions, cut open each of the fruits and look at the seeds. Take time to count and compare seeds. Talk together about what you observe:

   **What do you notice about the size and patterns of the seeds?**
   **Are all the seeds the same size? Which fruit has the biggest seeds? Which fruit has the smallest seeds? The most seeds?**

---

**From one librarian:**

Before we did the seed investigation, I put up a piece of chart paper. We looked at each fruit and named it. Then I asked the children to predict how many seeds we would find inside. I had some stickers of the fruits and vegetables, which I put on the chart, going down the left side. We wrote down what the children predicted. Then, when we cut into each one, we counted the seeds and recorded that next to their predictions. Some had so many seeds that the children couldn’t count that high, and they just said “lots!”

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**About Fruits and Vegetables**

The plant material we eat is divided into the categories of fruits and vegetables. Fruits are usually fleshy, often juicy and sweet. Vegetables can also be juicy and sweet, but are considered foods to put in a salad or have for lunch or dinner.

However, technically, if the plant part we eat has seeds, it’s a fruit. That means that peppers, tomatoes, etc. are all fruits! The other parts of plants that we eat are leaves (lettuce, spinach) and stems (celery), roots or tubers (carrots, potatoes) and seeds (peas, beans).
Germinating Seeds

Goal: Children observe germination.

What’s needed: Assortment of seeds, paper towels, paper plates, water and hand lenses.

1. Place an assortment of seeds between moist white paper towels held between two plates (to preserve the moisture).

2. Place a few seeds on a plate and keep these seeds dry for comparisons and discussion.

3. Check the seeds daily to make sure the towels are still damp. In five to seven days, most of the seeds will have germinated.

4. Using hand lenses, encourage children to observe and discuss the ways the seeds have changed from their dry form. Ask:

   **How is this (germinated) seed different from the dry seed?**

Some of the seeds will not have germinated. Ask:

**Why do you think this happened?**

5. Discuss all the possible reasons (temperature, moisture, light, etc.) and introduce an experiment to discover one or more possible reasons.

Even the youngest children can represent their data with simple drawings.

Remind children to hold the hand lens close to their eye while observing an object closely. The object can then be adjusted to bring it into focus.
From one librarian:

In January, we observed and planted amaryllis bulbs. First we observed the soil and what it contains, planted and labeled our bulbs in 3 containers—one in soil, one in water, and one with 3 smaller bulbs. Then each week at the beginning of each story time we took out our clipboards and made observations of the changes that occurred. Some storytimes were devoted entirely to plants and sometimes just the beginning was used for observations, measuring, predicting, and graphing. Over the weeks the children saw the complete life cycle of the bulb from flower to seed.

Children observed the changes of the bulbs and plants over a period of weeks, measuring by inches or other increments, compared the differences in Plant #1 that did not grow very tall, Plant #2 in water that grew very tall, and Plant #3 that was a totally different flower and color. Each week we measured and graphed the progress and reviewed the vocabulary words over the course of many weeks. Later, conclusions were made about the how and why the plants grew the way they did. Even later the seedpods yielded many seeds and we tried to count them.

I asked lots of questions! What do you see? What are the different words for soil? How many buds are there? Which one grew the most this week? Why do you think so? Which is the smallest? Which is the tallest? Can you predict what will happen next week? How did it change? Can you compare? What do you think will happen if...? What would happen if we...? What does the flower look like today? Can you find flowers on your way home?

Watching even toddlers using clipboards to write data, just like I was doing, was exciting to see.

I knew that I was on the right track with this long term growing project and it only spurred me on to do more!

An Experiment

1. Repeat the paper towel procedure at left (the control) and then set one or more of the following conditions (variables) where everything is identical except for each variable:

   • seeds presoaked for 24 hours
   • covered plates placed in bright sunlight (warm)
   • soil placed between the towels and among the seeds
   • seeds placed in dry paper towels.

   Be sure to label each variable.

   In one week’s time observe seeds with hand lenses and make comparisons between and among the different growing conditions.

2. Encourage children to talk about what they see. Ask:

   How many seeds germinated in each situation?

   What might be some of the reasons for the differences in germination?

   Which were the best growing conditions?

   Why? What do seeds need in order to germinate?

3. Display books about growing, photographs of the experiments and samples from your experiment.
Watch it Grow! In the Library

What’s needed: Pots or cups, potting or garden soil, bean seeds, water, spoons for scooping soil, yarn or string for measuring, paper for drawing and graphs and/or a camera (this is a great project for collecting data with photographs).

Read a book about how a seed grows. Go back and look at and talk about the pictures.

1. Have children work together filling five or six cups or pots with soil and plant two or three seeds below the soil’s surface. Water the seeds well.

Talk together about what seeds need to germinate and grow.

2. After germination, store the pots in a sunny spot for future observation. Add water when the soil gets dry. Continue the investigation by having children observe the plants each time they’re at a program.

3. As the seeds sprout, talk about what you see. Ask:

What do you notice?
How many leaves do you see?

4. Measure the plants. On a large piece of paper, draw a line at the bottom representing the top level of the soil the plants are growing in.

Tape each cut piece of yarn or string vertically, up from that line. Mark the date at the bottom of each measurement.

From one librarian:

As we continued with our growing plants project over a long period of time, one day I asked the children what observations they had made of the new leaves on the bean plants. One little three-year-old girl said she thought they looked like hearts and had drawn hearts all over her clipboard observation sheet. She had seen something I had never noticed before!

Children also observed that sometimes the roots are taller than the actual plant.
Discovery Center
What Do You Notice About Our Plant?

Display the plants you’re growing and place a blank journal with the plant, along with measuring tools. Invite families to record observations (in words and drawings) about the plant every time they visit the library.

Some questions to ask: How has the plant changed? What do they notice? Include books about plant growth in your display.

5. After a few weeks you will have a growth chart of the plants you have measured. Talk with children about this visual chart of the plants’ growth.

6. Have children make drawings of the plants at their different growth stages. Help children label their drawings with the correct scientific terms for plant parts.

Get children to talk about their observations. Ask:

Tell me about your drawing.
What do you predict the plant will look like the next time you see it?

Watch it Grow! At Home

What’s needed: Clear plastic cups, paper towel and seeds. You should have enough so that each child can take this experiment home.

At the library, soak the seeds in water for a couple of hours or overnight. Dampen one or two sections of paper towel. Put the damp paper towel in a clear cup so that it touches the sides and bottom. Place several seeds about halfway down the cup so that the seeds are between the paper towel and the side of the cup. You should be able to see the seeds from the outside.

Send directions home with each child:

Put the cup in a place where you and your child can see it. Be sure to keep the paper towel moist. Watch the cup for several days. Together, you can make drawings of the sprouting seeds or just talk about how they’re changing.

To extend this investigation, try making several germinating cups and experiment by putting them in different locations: a sunny place and a dark place or a warm place and a cold place. What happens to the sprouting seeds?

More ways to observe plant growth:

Purchase a Root Vue Farm Kit for an easy, reusable display. Kits are available from many suppliers; Google “root vue kit” for options.

Follow the directions and pictures in a book such as How a Seed Grows by Helene Jordan.
Decomposition: Indoors

Since there are often unpleasant odors associated with decomposition, it’s necessary to put the decomposing materials in a clear plastic container or plastic bag.

Goal: Children compare the differences in decomposition of apples when one apple is sealed in a plastic container and the other is exposed to air and other decomposers.

What’s needed: Two or more apples, a plastic zip lock bag, hand lenses, measuring tools

1. Place one apple in the plastic bag and the other next to it on a plate. Put the experiment in a place where it can be easily seen.

2. Periodically have children record the changes they observe in the fruits. What’s the same? What’s different?

3. Keep a chart calendar of any changes that occur over time. Take photos if possible.

4. Observe and discuss changes in color, shape and smell.

5. Measure changes in size, weight and temperature. Discuss what might be the causes for these changes.

Note: Keep the plastic bag closed and encourage children to only observe the apple, not smell it.

Decomposition

Bacteria and fungi are very important in the decomposition or decay of plants. Decomposing organisms change appearance over time due to the action of these life forms.

Many children have seen food spoiling. If this decomposition process is allowed to continue where it can be easily observed, they will have an opportunity to observe closely an important part of the life cycle.

To begin and continue programs about decomposition, read and discuss any book about how nature depends upon decomposition and how future generations of living things use the decomposed remains of the past generations.
When decomposition activities are conducted outside, the unpleasant odors produced should not be a problem.

1. Place a large fruit such as a pumpkin or zucchini outside the library.

2. Cover it with heavy screening material with holes large enough to allow decomposers such as insects and worms to reach the material but not larger animals that want to consume the material.

3. Periodically have children record the changes they observe in a large fruit such as a pumpkin or zucchini. Observe and discuss changes in color, shape and smell.

4. Keep a chart calendar of any changes that occur over time.

5. Measure changes in size, weight and temperature. Discuss what might be the causes for these changes.

6. Discuss the importance of food preservation and the various ways we use science principles in keeping foods from spoiling. Locate on a temperature scale the best and worst temperatures for food preservation. Encourage children to perform experiments at home to discover how temperature influences food that’s stored. Several containers holding the same food can be placed at different temperatures and compared.

7. Discuss why things decompose: what would it look like if all the leaves from trees just piled up on the ground?
Be Friends With a Tree

Goal: Children practice scientific inquiry by observing a tree over time and noticing changes.

What’s needed: Find a tree that you can regularly visit with children to observe a yearly cycle.

You will also need: paper, markers or crayons, clipboards, a camera, measuring tools and hand lenses.

1. Take children on a walk to visit “your” tree. Observation is the key activity in this investigation. Encourage children to use their senses to observe the tree.

   • Look carefully for signs of animal life in and around the tree. What else do you see?
   
   • Touch the bark and use a hand lens to observe the tree closely.
   
   • What smells can you detect and record around the tree?
   
   • Listen for sounds in and around the tree.

   Sit or stand and watch the tree quietly. Ask:

   Is there any wildlife visiting the tree?

2. If you can sit and draw near the tree, encourage children to make a drawing of the tree. If possible, photograph the tree.

3. Measure the size of the tree trunk. (You can also use non-standard measuring “tools” such as children’s hands.) Record your findings.

   Our Tree

   Include any of the following information on a chart:

   Your observations.

   Questions children have.

   Predictions about changes you’ll notice on your next visit.

   Your measurement of the tree.

   A leaf sample from each season.

   Information about what you see and find under the tree.

   Drawings and/or photographs.
4. Encourage children to talk about what they observe and ask:

**What can you see (or hear or touch or smell) that can be recorded about our tree?**

**How do you think that nest got there?**

**How do you think the leaves became brown?**

**What do you think the tree will look like next time we visit?**

5. When you return to the library make a record of your first visit to the tree (see box at left for one suggestion).

6. In one month visit the tree again. Repeat your investigation and record the data. Add new categories to your chart (such as “Changes we noticed”) as needed.

8. Display your chart and continue the investigation for a year or as many times as possible.

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From one librarian:

We don’t have any trees nearby but I really wanted to try this activity with the children in my regular story hour (now named Explorer Hour!). So we chose a giant forsythia bush on the library property. We began our investigation in the spring, when the bush was still leafless, but it didn’t take long for children to notice changes as the bush began to flower. We even cut a very few branches with buds and “forced” them to bloom indoors. One very determined child used her hand lens to examine each flower closely so she could draw it as accurately as possible. Her mother has noticed how carefully her daughter now examines things to see all their details. She even corrected her mother one day and said, “I’m not looking, I’m OBSERVING, Mom!”
Change Over Time: Weather

We live on a planet that is surrounded by a thin layer of gases called atmosphere.

Weather is the set of conditions occurring at any single moment and location within the atmosphere. It is measured in terms of such things as wind, temperature, humidity, atmospheric pressure, cloudiness, and precipitation.

In most places, weather can change from hour-to-hour, day-to-day, and season-to-season.

Children learn about weather when they:

• Make a weather chart to collect their weather observations and measurements.
• Use a rain gauge to measure rainfall.
• Set up an outdoor thermometer and record temperatures on a chart.
• Discuss local weather: are there hurricanes or tornadoes where they live? Is it foggy in the morning and sunny in the afternoon? Does it snow?
• Look for patterns and make comparisons and predictions as they collect weather data.

Math and Science Skills and Concepts

When children explore weather, they:

• Use tools to gather weather information.
• Collect, discuss and record weather data.
• Use observations and data to make predictions.
• Observe and discuss seasonal and weather patterns.
• Use their senses to explore the weather and seasons.
• Make comparisons and recognize what we do differently when the weather and seasons change.

Website Resources

www.weatherwizkids.com
www.noaa.gov
www.nasa.gov
Books About Weather

What Will the Weather Be? by Lynda DeWitt

Weather Words by Gail Gibbons

Weather Forecasting by Gail Gibbons

Come On, Rain by Karen Hesse

The Wind Blew by Pat Hutchins

The Snowy Day by Ezra Jack Keats

Cloud Dance by Thomas Locker

Hailstones and Halibut Bones by Mary O’Neill

Clouds by Gail Saunders-Smith
Weather: A Typical Program


Activity: A picture representing “One Rainy Day.”

Begin by talking about the weather. Ask:

What do you do on rainy days?

What words describe how the rain feels? Smells? Sounds?

Read Who Likes Rain? Go back and look at and talk about each picture. For example, when you re-read the first page: “Pit-pit pat on the windowpane,” ask:

What other words could we use to describe the rain?

Repeat this with all or pre-chosen pictures from the book.

Fingerplay: “Eensy Weensy Spider”

Read In the Rain With Baby Duck.

Talk together about all the different things children and families might do outside in the rain.

Allow children time to draw, paint or make a collage about “One Rainy Day” to display or take home.

Repeat this storytime for other weather conditions such as snowy days or very hot days, using books such as This Place in the Snow by Rebecca Bond or Heat Wave by Eileen Spinelli.

Vocabulary

Climate: The average of weather over time and space.

Atmosphere: The mixture of gases that surround a celestial body such as the earth.

Season: One of the major divisions of the year generally based on yearly periodic changes in weather.
Thermometers and Temperature

Goal: Children explore thermometers and begin to understand how to measure temperature.

What’s needed: Thermometers, Styrofoam cups and a supply of warm and cold water.

1. Talk with children about how we know if it’s hot or cold outside. Ask:

What clues or observations do we use? How can we measure the warmth and cold (temperature) of air more precisely?

2. Distribute thermometers to children. Talk about where the red line ends. Ask:

Can anyone read the numbers (temperature) on the thermometer?

3. Have children place their fingers or hands on the red bulb at the bottom of the thermometer.

4. What do children observe? Ask:

What happens to the red line? Why do you think the red line got longer?

5. Use a large demonstration thermometer to show how the red line can move up and down, indicating temperature change.

6. Ask children to make predictions:

What will happen to the thermometer if we put it in a cup of cold water? In a cup of warm water?

7. Have children place thermometers in the cold water and observe the change. Talk about what they notice and then repeat with warm water. Ask:

Can anyone read the temperature?

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From one librarian:

We have snow in the winter where we live, but I wanted to do an experiment during the warmer months that involved snow or ice melting. It might cool us off a little!

So on the hottest day of the year (at least it felt like it!) I read *The Snowy Day* to my group and we “shivered” with cold and talked about winter and what we wear when it’s cold outside. We talked about the snowball Peter puts in his pocket and what happens to snowballs when they get warm.

Then I put some ice cubes on plates and talked about our experiment. How quickly would the ice cubes melt inside our library, even with air conditioning? Would they melt more quickly if we put some in a sunny window? What would happen if we put them in a dark closet? We set up several paper plates with ice cubes in different locations and made a chart with all the components. We decided to check the cubes in 30 minutes, record our data, and then check again in another 30 minutes. I displayed our chart after we completed our experiment and I overheard one little girl telling her mother the next day that she had done an important experiment, which gave me the opportunity to talk with the mother about what a scientist her little girl was!
Making a Weather Chart

Goal: Children record weather observations and measurements, noticing patterns and making predictions.

What’s needed: A calendar with large squares, weather stickers or rubber stamps, a thermometer and a rain gauge.

1. Set up an outdoor thermometer to record temperatures.

2. Use a rain gauge to measure rainfall.

3. Talk about words used to describe weather: hot, cold, sunny, rainy, humid, cloudy, stormy, thundering, snowing, foggy, windy.

4. Set aside time at each program for “Our Weather” moments in which to record the temperature, rainfall, and observations about the current weather. On days when you don’t have a program, have a child or adult post that day’s data on the chart.

5. Make a monthly weather chart to collect observations and measurements.

Use weather data for counting and comparing questions such as: How many sunny days did we have this week? How many inches of rain fell in that last storm?

Discuss and list interesting observations that can be collected about your local weather.

Are there hurricanes or tornadoes where you live?

Is it foggy in the morning and sunny in the afternoon?

After you begin to collect information there will be many opportunities to look for patterns, make comparisons and predictions.
6. In each date square ask children to record: observations, temperature, and/or rainfall. Talk about how the weather is the same or different from yesterday or from last week.

7. Set aside time each month to look at the chart, make comparisons to past months and ask:

   **What do you notice about the temperature?**
   **The rainfall?**

   **Which month(s) had the most rainy days? The most sunny days?**

   **The coldest temperatures? The warmest temperatures?**

8. Provide a take-home sheet for families to continue recording the weather.

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**Discovery Center**

*What’s the Weather Today?*

Post a blank calendar page with spaces to post weather data. Display data collection tools such as thermometers, weather stamps, weather stickers and markers.

Encourage families to collect and post weather data on your weather chart each time they visit the library.

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From one librarian:

We have a rainy season here so I wanted to have children explore rain over a long period of time. First I read lots of books about rain and rainy days. I asked questions such as:

*How does it feel and smell before it rains?*
*After it rains?*
*What kinds of things do we do differently when it rains?*

I then made a Sunny Day/Rainy Day chart with two columns and we listed what we did on sunny days and then what we did on rainy days.

The next time I read more “rainy day” books and then asked how we might measure rain. We then built our own rain gauge—I know that you can buy a rain gauge but I wanted children to understand what the component parts of a rain gauge are.

We started with a clear plastic container. We used unit blocks and taped those to the side of the container. I explained that the blocks would help us measure the rain. The younger children didn’t at first understand about collecting rain for measuring so I demonstrated with a watering can and sprinkled the container to show how we would collect and measure the rain. Some of the questions I asked:

Have you seen water collected in a container outside?

What might happen if we put our rain gauge under a tree? By the corner of the library?

I think the most important thing we learned is how much it needs to rain in order to collect a measureable amount of rain.
Cloud Exploration

Goal: Children observe clouds and represent them in drawings.

What’s needed: Blue or black paper, paints, sponges and brushes. Pictures of clouds on a cloud chart, in stories or non-fiction books and for small groups or older children, pictures on websites.

1. Begin by discussing clouds with your group. Ask:

What do you know about clouds? What have you observed?

What are clouds made from? Do clouds move?

What can fall to earth from them?

What else do you notice about clouds?

2. Using books or photos introduce the idea that clouds create different patterns that have names.

3. Observe and talk about cloud patterns in the sky and/or in books. Ask children what words they would use to describe the clouds and make a list.

4. After observing some cloud shapes and colors, make cloud prints or paintings to record the type of clouds children see. Use sponge paints or different tools to create various patterns. Display children’s drawings near a cloud chart, books about clouds, or photographs of clouds.

Cirrus clouds are white, thin and very high.

Stratus clouds are wide, low and gray.

Cumulus clouds are puffy, low and shape changing.

Nimbo-stratus are dark gray and accompanied by precipitation.
Wind Exploration

Goal: Children explore wind.

What’s needed: Sticks or dowels, pieces of nylon material cut in long rectangles or triangles, glue or tape.

1. Talk with children about the wind. Ask:

How do we know the wind is blowing?

(Some examples are a waving flag, bad hairdos, flapping laundry, shaking leaves on a tree.)

2. Make a list of words used when describing the wind.

3. Make a wind flag and observe the effect and any patterns of air in motion.

4. Take children outside to discover in which directions the wind is blowing and discuss how its strength changes from place to place and over time. Ask:

Can you find a place that is windy and a place that is not windy?

From one librarian:

One day I was at our recycling center and noticed an old TV set being thrown away. We’d been exploring weather at story hour over the past few weeks so I decided to introduce a TV weather station idea the next time. I read lots of books about the weather and then asked children to come forward in teams to give the weather report on the “TV.” Parent volunteers and I made props (weather symbols, see above) so that children would have visual clues to prompt their “reports.” This routine was repeated at story hour two or three times. We then moved the “TV” downstairs into the Children’s Room and made a Discovery Center with the props and lots of weather books. We added suit jackets as additional props for the “weather reporters.” Children couldn’t wait to visit the Discovery Center to give their weather reports whenever they visited the library.

Next time we’re making weather maps to include in our “weather reports.”

We’re fortunate to live in a place with lots of “weather,” but we also included ideas such as “In Oklahoma, we’re seeing lots of tornadoes today” so that we discuss the weather in other places.
Shapes and Spaces: Geometry for Young Children

As children move around and explore their world they begin to recognize the differences in the form and location of objects. In this way they are learning basic elements in geometry.

Geometry is the area of mathematics that involves shape, size, position, direction and movement. The National Council of Teachers of Mathematics says, “As [children] become familiar with shape, structure, location and transformations and as they develop spatial reasoning, they lay the foundation for understanding not only their spatial world but also other topics in mathematics and in art, science and social studies.”

Young children begin gaining knowledge of geometry by recognizing and naming shapes and forms of familiar objects such as windows, doors, tables, light fixtures, signs, wheels and buildings. They become aware of the position of objects and describe their locations with positional words and phrases. They then can be more precise with their descriptions and can better follow directions. Early geometry experiences help children describe, measure, build and classify the world around them.

Eventually children develop spatial skills that allow them to form mental pictures of objects’ shapes, sizes and relationships. Children can then learn to use diagrams, drawings, maps and pictures to understand and represent objects in their world.

Exploring Shapes, Learning About Spaces and Places and Building and Construction—all involve geometry. Children learn geometry best through hands-on experiences. Anything they can touch and manipulate—such as shapes and blocks—enhances their understanding.
Exploring Shapes

Understanding geometric shapes is more complex than just knowing the names of common shapes such as circle, square and triangle. When children explore shapes, they:

• **Find the right shape for the right space** in a puzzle.

• **Create designs**: Put shapes together to make new forms.

• **Recognize shapes and spaces**: Locate circles in the supermarket or observe that this room is larger than that one.

• **Create different shapes and sizes** by folding a single sheet of paper or using string or other objects.

• **Describe shapes**: Identify a shape’s attributes such as number of sides, corners or faces.

• **Compare and match** shapes of different sizes.

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Math and Science Skills and Concepts

When children explore shapes and use spatial thinking, they:

• Learn to name, build, draw, compare and sort shapes.

• Describe the attributes and parts of shapes.

• Predict and test the ways shapes can be combined or taken apart in order to make other shapes and patterns.

• Compare changes in shape that take place when objects are slid, flipped or turned.

• Discover symmetry when arranging shapes into designs.

• Build spatial memory and visualization by forming mental images of geometric shapes.

• Recognize and represent shapes from different perspectives.

• Locate shapes in the environment and describe their location by using positional words.
Books About Shapes

*Grandfather Tang’s Story* by Ann Tompert

*I Spy Shapes in Art* by Lucy Micklethwait

*Mouse Shapes* by Ellen Stoll Walsh

*Round is a Mooncake: A Book of Shapes* by Roseanne Thong

*Shapes All Around* by DK Publishing

*Shape Capers* by Cathryn Falwell

*The Shape of Things* by Dayle Ann Dodds

*The Wing on a Flea* by Ed Emberley
Shapes: A Typical Program

Books: *The Magic Hat* by Mem Fox  
*Every Friday* by Dan Yaccarino

Activity: Any Shape activity from the following pages.

Opening fingerplay: Grandma’s Glasses

**Here are Grandma’s glasses.**  
And here is Grandma’s hat.  
And here’s the way she folds her hands  
And puts them in her lap.

Ask children:

**What shape are we making for the glasses?**  
**What shape can we make for the hat?**

Read *The Magic Hat*.  
After reading the book, go back and look at the pictures together. What shapes can children find and name?

Poem/Song:

**Draw a circle in the air.**  
**Draw a small one, now compare.**  
**Make one big, make one small;**  
**Now draw a short one, now make one tall.**

Read *Every Friday*.  
After reading the book, go back and look at the pictures together. What shapes can children find and name?

Engage children in any one of the Shape activities from the following pages.

At another program read *The Magic Hat* again and pair it with *Zoe’s Hats* (Holm) and *The Hat Seller and the Monkeys* (see Bibliography that begins on page 143). Make hats and decorate with shapes (page 123).

Almost any picture book offers opportunities to talk about and explore shapes. Here are a few suggestions:

*The Very Hungry Caterpillar* (circles)  
*Knuffle Bunny* (different shapes on every page)  
*Every Friday* (different shapes on every page)  
*The Great Fuzz Frenzy* (circles)  
*Hippos Go Berserk!* (squares and rectangles)
Shapes All Around

Goal: Children look for, identify and name shapes in the environment.

What’s needed: Foam shapes and paper.

1. Select one shape (such as a rectangle) and engage the group in a discussion about this shape. Hold up the shape and ask:

   What do you notice about this shape?
   What does it look like?
   How many sides does it have?
   What’s it called?

   Listen for words that describe its shape, size and other attributes. You might also ask:

   Can you draw this shape in the air?
   Can you make the shape larger in the air?
   Can you make the shape with your body?

2. Look around the room and search for other rectangles. You’ll be surprised at how many you and your group will see—books, ceiling tiles, windows, etc.

3. Talk together about what’s the same or different about the rectangles you see.

4. Have children show their data by drawing the shape you identified, along with one or more objects they found.

5. At subsequent programs, read and talk about other geometric shapes.

From one librarian:

I did a Shape Search with older children. I gave each child a sheet of paper and asked them to make a tally chart—a list of the shapes they’d be searching for: rectangle, triangle, circle and square. Each child collected data by putting a mark next to the shape name as they found it.

We then put all the information on a “master” tally chart for display (see below). We never knew there were so many rectangles in the library!
Combining Shapes

Goal: Children put together and take apart shapes in order to identify congruent shapes. (In geometry, *congruent* means identical in form, coinciding exactly when superimposed.)

What’s needed: Foam shapes, paper and shape stickers.

1. Begin by saying:

   *I was building a design with the foam shapes and I ran out of squares. Are there any other shapes I could use to make a square? Does anyone have an idea?*

2. Look at the foam shapes together and let children discover that two equal rectangles are the same as one square. You can use the term congruent (or the same as).

3. What other shapes are congruent? Let children experiment with all the shapes. Can you make a shape congruent to the blue rhombus? (Two green triangles.) Or the trapezoid? (Three green triangles or ____?)

4. The most interesting shape to work with is the hexagon because there are several different ways to make a congruent shape. Ask:

   **How many can you find?**

Encourage young children to use a yellow hexagon as a base and put other shapes on top of it like filling in a puzzle.

5. Have children use paper and shape stickers to record the different ways they found to make shapes.

As children learn to recognize shapes, they can also learn to use words to describe the shape. This enriches their understanding of the shape itself and they learn new vocabulary. So, for example, a square is a figure with four equal sides and four right angles.

Children won’t need to memorize all these words to understand *squareness*, but it’s important to introduce and use terms like *angle* and *equal*, even with young children. Once you’ve introduced the words, make sure to use them whenever it’s appropriate.
Sorting and Matching Shapes

Goal: Children observe, identify and describe characteristics of shapes.

What’s needed: A collection of foam shapes concealed in a bag or box.

1. Place enough shapes in a bag or box so each child can choose one. Without looking, have children take turns choosing one shape from the bag.

2. After they’ve looked at their shapes, ask children to sort themselves by the attributes of their shapes. Ask:

   Can you find someone who has a shape like yours? How do you know it is the same shape?

3. When the shapes are sorted have each group name or describe their shape. For example:

   We have orange squares. Our shape has four sides.

4. Challenge each group to think of something their shapes could be such as four circles are like the tires on a car or five squares look like the sidewalk.

5. You can do this shape-sorting activity more than once so children have the opportunity to compare and sort more than one shape.

6. Place one of each shape back in the bag, then have each child put his/her hand in to select, touch a shape and try to identify it without looking while you ask:

   How can you tell which shape it is without looking?

Encourage children to use descriptive words such as number of sides, longer than and shorter than, straight or curved edges, etc.

From one librarian:

I like to do lots of shape activities with children—and they love to do them! This time I knew I wanted to sort, name and describe shapes with children. I also planned to draw a representation of the shape sorts.

I read Shape Capers and then went back through the book and asked children to find the shapes on each page. Children described the attributes of the various shapes and I encouraged them to use the appropriate geometric names.

After reading Orange Bear Apple Bear we again looked at the pictures and searched for shapes. This is a sophisticated picture book and I think that some of the younger children didn’t understand the concepts although they were able to identify the shapes.

I put out the foam shapes and we talked about how we might do a sort. We took turns choosing an attribute and sorted our choices inside sorting loops (shoelaces). After sorting and resorting the shapes, children made a drawing (graphic representation!) of one of the sorts. Even the youngest children had fun doing this.
Shape Pictures and Designs
Goal: Children sort, name and describe shapes as they create shape pictures.

What’s needed: Foam shapes for exploration and cut-out paper shapes or sticker shapes for pictures.

1. Encourage children to explore a variety of shapes and watch how they experiment with the shapes as they make designs and pictures. As they work alone or in small groups, ask:

   **Can you name this shape?**
   **What’s the same and what’s different about this shape from that one?**
   **Can you make one shape by combining one or more shapes?**

2. Challenge children to make their own pictures using either the sticker shapes or gluing cut-out paper shapes on pieces of paper. Ask:

   **How many different shapes did you use in your picture?**
   **How many shapes are there altogether in your design?**

String Shapes
What’s needed: String, glue and/or tape. Optional: chenille sticks and toothpicks.

Using pieces of pre-cut string, children can make a variety of shapes. Tape or glue the shapes to a piece of oak tag or construction paper.

Children can identify the shapes as an adult helper labels each shape. Children may also use chenille sticks or toothpicks to make the shapes.

Shape Collage
What’s needed: Magazines and other sources of pictures. Also, paper, scissors and glue.

Have children find and cut out examples of one shape or examples of different shapes and make a collage of their choice.
**Just One Shape**

Goal: Children will compare changes in shapes that take place when they’re slid, flipped or turned.

What’s needed: Paper and crayons or markers.

1. Have children decide which shape they’d like to use.

2. Demonstrate how one shape, drawn in different sizes and forms can be used to make a one-shape picture: a town made out of triangles, a spaceship from rhombi (diamond shapes), a room from rectangles, etc.

3. Help children create their one-shape pictures. Talk together about the many ways just one shape can be made: small, big, elongated, etc.

**All the Shapes**

Challenge children to make a picture, using as many different shapes as possible.

**My Shape Book** *(for school-age children)*

Goal: Children find shapes from various sources and use them to illustrate a book.

What’s needed: Shapes to trace, book-making materials including paper, scissors, glue, crayons, markers, magazines and other sources of pictures.

1. Have children select one shape and illustrate the pages of a blank book with objects illustrating the shape. Pictures can be cut from magazines or drawn by each child.

2. The book itself may be made in a shape. For example, rectangle-shaped pieces of paper for rectangles, paper plates for circles, etc.

When you try this idea, make sure you use different sizes and forms of the same shape. If you make a triangle town, use little triangles, big triangles, tall and skinny triangles, short and wide triangles, lopsided triangles, and tipped-over triangles!
Nine-Patch Patterns

Goal: Children combine like shapes to fill a space and make patterns using two colors, and then three colors.

What’s needed: Each child should have a 6-inch square of paper and at least nine 2-inch squares of paper in two colors, plus glue sticks or tape.

1. Give children a 6-inch square of paper as a base and 2 colors of 2-inch squares. Let children experiment making a pattern with small squares (see right). This is also sometimes called a “checkerboard” pattern. Allow time for trial and error as a child works on a pattern. You might ask:

   **How did you start your pattern?**
   **What color will you use next?**

2. When a child is satisfied with a design, glue or tape the small squares to the base paper.

3. When individual patterns are completed, place them on a table. Ask:

   **What do you notice about the patterns you made? How are they the same or different?**

Arrange and rearrange the blocks into different designs. Take photos of the different patterns children have created.

Note: To build a larger pattern with two colors you will have to alternate the two patterns of squares.

4. After children have lots of practice making two-color patterns, add a third color and challenge them to make more complex patterns.
From one librarian:

I knew that one of the mothers at my school was a quilter, so I asked her to bring different quilts she’d made into the library to show the children. I told her that we had been reading books and doing hands-on activities involving geometric shapes and designs.

The children were amazed at all the patterns and colors she used! She showed us how she sometimes makes a pattern with cut-out paper shapes in order to make a design that she can change over and over again. I then gave each kid nine triangles (three each of red, blue and green). We made sample quilt patterns with triangles on the flannel board. The kids then glued their triangles onto a paper “blanket.” Some made squares by putting the triangles together, others lined up the triangles and one even attempted to make a pinwheel design.

Discovery Center
Quilt Patterns
For older children and adults

What’s needed: Graph paper, colored pencils or pens, rulers, copies of quilt patterns with triangles and squares.

Provide display examples of quilt patterns made mostly with triangles and squares.

To do: Draw a large square on the graph paper. The challenge is to copy one of the quilt patterns by dividing the larger square into smaller sections and filling in colors and shapes. Use a ruler to help draw straight lines.

*The Quilting Bee* by Gail Gibbons

*Sweet Clara and the Freedom Quilt* by Deborah Hopkinson

*Quilting Now and Then* by Karen Bates Willing and Julie Bates Dock
Triangle Block Puzzles
The challenge: Children make a square by moving, flipping and combining triangles.

What’s needed: Each child should have a 6” x 6” piece of paper as a base and 3” x 3” post-it notes in a different color than the base. Construction paper will also work. Fold a 3” x 3” square diagonally and cut on the fold to make triangles.

1. Show children how to fold a post-it to make a triangle. Allow time for children to make a few triangles.

2. As children begin to work, ask:

**Can you find a place to fit a triangle onto the big square piece of paper?**

**Can anyone find another place a triangle will fit on the square?**

Talk about and demonstrate some different ways the triangles can be placed on the 6” square. Ask:

**How many triangles do we estimate we will need to cover the square piece of paper?**

3. As children make and arrange triangles, have them move the triangles around, fitting them together on the square like a puzzle. Glue them together for children to take home.

Did everyone need the same number of triangles to cover the square?

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Discovery Center
Quilt Patterns

Half-triangles are one of the most common quilt units.

What’s needed: Many 2-inch squares of colored paper in various colors and designs and 6-inch squares of white paper, scissors, glue sticks and quilting books illustrating half-square patterns.

To do: Find a half-square block pattern you’d like to copy. Or, design your own triangle block. (See Figures 2, 3 and 4 at right.)

Fold paper squares into halves to make the triangles.

On a 6” square of white paper, arrange the triangles to make one block. Slide, flip and turn you triangles to change and create your pattern.

Glue the triangles to the white paper.

Make several of the same pattern to make a larger pattern block.
Triangle Block Patterns

Goal: Children flip and turn triangles in order to make a pattern.

What’s needed: Paper of different colors or post-it notes.

1. Using a 6” square paper base, have children experiment with two triangles of two different colors. What kinds of patterns can children create?

2. Have children try different 2-color designs before choosing one to glue onto their own square.

3. Gather all the completed squares on the floor or on a table. Ask:

   What’s the same or what’s different in these designs?

The triangles can be combined in many ways. Each design is made of 8 triangles and overall makes a square.

4. At future programs extend this activity by asking:

   How can we combine the squares into a quilt and make another larger pattern?

The results in size and pattern will depend on the number of designs made by children. If you have a large group, try making smaller quilts of 6 or 9 squares at each table.

Take photos of the completed quilts to display.
Exploring Tangrams

Goal: Children flip, slide and turn shapes to make pictures.

What’s needed: Sets of tangrams

1. Look at and talk about the characteristics of a set of tangrams. Each piece is called a tan. Count the tans and name the shapes. (There are 2 large triangles, 1 medium triangle, 2 small triangles, 1 square and 1 parallelogram.) Ask:

How could we sort the tans?

Children might sort the tans by shape or by size.

What kinds of different shapes or pictures can be made by combining the tangram pieces?

2. Allow children plenty of time to combine the shapes into different patterns, shapes or pictures.

What are Tangrams?

Tangrams are ancient Chinese puzzles that are still used today.

Tangram experiences help children identify shapes and understand basic geometric concepts and relationships.

A tangram begins with a square that’s cut into 7 standard pieces. Each piece is called a tan. In creating a picture, all 7 tans must be used. They must touch, but none may overlap.

Discovery Center

Tangram Shapes Challenge
for older children and adults

What’s needed: Sets of tangrams

Use all 7 tangram pieces to:

Build...a triangle
    a rectangle
    a trapezoid
    a parallelogram
Copying Tangram Pictures
What’s needed: Sets of tangrams, tangram pattern cards, *Grandfather Tang’s Story.*

1. Give each child a set of tangrams (7 pieces).

2. Children will want to use many different pattern cards as they match and copy the pictures.

Younger children can match the tangram pieces to the shapes on the pattern cards.

School-age children will be able to copy the pictures by just looking at the pattern.

3. Challenge older children to make the tangram pictures found in *Grandfather Tang’s Story.*

Discovery Center
Take the Tangram Challenge!

What’s needed: Sets of tangrams

This is a very challenging activity for all ages.

Make a square, using…
- one tangram piece
- two tangram pieces
- three tangram pieces
- four tangram pieces
- five tangram pieces
- all seven tangram pieces

Make Your Own Tangram Set

What’s needed: Sets of tangram pieces, colored cardboard, thin markers or pencils, scissors.

Ask children to trace and cut out the 7 tangram pieces to use in the library and take home.

Website Resources

There are many interactive websites with tangram resources. Use the keywords “tangram patterns” to find information, patterns and games. The following are a few we recommend from the many available:

http://tangrams.ca/inner/diver.htm

http://pbskids.org/sagwa/games/tangrams/index.html


http://it.geocities.com/tangmath/BillionPatterns.htm#top
Face to Face: Exploring Symmetry

Goal: Children observe and compare shapes for symmetry.

What’s needed: Paper and crayons.

1. Have children draw a simple face diagram with two eyes, two ears, a nose and a mouth.

Ask children to look at each other’s drawings. Ask:

**What is the same about our faces?**
**What is different about our faces?**

2. Talk with children about how the face is symmetrical from side to side (or vertically). That means if we draw a line from the forehead to the chin each side of the line is a mirror image of the other. Point out that there is an eye and an ear on each side as well as half of the mouth, nose and chin.

Ask:

**Is the face symmetrical from top to bottom? That is, if we draw a line from ear to ear is the face the same on both sides?**

**Symmetry:** an object or shape is symmetrical if one side has an exact reflection on the opposite side of a dividing line. The line of symmetry is the line that divides a shape in half so each side is a mirror image of the other.

By folding in half and cutting paper, you can demonstrate how some objects are symmetrical. With older children you can show symmetry using one or two mirrors with small objects.

**Website Resources**

[www.linkslearning.org/Kids/1_Math/2_Illustrated_Lessons/4_Line_Symmetry/index.html](http://www.linkslearning.org/Kids/1_Math/2_Illustrated_Lessons/4_Line_Symmetry/index.html)

Symmetry With Shapes

Goal: Children observe and compare foam shapes and make symmetrical designs.

What’s needed: Foam shapes, paper and crayons.

1. Take out the foam shapes and a piece of paper with a bold line drawn down the middle. Make a simple design on one side of the line. One edge of a shape should touch the middle line. Ask children to notice the number of shapes in the design and to name them.

3. Show the line of symmetry down the middle of the paper. Ask:

   How can we complete the design so that one side is symmetrical to the other?

Begin by collecting the same number and shapes of foam pieces used in the first half of the design. Remember that the line of symmetry is like a mirror and shows the reflection of the design on the other side. If you have a small mirror place it on the line of symmetry and ask children what they see. Place shapes into the design as seen in the mirror.

Building a symmetrical design can be a challenge for young children. At first they may continue the pattern of shapes instead of making the symmetrical design.

Another way to represent this:
A-B-C-A-B-C: a repeating pattern
A-B-C/C-B-A: a symmetrical pattern
Spaces and Places

Following a treasure map, going on a scavenger hunt, finding a book in the library and planning a trip all require spatial thinking.

When children explore spaces and places, they:

- **Give directions**: Tell how to find something or explain how to get somewhere.

- **Make maps**: Notice and describe the relative position of objects and distances.

- **Notice and talk about the relative position** of one object to another. They might say:
  
  The book is on top of the shelf, under the window.
  
  I think this puzzle piece will fit in that space.
  
  These two rectangles make one square.

Spatial thinking is used in all areas of geometry. When we estimate, measure and make representations, graphs and drawings, we are using spatial thinking.

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**Math and Science Skills and Concepts**

Children are using spatial thinking as they:

- Specify locations and describe spatial relationships.

- Describe where objects are located: *near to, under, over, behind, above, below, inside*, etc.

- Describe direction and distance as they talk about and represent objects and places: *What objects? Where? How far? Which way?*

- Collect and use data by thinking about and drawing what they observe.

- Communicate information and ideas by using drawings to express what they’ve experienced.

- Navigate an obstacle course and use words such as *above, under, over, around, behind, between and through* to describe where they are going.

- Communicate directions for getting from one place to another, including which way and how far to go.
Books About Spaces and Places

As the Crow Flies by Gail Hartman

Mapping Penny’s World by Loreen Leedy

Me on the Map by Joan Sweeney

A children’s atlas such as Beginner’s World Atlas (National Geographic, 2005)

Any book about taking a walk or going on a trip offers opportunities to talk about maps, mapping, and giving or following directions. Here are a few suggestions:

Taxi! Taxi! by Cari Best

The Big Trip by Valerie Gorbachev

Rosie’s Walk by Pat Hutchins

Down the Road by Alice Schertle

Jonathan and His Mommy by Irene Smalls

On the Road by Susan Steggall

Where are you going Manyoni? by Catherine Stock

Mei Mei Loves the Morning by Margaret Tsubakiyama

Are We There Yet, Daddy? by Virginia Walters
Spaces and Places: A Typical Program

Begin by talking about directions. Explain that directions or instructions tell us where to go, how to do something or how to find something. Ask:

Have you ever told someone how to find something?

What words did you use?

Two books about finding a lost object:
Corduroy by Don Freeman
Knuffle Bunny by Mo Willems

Opening fingerplay: Anything that has directions in it, such as “Head and Shoulders, Knees and Toes.”

Repeat the fingerplay several times.

Read: Corduroy

Talk about losing things:

Have you ever lost something?

How did you go about finding it?

What was your plan?

Fingerplay/Song: “Put Your Finger in the Air”

Read: I Lost My Bear

Go back and look at the pictures together. Talk about the words the girl uses as she tries to find her bear: under the bed, in the bookcase, on the couch, behind the curtain, etc.

Activity: Tell Me How to Find It (page 122).

It is easy to use positional and directional words with children during any programs: acting out stories, talking about art projects, designing and using treasure maps or in scavenger hunts, in conversations about trips and transportation.

One way to introduce and talk about maps (spatial thinking) is to use a concept book such as Me on the Map. Like many concept books, you will want to look at and read just one or two spreads at different programs and make connections to the other books in your program and your planned activity.
Act Out a Story

Acting out stories, folktales, original stories or poems, provides children with opportunities to hear and practice using positional and directional words and to follow directions.

Traditional folktales such as *The Three Billy Goats Gruff*, *Jack and the Beanstalk* and *Little Red Riding Hood* (as well as modern stories such as *Rosie’s Walk*) provide opportunities for using directional and positional words.

When children act out words such as *over, under, near* and *far* they are learning about location, space and shape. They learn about numbers when they take *two small steps* and *one giant step*. Older children will be able to understand ideas such as *turn left* and *turn right*.

Website Resources

www.nationalgeographic.com/geospy

www.nationalgeographic.com/kids/games

www.iknowthat.com

www.sheppardsoftware.com/Asian_Geography.htm

www.funbrain.com/where/
Tell Me How to Find It

Goal: Children follow directions and interpret positional words and relationships.

What’s needed: An object or “treasure” to hide.

1. Talk together about why we need directions in order to find something.

Have you ever given anyone directions to get somewhere?

What happens if we don’t have directions?

2. Ask children to hide their eyes while you hide a small object. Choose one child to find the hidden object. Have the child ask, “Where should I go?”

3. As you give directions use as many positional, directional and number words as you can: under, over, behind, next to, inside, go five steps back, etc.

4. Hide the object in different locations and give all the children an opportunity to follow directions.

5. Extend this exploration by having each child take a turn hiding an object and giving directions to another child.

6. As children become more proficient, use a timer to see how long it takes to find the hidden object.

Locational and Directional Words

- on, off
- on top of/under
- top/bottom
- in front of/behind
- next to/between
- up/down
- forward/backward/sideways
- around/through
- near/far
- close to/far from

From one librarian:

When I was doing my summer reading program I went through the manual and found a Treasure Hunt activity. I decided to add some positional words (and math and science skills) by making a script for my group to follow. I included directions such as: go under, next to, over, far from, go left and go right.

Not only did the children have fun, I felt I had given them a “math” experience. Even better—one parent told me it was the best program she’d ever been to!
Obstacle Course: Over and Under, Around and Behind

Goal: Children build and navigate an obstacle course.

What’s needed: Objects and materials to use for an obstacle course. To make a tunnel, use a blanket or large towel or set up two cardboard boxes on their ends with another piece of cardboard serving as a roof.

1. Help children build a simple obstacle course. Make sure it’s designed so that you can use words such as: over, under, around, behind, between, above, etc.

2. Begin by giving directions to one or two children. Step over the block, crawl under the chair, take three small steps, go around the table...

3. As children become familiar with the obstacle course, have them give directions to each other. Remind them to be specific and use locational words.

4. Estimate how long it will take to complete the obstacle course. Use a timer to check your estimations.

Discovery Center
Can you follow directions?

Making Paper Hats

What’s needed: One sheet of newspaper that consists of two pages side by side (a spread). Optional: Scotch tape.

Make a Party Hat
1. Fold the sheet of newspaper in half vertically (lengthwise).
2. Fold both corners on folded side to the middle, making sure both corners meet in the middle.
3. Fold one bottom flap up.
4. Flip the hat over and fold the other bottom flap up.
5. Add a bit of Scotch tape, if you like.

Make a Beret Hat
1. Fold the paper in half horizontally.
2. Fold down both corners of the folded edge toward the middle, leaving a small bottom edge on the bottom.
3. Fold up the edges on each side of the bottom.
4. Fold each end of the bottom edge.
5. Secure with Scotch tape.

Try variations in folding to create a variety of hat shapes. What happens if you don’t follow the directions?
Where am I?
Looking at Maps

Goal: Children explore a variety of maps.

What’s needed: The laminated maps from your What’s the BIG Idea?™ Librarian Kit.

1. Look at the map of the United States. Ask children what they notice about the map. For example, the oceans and lakes are blue.

2. Help children find their home state. Ask:

   **What do you notice about our state?**
   Is it larger than other states? Smaller?
   Is it near the ocean? Far from the ocean?

3. Can anyone find another state, perhaps where a relative lives or a state they’ve lived in or visited?

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**Discovery Center**
Find the States

What’s needed: Dry-erase blank map of the United States, dry-erase markers and timer.

Challenge families and older children to fill in as many states as they can on a blank map of the United States in one minute. Make a data chart of your findings.

---

How Many States Can We Find in One Minute?

<table>
<thead>
<tr>
<th>Name</th>
<th>Number of States</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sally</td>
<td>11</td>
</tr>
<tr>
<td>Rose</td>
<td>16</td>
</tr>
<tr>
<td>Robert</td>
<td>6</td>
</tr>
</tbody>
</table>
Tell Me How to Find It: Follow the Map

Goal: Children follow a treasure map(s) you’ve drawn.

What’s needed: Copies of your treasure map(s).

Talk about your treasure map(s). Challenge children to follow the map and find the treasure(s) you’ve hidden.

Older children can form teams and make their own treasure maps.

From one librarian:

Since my group is mostly four-year-olds, I made a simple map of our children’s room. I began the program by talking about how children got to the library. After many children responded with “In my car” and “We walked” I explained that I meant what route did you take. Many answers were quite explicit:

We went down the hill, past the school, turned at the corner and parked right in front of the library.

Next I read Oliver Finds His Way. I gave each child a copy of the treasure map I’d made, we talked about the map and the children went on their treasure hunt. I was surprised that each child followed the map (I had thought that most would run directly to the treasure). After finding our treasure we “went on a Bear Hunt” (lots of directional words!!).

I ended the program with a reading of Rosie’s Walk followed by the DVD version (my favorite). I was surprised how many of the children insisted on staying at the library afterwards to follow and re-follow their maps.
**This Room:**
**Making a Map With Blocks**

Goal: Children observe a space and represent it with blocks.

What’s needed: Unit blocks and a piece of paper on which to build your map. The paper should be approximately the same shape as your room.

1. Read a book(s) that takes place in a library. Some examples: *Library Mouse* by Daniel Kirk and *Library Lion* by Michelle Knudson.

2. Talk together about the room in the library where you and the children are sitting. Ask children what they see and where objects are located:

   **Where is the desk?**

   **How many windows are there in this room? How many chairs?**

3. Using the blocks, make a map of the room you're in.

4. Challenge older children to make a drawing of this map.
Taking a Walk:  
Where did we go?  
What did we see?

Goal: Children take a walk inside or outside, then draw a map of where they went.

What’s needed: Large sheet of butcher paper or oak tag, colored construction paper, crayons or markers, blocks or other building materials (optional), and a collection of maps.

1. Read any book about going on a walk or taking a short trip. Talk together about the route the travelers followed. Emphasize the directional and positional words in the text as you do a picture walk through the book.

2. Show children a simple map (for example, the “This is my street” or “This is my house” picture in *Me on the Map*). Talk about what maps tell us.

3. Go for a short walk in or near your building. Stop often and encourage children to look at and talk about what they see. Make a list of their observations. Encourage children to be observant and report details. If they miss something interesting, prompt them to look more closely.

4. Walk and talk together about what you see, using locational words. When you return, use drawings, cutouts or three-dimensional objects to represent what you saw on the route you took.

5. Remind children that a map is not just a picture of the places you went but it’s also a way to retrace your steps and see and discuss the route you traveled.

6. Use the map to retrace your route.

---

On our walk we first saw a white house with a red door. A barking dog was next to the house. Two trees and a mailbox were across the street from the fire station. Next to the fire station we saw a red stop sign in the shape of a hexagon and on the other side of the fire station we saw two swingsets.
How Did We Travel Today?

Goal: Children make a graphic representation of their means of transportation to the library.

What’s needed: Chart paper, markers and measuring units such as post-it notes.

1. Talk with children about the ways each traveled to the library that day. Make a chart (see below) of the various means of travel.

2. Give each child a small post-it note or square of paper with the number 1 on it. Ask each child:

   **How did you get to the library today?**

As each child answers, have him/her place the post-it above that mode of travel on the chart.

After your chart is completed, ask: **What do you notice about the chart?**

Encourage children to use words such as *more than, less than* and *the same as*.

4. After your group has discussed the chart, have children count each column of post-its to draw a final conclusion.
Goal: Children explore ways to map many different locations.

What’s needed: Paper, crayons, markers and other map-making supplies such as blocks or found objects.

Some mapmaking ideas to explore:
• A walk around the library or neighborhood
• The Children’s Room or other rooms in the library
• A playground or play area
• A room in a child’s house
• Imaginary places
• A favorite tale or story
• The entire neighborhood
• Streets, cities and towns

A group of preschool children can make one map together. Older children may want to make their own individual maps, or work in teams.

From one librarian:

I have a group of older children in my afterschool program most days and I wanted to do a project with them that would last for several days. I also wanted it to be a “meaningful” project, learning-wise, and this one was perfect because it incorporated spatial thinking and skills like representing and communicating using positional words. I asked them to make a map of our entire village!

We’re in a small town, so that made the project do-able, but it took many days for the kids to make a plan and team up to do sections of the map. At the end they put all their data together and made a map mural for the library. It’s been a hit! They were so proud of themselves! Now they spend time looking at maps in the library and talking about “their” map!
Building and Construction

Much of our environment is built—not just buildings, but roads, bridges, communication towers, etc. These structures are the result of science and mathematics being applied in the disciplines of design and engineering.

Structures are designed and built to serve utilitarian functions as well as to please the eye.

First and foremost, a built structure must withstand the forces that act upon it such as gravity, friction and wind force.

Children learn in a very practical way how these forces act as they construct with materials and fasteners. When children build, they learn about:

- **The relationships between the form** (what they want the building to look like) and the basic function of it not coming undone by forces, especially gravity.

- **The importance of balance, strength, materials and good design** so their built structures do not fall down.

---

Math and Science Skills and Concepts

As children build, they:

- Learn about a variety of materials.

- Explore and compare how different building materials have different properties because of what they are made of and the shape and size of the units.

- Decide what function a building will have and design and build a structure to meet that need.

- Learn how certain design elements make buildings stronger and more stable because of the way they channel these forces.

- Communicate information about their structures.

- Work with symmetry and design as they explore and copy patterns in the built environment.

- Use building structures for opportunities to count, measure and compare.

- Observe how the force of gravity and the forces of compression, tension and torque act on their structure.
Books About Building and Construction

Let's Try It Out With Towers and Bridges by Seymour Simon

Albert's Alphabet by Leslie Tryon

The Three Little Javelinas by Susan Lowell

The Three Little Pigs by Paul Galdone

The House in the Meadow by Shutta Crum

Many books offer opportunities to talk about building and construction. Here are a few suggestions:

Changes, Changes by Pat Hutchins

Roxaboxen by Alice McLerran

Anno’s Counting Book by Mitsumasa Anno

How a House is Built by Gail Gibbons

A House is a House for Me by Mary Ann Hoberman
Building and Construction: From one librarian:

For Story Times for 3-5 year olds, three sessions focused on building with blocks. For the first session, we read books and built towers. In the second session we built an enclosure for an animal after we read books. And for the third session, each child made a house for a pig. Their objective was to make it strong enough so that the wolf puppet couldn’t blow it down. For each session, we used the wooden blocks only.

For Discovery Hour (ages 5-14), we had a “Block Party.” After reading Twenty-One Elephants and talking about bridges and towers, we built our own. We used a variety of blocks as well as paper. The kids really enjoyed making towers as tall as possible, and measured up to the challenges of “Can you make it taller?”, “What if you do this?”, etc. It was difficult to get them to understand that the program was over. They wanted to stay all night!

I just loved watching the kids trying to make their towers as tall as they could (to the point where they stood on chairs and stools). Even the parents got involved! I really stressed the “Oh, well!” factor as the proper reaction should a building fall down, and was really happy at how well it worked.

4th Grade Class: This was a special treat for me. The teacher saw the ad for my Block Party and asked if I would do a special program for her class because they were studying bridges. They came to the library one morning, and we read the book The Great Bridge Building Contest and talked about Let’s Try it Out With Towers and Bridges. We talked about tension, compression, arches, trusses, etc. and then went about building bridges using all of the What’s the BIG Idea?” Family Building Kits as well as paper and scissors. It took a long time for them (the teacher as well) to understand that the bridge had to stand alone—it couldn’t be supported entirely by the table or floor. (It had to actually go over something and support weight.) The fact that they didn’t grasp that concept initially really surprised me. But in the end, they “got it” and put together some fabulous structures.
Exploring Blocks

Goal: Children describe, compare and sort a set of blocks based on characteristics.

What’s needed: Sets of solid wooden building blocks and a set of foam shapes (for reference).

1. Display a set of the wooden building blocks. Ask children to notice and describe the shapes they see in the blocks.

**What shapes do you see? Are some of the shapes the same as the foam shapes?**

What is interesting to notice and discuss is that in many solids the sides are different shapes. Look at the triangle prism: the ends are triangles and the sides are squares. Ask:

**How many sides (or faces) do the solid shapes have? Is the number always the same?**

2. Discuss some of the different characteristics you could use to sort the blocks such as shape, flat sides or curved sides, etc. Have children sort the blocks in various ways. Ask some counting and comparing questions:

**How many blocks are in the shape of triangles? How many blocks are squares?**

**Are some blocks taller than others? How can we compare them?**

**Can you order the blocks from tallest to shortest?**

3. Now see what happens when children combine block shapes. Ask:

**If you put two square blocks together, what shape do you make? What other combinations can you make? What would you like to build with the blocks?**

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Research shows that children’s block play is related to later math competence.

Block play provides a natural context for exploring the natural world. Like scientists, children can experiment with structures and observe outcomes of their building efforts. Through this process they learn about mass, weight, proportionality and balance and can use their new concepts to plan and predict outcomes. (Harriet Shaklee, University of Idaho Parents as Teachers, August 2006.)
Building With Blocks

Goal: Children combine blocks into a variety of shapes and structures.

What’s needed: Sets of solid wooden building blocks and drawing materials.

1. Put out all the blocks and let children build.

2. Ask children to describe what they are doing as they build. Ask:
   **Tell me about your building.**
   **Why did you use this block here?**

I noticed you used two rectangles. How many different kinds of blocks did you use?

3. Encourage children to predict and go further. Ask:
   **What do you think would happen if…?**

4. Take time for children to see and discuss each other’s buildings. Ask:
   **Which building is tallest? Shortest? How can we measure our buildings?**

Have children make drawings of their buildings to take home. You can also use the drawings to make a display of the buildings.

From one librarian:

After reading the stories we talked about houses and what they’re made of, who lives in them and how to build them. I put out building materials: wooden blocks, foam blocks and linking cubes. We practiced making different kinds of structures. I also put out a wooden layered puzzle on how a house is built, and some of the children did the puzzle with me. We also discussed tools and what they’re used for.

Houses are something that all children are familiar with and building is always fun! A challenge for me is keeping children focused on one idea (like balance or height). Instead, we often have a creative building free-for-all! I try to use what they’re already doing, and tie in concepts, but I often end up listening to their interactions with each other. I’m going to do building in my summer program too, and I’ll add some ideas I’ve been working on. Each time I do a program, I think of improvements for the next time!
Copy My Design

Goal: Children communicate placement and names of blocks and follow directions.

What’s needed: Sets of solid building blocks.

1. Put out the building blocks. Build a simple structure of three blocks and describe it as you add pieces. When you have finished ask children to make the same shaped structure. (The colors might not be the same depending on how many children there are and how many blocks you have available.)

2. In pairs have children take turns being the designer and the builder. One child builds a simple structure of three-five blocks and the other child then builds the same structure. Encourage children to practice describing their structures with names of shapes and positions. For example:

   I built a house. The base is a square cube with a triangle roof on top.

3. Then try this more challenging activity. Stand a book or a folder in front of where you are building to hide your structure from view. Build a structure and describe it as you build. Example:

   First I put down a rectangle block with a long side touching the table. Next I place a cylinder on end in the middle of the rectangle. Third I put a small triangle prism on top of the cylinder.

Challenge children to build the same structure without seeing it, only using the verbal directions. This can be much more difficult than using our eyes to see and copy a structure. Describing how to build a structure requires use of specific vocabulary of shapes and positions.

Measuring, estimating and comparing are some of the math and science skills children practice when they explore and build with blocks.

- How many blocks tall can I make this?
- Which tower is the tallest? Which is the shortest?
- Is the house for the dog taller or shorter than the house for the giraffe?
- Will I need more or less straws for this bridge?
- How long is your bridge?
- Which bridge will hold the most pennies?
- Let’s measure our house with paper clips. How many paper clips tall is your house? Is it taller than mine?
Building Towers

Goal: Children combine and balance shapes while they build towers.

What’s needed: Sets of the solid building blocks and drawing materials.

1. Talk with children about building towers. Ask:

   **What shapes can we use to make a strong base?**

2. Encourage children to work together in small groups to build towers.

3. While children are building, observe and ask questions. Ask:

   **How did you keep the tower from falling down?**
   **What shapes did you use for the base?**

   **What do you think will happen if….?**
   **How many blocks tall is your tower?**
   **Which shape did you use the most?**

   **How can we find out if the tower is strong?**

4. Measure your towers with standard or non-standard units and make a chart to display.

Have children make drawings of the towers to take home. You can also take photos to make a display of the towers.

<table>
<thead>
<tr>
<th>Group</th>
<th># of Shoelaces</th>
<th># of Plastic Spoons</th>
<th>Inches</th>
</tr>
</thead>
<tbody>
<tr>
<td>Group #1</td>
<td>1</td>
<td>7 1/2</td>
<td>38</td>
</tr>
<tr>
<td>Group #2</td>
<td>1 1/2</td>
<td>11 1/2</td>
<td>57</td>
</tr>
<tr>
<td>Group #3</td>
<td>1/2</td>
<td>3 3/4</td>
<td>19</td>
</tr>
</tbody>
</table>
Building Bridges

Goal: Children experiment with building bridges.

What’s needed: Drawings or photos of bridges, solid blocks, paper cups, paper, straws, tape and small figures, animals or cars to test the strength of the bridges.

1. Display some drawings or photos of real bridges. Ask:

Where do we use bridges? What shapes do you see in the bridges?

A bridge can be as simple as a log across a stream or as complex as the interconnected towers and cables of the Golden Gate Bridge.

2. Challenge children to build a bridge using paper between two stacks of blocks, paper cups or books.

3. Test the bridge with small figures. Ask:

Can the people cross the bridge? Can you make the bridge stronger?

Encourage children to arch, fold or pleat the paper and test the bridge again. Ask:

How can we make the bridge even stronger? What materials might we use?
Building Enclosed Structures

Goal: Children design and build a structure for a specific purpose.

What’s needed: Sets of solid building blocks, foam shapes, and other optional materials such as plastic cups, film canisters, paper towel tubes or pieces of cardboard.

1. Invite children to build a structure for a specific purpose such as a garage for a truck, a house for a horse, etc.

2. While children are building you can observe, ask questions and find out the story of their structure. Ask:

   **Tell me about your structure. Why are you building a house for a horse?**

3. Talk about design aspects and material choices and ask:

   **Is the building wide enough for the truck? I wonder how the people will get into the house. How did you arrange the cups to make them stand up?**

4. Use a non-standard measuring tool to make comparisons among the structures.

5. Take photos to make a display of the structures. Children can dictate descriptions of the structures to add to the photos.

From one librarian:

I went to our local Home Depot to see if someone could help me with a building program at the library. And that’s how John became our community partner! I told John that we’d been exploring building and had been using lots of different building materials, but the one thing we hadn’t built was an enclosed structure. He suggested birdhouses—perfect!

John brought scrap wood and all the tools he needed so we made it a family program. After the children explored the tools and materials, John asked questions such as What kind of house would a bird have and why? What are some of the things we need to think about in order to build an enclosed structure?

This project worked especially well because each family could take home their own birdhouse.

I was pleased I had taken the time to talk with him ahead of time because thanks to our planning, he turned out to be the perfect community partner. He even suggested another program that would include showing children building plans and what builders need to think about when building houses for people.
Discovery Center

What’s needed: “Scrounge” materials for building.

Ask families to bring shoeboxes, paper towel tubes, clean yogurt containers, paper cups—any item that can be used to build.

Set up your building materials on a table and challenge families to build every time they visit the library. It’s fun to build with “scrounge” materials: families can bring their structures home!

Building With Recycled Materials

Goal: Children build with a variety of materials and explore their properties. They will also build a structure for a specific purpose.

What’s needed: Recycled/found materials such as shoeboxes, paper towel tubes, paper cups, straws, cereal boxes, clean yogurt containers and lids, etc. Also provide paper, scissors, tape and glue for joining the materials.

1. Display the variety of materials and talk about them. Compare and discuss the attributes of each material such as strength, flexibility and weight.

2. Ask children what they would like to build. Ideas might include a fire truck, a garage, or a house for a small toy. Possibilities are unlimited!

3. Allow children time to explore the materials and test some ideas. It will be helpful to have extra adult helpers for the construction part when materials get taped or glued together.

4. Encourage children to talk about what they have done:

Tell me about your project. Why did you choose this material to build your ____?

5. Take photos of children as they work and of the finished projects.
Straw Structures

Goal: Children build with a different type of material and explore its properties.

What’s needed: Sets of straws and connectors.

1. Display the straws and connectors and demonstrate how to join them into a square. You might say:

One shape we can make is a square. What else can you build?

Let children build with the straws. They may want to build flat shapes, a shape like spokes on a wheel or some other wonderful idea.

2. Ask children to describe what they built:

Tell me about your structure.

Encourage children to notice and describe shapes:

What shapes do you see in your building?

3. Build a cube with the straws and connectors. Discuss with children:

Have we seen this shape before? It is the same as the square cube in the wooden building blocks. How is it the same? How is it different?

The straws are larger and form the edges of the cube. The block has solid faces.
4. Challenge children in teams of two or three to build a tower with straws and connectors. Ask:

**Can you build a tower as tall as you are?**
**How many squares tall are you?**

**Can you build a tower as tall as an adult?**

**How tall can you build before the tower begins to bend or come apart?**

When the straws bend and pull apart that is the force called tension. If the tower begins to twist and pull apart that is called torque.

5. For another challenge:

Build a structure that one or more children can get inside. Ask:

**How will you get inside? How many squares tall and how many squares wide does it have to be?**

6. Take photos of children with their towers and in
From one librarian: Building and Construction Program

I planned a weekly, hour-long Building Club for grades K-3 as part of my Summer Reading Program, using materials such as Straws and Connectors, Zoobs, magnet builders, small plastic pipes, Lego, Lincoln Logs, and Keva blocks. Additionally, I planned for the children to have recyclable/alternative building materials available for several of the meetings.

We had more than 30 kids at our first Club meeting, including 10 children from the Boys and Girls Club. At this point, I decided to create a separate program for the Boys and Girls Club, and moved the upper age limit to 6th grade for that group (after their counselors begged and begged). There were some differences in the approach for the different groups, due primarily to the age of the participants and because of their familiarity with the other participants in their group.

The first week, we began the Club meeting by reading two versions of the Three Little Pigs, and identified and discussed similarities and differences in the two stories. Then I presented straws, sticks and bricks and asked kids to come up and try their hand at building with each material. We then discussed the difficulties encountered, and what we could do to overcome the difficulties. Their ideas included using playdough for mortar for the straw and sticks, string to tie the sticks together, and strips of fabric to weave the sticks together into panels. This approach worked best with the Boys and Girls Club children, and so we continued it throughout the rest of their Club meetings. I found that I could address concepts such as compression and tension through activities my teen volunteers presented for this group.

Each week, we had tables set up around the room with building materials at each, and teen volunteers manned each building center as role models, coaches and monitors. Additionally, several parents participated with their children and offered suggestions and guidance to the children. I also included other materials such as re-hydrated dried peas and toothpicks, paper cups, straws, string, film canisters, toilet paper rolls, plastic containers, and tape, tacky glue and staples, etc. The kids really enjoyed the oddball materials, in great part because they could (usually) take their creations home.

The children didn’t actually ask many questions—they were so busy carrying out their own ideas. They did, however, interact with each other in interesting ways, collaborating and dissenting primarily about the design of their structures. My teen volunteers and I deliberately built structures with problems and would then ask for advice on such things as how to make our walls stronger, how our building could go higher, and what would happen if we added a Lego top to our building?

Opportunities for science and math learning abounded during these sessions, as children learned about the need for stability when building, how different materials required different approaches, how symmetry is sometimes necessary for stability and also through communicating about their own structures and those of others. My favorite anecdote: My teens fell in love with the Straws and Connectors and had to be reminded not to hog them during the meetings. At our weekly after-hours, teens-only Book Club/Movies&Games evenings, they begged to use the Straws and Connectors and it was common to see 8 or 10 teens collaborating on building gigantic structures. Similarly, parents were also entranced with these materials to the chagrin of their children who didn’t WANT Mom’s or Dad’s help!
Bibliography

This What’s the BIG Idea?”™ Bibliography contains picture books recommended for the math and science themes addressed in this manual. Our online database is updated frequently as new books are published. Please search www.mothergooseprograms.org to find the newest titles.

Animal Growth


Miller, Margaret. *Now I’m Big*. Greenwillow, 1996.


Building and Construction


**Gardens**


Graphs


Maps and Mapping


Measurement


**More Than Counting**


Paparone, Pam. *Five Little Ducks*. North South.


**Patterns**


Seeds and Plants


Richards, Jean. *A Fruit is a Suitcase for Seeds*. First Avenue, 2006.


Shadows


Shapes


**Sorting**


McDonald, Megan. *Insects Are My Life.* Orchard, 1997.


Tools

Trees

Weather


---

**Other Books Featured in This Manual**


McMullan, Kate and Jim. *I Stink!* Cotler, 2002.


What’s the BIG Idea?™ for Trainers

What’s the BIG Idea?™ is one of many Mother Goose Programs™ (MG) developed and disseminated by the Vermont Center for Book. The philosophy, content and implementation style is based on a series of programs for families, early childhood educators and librarians. These include, for families:

Beginning With Mother Goose
Growing With Mother Goose
Mother Goose Asks “Why”?*
You Can Count On Mother Goose*
Especially for Dads

For early childhood educators:
Mother Goose Cares About Math and Science*
Mother Gooses Cares About Social Studies
Mother Goose Cares About the Early Years

For librarians:
What’s The BIG Idea?™*

Science and math educational consultants (all of whom had worked on previous MG projects) helped develop and implement What’s the BIG Idea?™

All of the What’s the BIG Idea?™ content (activities, family programs, Discovery Centers, etc.) was first tested by 57 public librarians from the Houston Public Library System (led by Rose Treviño, Youth Services Coordinator), Delaware (led by Patricia Langley, Administrative Librarian) and the Franklin-Clinton-Essex Library System in upstate New York. These three systems provided a mix of librarians from large and small, urban and rural libraries.

*Funding for development and initial implementation from the National Science Foundation (NSF).

The What’s the BIG Idea?™ Librarian Manual is the basis for teaching librarians important knowledge needed to infuse their work with science and math content, skills and processes.

The Manual is essential for librarian trainings and for use as a reference for library programming. The Manual is not an end unto itself; it’s the beginning of seeing what librarians already do through a different lens.

Become familiar with the Manual content so that you can easily reference particular ideas or activities. At your training:

Ask open-ended questions as often as possible and allow “wait time” for responses. Look for “teachable moments” during training.

Integrate standards and other basic information found on pages 1-23 into all aspects of a training. Use math and science vocabulary when appropriate.

Provide librarians with time to explore materials, work in small groups and share ideas.

Remind librarians to look for math and science program opportunities in almost any book or activity. What’s the BIG Idea?™ is not an add-on! Encourage them to think beyond “traditional” story hours as they plan programming. They should ask themselves: Is this a meaningful activity for children? Am I helping them make sense of their world?

Be enthusiastic and have fun! Your enthusiasm will influence librarians as they prepare their programming.
Introductory Information

The activities were developed for pre-K through Kindergarten children. Librarians can adapt and modify suggested activities to meet the needs of their audience. For example, toddlers and their caregivers may want to touch and play with the shapes, blocks, etc. Older school-age children can be challenged to work with bigger numbers and more complex problems.

What is *What’s the BIG Idea?™*

It’s about science and math, new and stimulating library programs for young children and their families and it’s FUN!

It’s about looking at what you’re already doing, the books you already read in your story hours, the hands-on activities children already do and asking: *How can I introduce a science or math skill into this?*

It’s about learning some new ideas and discovering that you’ve been doing science and math in many of your programs but haven’t been naming it or using specific vocabulary to describe what’s happening.

It’s about understanding and implementing state and local education standards, telling parents about what their children are doing and focusing on meaningful experiences for all the children in your community.

It’s about reaching out to find community partners to help enrich programs and setting up Discovery Centers for all patrons to explore and collect data.

**Pages 2 and 3:** It’s Not Rocket Science! Review and discuss.

**Pages 9-16:** What are the standards? Why are
Why These BIG Ideas?

According to many researchers, the major areas of study for pre-K mathematics education are:

- Numbers and Operations
- Geometry (Shapes and Spaces)
- Measurement

Children learn math and science content and use the process skills of math and science as they:

- Find patterns
- Recognize relationships
- Observe
- Predict and measure change over time
- Engage in building and construction activities

For ease of organization, we have divided the Librarian Manual into particular sections. However, as you use the Manual, you will find that the content, vocabulary and process skills are inter-connected between and among the three content sections. Children:

- Count as they analyze data
- Measure and count as they do weather activities
- Use spatial thinking, create/copy patterns and measure when they build

Whenever you incorporate math and science into your programming, children will make predictions, observe the world around them, communicate the information they see, recognize same and different, describe attributes, and so on.

What’s important when you do programs? The vocabulary you use, the ways children gain an understanding of the world around them, the excitement and joy they experience being scientists and mathematicians.

Why in the public library? Because libraries are community centers and resources for all types of programming for children and their families. The programs involve books, discussion and hands-on activities.

Young children are naturally curious. They make observations, they predict and estimate, they ask questions, they count, sort and estimate patterns—they use the skills and processes of scientists and mathematicians.

Why not build on this natural curiosity with intentional science and math activities?

Librarians are already doing many math and science activities with children. What is lacking is intentionality: planning a program or series of programs that incorporate math and science vocabulary, concepts and skills.

As librarians become more familiar with the standards, skills and processes and use them in planning and programming, it becomes easy to find science and math extensions in almost any picture book.
Data Collection and Graphic Representation
Pages 17-19

Pages 17:
Introduce and talk about:

The blue box: one librarian’s experience

The yellow box: science/math information

Read and discuss the content about data collection and the examples of how data may be represented.

Pages 18 and 19:
Talk together about these examples.

Group Activity: Collecting Data

What’s needed: Chart paper and markers for each group of four.

Ask librarians to work in small groups of three to five people.

Each group begins by asking a question for which they will collect and represent data.

The data should be understood by just looking at the representation.

The groups should consult pages 17-19 as they work together.
Standards Practiced

Where’s the science?
Page 14:
Science Inquiry Standards:
  Asking questions
  Collecting and Using Data
  Communicating Information
  Recognizing relationships

Where’s the math?
Page 10:
  Communicating
  Making Connections
  Representing
  Numbers and Operations

Have the entire group look at and talk about each group’s representation, asking:

What is the question being answered?

Is the visual representation clear and easy to understand?

Should any changes be made?

What books might be used for a program for which this data might be collected?

What standards were practiced in this activity?

See other examples in the Librarian Manual on pages 33, 42, 71, 96, 105.
Discovery Centers

Next two hours (one hour for exploration, one hour for processing):

The best way to introduce librarians to the What’s the BIG Idea?™ content is to set up Discovery Centers. Discovery Centers:

• set the tone for math and science learning
• introduce the “big” concept areas included in the Librarian Manual
• allow librarians to experience activities as families or children will

Review pages 20 and 21.

Set up Discovery Centers and invite participants to spend time at each center exploring the materials and doing the activity. Divide participants into three or four per group and give each person a copy of the “Exploring” form, which can be found at the end of this section.

An instruction sheet for each of these Discovery Centers is included at the end of this Trainer Section.

The Exploring and Processing forms are also included at the end of this section.
Processing the Discovery Center Experience

What other books could you use?

How could you extend each Discovery Center into several different programs?

How could you incorporate these Discovery Centers into what you’re already doing?

How could you tie this into any/all interactions with children and families?

How can you do this at your library?

What other materials could you use?

How could you adapt it for different age groups?

Which community resources might enhance the activity?

What (other) kinds of graphic representation could you do with this activity?

Part-Part-Whole
What’s needed: Pom-poms and shoelaces. See page 38. Display books such as *Seven Blind Mice* and *12 Ways to Get to 11*.

Addition and Subtraction
What’s needed: Items for making number sentences (equations). Suggestions: linking cubes, counters, dominoes. Make function cards (+, =, etc.) from small slips of paper. See pages 40-41. Display counting books such as *How Do You Count a Dozen Ducklings?* and *The Doorbell Rang*.

Measuring This Room
What’s needed: Shoelaces or chopsticks (for non-standard measurement) and measuring tape. See page 42. Display books such as *Actual Size* and *How Big is a Foot?*

What’s My Rule?
What’s needed: Sorting kits and/or items to sort. Select items with many different attributes. See page 70. Display books such as *Hannah’s Collections* and *Bein’ with you This Way*.

What Do You Notice About Our Plant?
What’s needed: Seeds, clear plastic cups and paper towels. See page 87. Display books such as *Jody’s Beans*, *How a Seed Grows* and *From Seed to Plant*.

Shapes in This Room
What’s needed: Assorted shapes, paper and writing utensils for representing data. See page 105. Display books such as *The Shape of Things*, *The Wing of a Flea* and *Shape Capers*.

Mapmaking Center
What’s needed: Paper and writing/drawing tools. See pages 127 and 129. Display books such as *Rosie’s Walk*, *Down the Road* and *The Three Bears*.

Building Bridges
What’s needed: blocks, straws, paper cups, construction paper. See page 137. Display books such as *Let’s Try it Out With Towers and Bridges*. 
More Than Counting: Numbers and Operations  
Pages 24-47

We’ve already experienced several of the activities suggested in this section of the Librarian Manual, through the Discovery Center explorations, namely:
Part-Part-Whole  
Measuring This Room

Page 24:
Concept Map  
This is a graphic representation of the section’s activities.

Page 25:
The introductory essay provides an overview of the content emphasizing standards and why informal experiences with math processes and content are important for young children.

Page 26:
Read and talk about *Math and Science Skills and Concepts* (standards, page 11) and how children talk about and explore numbers.

This information repeats and extends the introductory essay.

Page 27:
A sample of books about More Than Counting.  
An extensive subject bibliography begins on page 143.

Page 28:
A Typical Program
An example of how favorite storytime books can be used to introduce and practice counting skills.

What other books could be used for different programs about counting?

Page 28

Yellow box
Review and talk about these math terms/concepts

Concepts that form the core of young children’s number sense and understanding:

Use numbers to quantify sets (collections):
*How many fingers do you have on one hand?*

Use numbers to compare sets:
*I have three books and Connor has two books.*

Add and subtract single digit numbers:
*I have three blocks. If I give you one block I will have two for myself.*

Understand part-part-whole relationships:
*If we have six children and four sit at one table and two sit at another table, do we still have six children?*

Understand equal partitioning or grouping:
*There are four cookies. It’s fair if we each have two cookies.*
What the Research Says

Children’s basic understanding of mathematics is gained long before they enter school.

Development of oral counting skills may begin as early as age two.

Children as young as age two or three may begin to use number words when they count their fingers or other groups of objects, even though they may count “1, 2, 6” for three objects and so on.

Children first begin to memorize the sequence of number words, often missing portions of the sequence.

Children begin to recognize numerals between the ages of four and five.

Kindergartners typically can count out sets (collections) of at least five items accurately.

Page 29:
It’s important to assess number knowledge before engaging children in counting activities.

Pages 30-34:
Allow librarians time to discuss/do some counting activities. Emphasize: children need time to explore materials. As they explore, new vocabulary can be used and children’s knowledge assessed.

Pages 35 and 36:
Numerals: Sharing counting books that both represent the number of objects and show the numeral is a good way to help children practice this skill.

Interpreting data offers many opportunities for counting and using numerals.

Pages 37-42:
Review the Discovery Center experience. Addition, subtraction, division and number sentences (equations) are part-part whole operations.

Use dominoes and MG Math Cards to make number sentences.

Pages 44 and 45:
Review the Discovery Center experience. Brainstorm other measurement activities.

Measurement activities are in all sections of the Manual. Measurement is a process skill of science and a content standard in mathematics.

Refer to page 15 and discuss the difference between estimate and predict.

Pages 46 and 47:
Exploring weight: The activity on page 47 requires a balance.
Patterns and Relationships / Change Over Time
Pages 48-99

Page 48:
The Concept Map is a graphic representation of each of the three sections in Patterns and Relationships:

Finding Patterns
Recognizing Relationships
Noticing Change Over Time

Page 49:
The introductory essay begins with a description of what might occur at a story hour when *The Little Red Hen* is read.

Notice how this reading is extended into a math and science program.

Finding Patterns
Pages 48-61

Page 50:
Read and talk about *Math and Science Skills and Concepts* (standards, beginning on page 10) and how children talk about and explore patterns. Emphasize that the introductory essay, the math and science skills and Finding Patterns are all interrelated.

Look at and talk about the photo of the Pattern Discovery Center on page 50. Note that not all children are able to make a pattern.

Page 51:
A sample list of Books about Patterns appears here (a more extensive list begins on page 154).

Page 52:
An example of how favorite storytime books can be used to implement math and science. What other books might be used for exploring patterns?

Website Resource

You will find extensive bibliographies, articles, downloadable activities and other free resources on our website:

[www.mothergooseprograms.org](http://www.mothergooseprograms.org)

In addition to the resources listed above, the site includes a picture book database of over 1,200 titles, searchable by author, title, subject, age and ISBN. All titles have been fully reviewed by the children’s literature experts at Mother Goose Programs and the Vermont Center for the Book.
“Mathematics is the science and language of patterns. Thinking about patterns helps children make sense of mathematics. They learn that mathematics is not a set of unrelated facts and procedures; instead, recognizing and working with patterns helps young children predict what will happen, talk about relationships and see the connections between mathematics concepts and their world. Because the study of patterns is basic to all mathematical thinking, it has a close natural connection to the other math content areas. Patterns in number, geometry, measurement and data analysis—all belong in the math curriculum for young children.”
—Juanita Copley, *The Young Child and Mathematics*

**Pages 53-61:**
Pattern activities
Finding, creating, copying and extending patterns are the core concepts in all the pattern activities that follow.

**Page 54:**
Beginning With Patterns
This is a simple activity for introducing patterns. Note that it’s the suggested activity for A Typical Program.

When talking about patterns, always ask:
**What comes next?**

**Pages 54-58:**
Visual patterns
Talk about and do at least one activity from this section.

**Pages 59 and 60:**
Sound and Movement patterns
These activities involve creating, copying and extending patterns.

Activities for *Max Found Two Sticks* and *Listen to the Rain* involve identifying, naming and copying patterns in the environment.

**Page 59:**
Review the “From one librarian” information in the blue box. This librarian encouraged children to make, copy and extend patterns by combining visual, sound and movement patterns.
Recognizing Relationships  
Pages 62- 75

Page 62:
Read and talk about *Math and Science Skills and Concepts* (standards, beginning on page 10) and how children talk about and explore relationships. Return to the essay on page 49, emphasizing that the information about relationships, the math and science skills and short essay on page 62 are all interrelated.

Page 64:
Sorting: A Typical Program  
We’ve selected “shoes” for this storytime; what other subjects/books could we use for a sorting program? The books pictured on page 63 will help spark ideas in the brainstorming.

Pages 64-71:
There are 15 sorting activities altogether (including Discovery Centers and “From one librarian” information). Select and read about/do one or more of them with librarians.

Discuss the What’s My Rule? Discovery Center experience.

Page 71:
Sink or Float?  
This is a sorting and data collection activity. The following week’s program could be Count and Compare Cargo (page 45). The same books could be displayed at each program.

What’s the same and what’s different about *Who Sank the Boat?* and *Mr. Gumpy’s Outing*?

Use words such as *attribute* and *set* as children sort.

Always allow children plenty of time to touch and talk about any sorting materials, asking:

*Which are the same? How do you know? What words would you use to describe these objects? Can you make a group (set) of all the red ones?*

The Sorting a Button Collection activity on page 68 is a good example of exploring a collection, naming attributes and making sets.
Two very important mathematical processes are problem solving and reasoning. Both require logical thinking. Logical thinking involves moving from one step to the next in a way that makes sense. Being able to notice similarities and differences helps children to begin logical thinking, reasoning and problem solving.

Scientists investigate the nature of things in well-thought-out, organized, step-by-step series of experiments. For young children, an important way to discover the “nature of things” is to notice ways in which things are the same and different.

Pages 72 and 73:
Talk together about sequences. Can any librarians think of how an activity they are already doing might be used to talk about sequences?

Pages 74 and 75:
Notice that there are actually four activities on these two pages:

Outdoor Shadows
Indoor Shadows (From one librarian)
Changing Shadows
Shadows / Data Collection (From one librarian)

Talk about how these program could be done in various settings: What are the challenges?

Change Over Time: Growth
Pages 76-91

Page 76:
Read and talk about the short essay and the Math and Science Skills listed on this page. Note that these are also the process skills of science. Talk about the Discovery Center experience. Ask:

Do librarians already grow plants in the library? Have any librarians tried live animal displays?

Page 77:
Note that there are other books on Seeds, Plants, Gardens and Animal Growth listed in the bibliography on pages 143, 146, 156 and 160.
Page 78:
A Typical Program
There are many picture books about children growing. What other books do librarians suggest?

Discuss that for young children, one of the best ways to talk about animal growth is by sorting, as shown in the activity on page 79.

Though there isn’t a Typical Program on plant growth outlined in the manual, what books/activities might be used?

Page 80:
Depending on the library itself, many librarians may choose to set up live animal displays. The yellow box includes science information about animals.

Page 81:
Successful displays are discussed in both the yellow box and “From one librarian” in the blue box. Both provide questions and suggestions for doing a series of programs about observing a complete life cycle.

Page 82:
Introduce the concept of growing plants by first discussing gardens. The yellow box provides science information about plant growth.

Page 83:
This activity introduces children to the idea that seeds are inside fruits.

Pages 84-85:
These activities allow children to see what happens to seeds when they’re exposed to particular conditions (water/no water, light/no light, etc.).

Discuss the “From one librarian” blue box on page 85. How could librarians try this activity in their libraries?

Community Partners

In the “From one librarian” blue boxes throughout the Librarian Manual you’ll find many examples of how librarians enhanced their programming with community partners (one example is on page 82).

Review the information on page 22 and brainstorm other ideas for Community Partners.
This activity can be done over time in the library. What math and science skills do we practice in this activity?

Discuss the Discovery Center experience based on Watch it Grow!

Depending on their programming, librarians may choose to do explore Decomposition. Discuss possibilities and challenges of doing these activities.

Be Friends With a Tree
This is another activity that can be done over several months. Talk about the “From one librarian” blue box.

Whenever possible, it’s important to give children many opportunities to use their senses as they explore the weather:

What are the smells, sounds, textures, etc. of rain and snow?

In inquiry science, children make observations and predictions, measure and collect data about:

What we see
What we hear
What we smell

Read and talk about the short essay and the Math and Science Skills and Concepts listed on this page. Ask:

Are any librarians already doing programs about weather?

What are they doing? What books are they using?

How many of the standards are children practicing?
Page 93:
Notice that the pictured books are a combination of fiction and non-fiction books. (The same mix is on every book page and in the subject bibliography on pages 143-164.)

Page 94:
Weather: A Typical Program

Ask: **What other books could be used?**

Page 95:
Thermometers and Temperature
Some librarians may want to explore measuring tools such as thermometers.

Page 96:
Making a Weather Chart
Talk about how to do this activity and ask:

**Who will collect the data?**

**How can it be done by children and families each day?**

Take time to talk about the chart and ask:

**What do you notice?**

**Which has more? Which has less?**

**What’s the same? What’s different?**

Count as you make comparisons.

Page 97:
Talk about the “From one librarian” blue box. This librarian explains how to make your own rain gauge.

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You’ll find many weather activities for young children online or in books for young children. However, as you review these activities, ask yourself:

*Where’s the science? Where’s the math?*

*Is there intentional use of appropriate vocabulary?*

*Can you match the activity to a math or science standard?*

*Does the activity help children practice the process skills of science?*

*Are there opportunities for data collection? For counting? Recognizing shapes and patterns?*

Talk about the websites listed on page 92 of the Librarian Manual. Older children can explore the sites to learn about weather in other parts of the country.
Shapes and Spaces
Pages 100-142

Pages 101:
Read and discuss the introductory essay. The Concept Map shows how the activities are divided into three groups. The activities in Exploring Shapes and in Spaces and Places are explicitly linked to the Geometry and Spatial Sense math standard (page 12).

Building and Construction activities help children practice Inquiry Science skills (page 14) as well as using Shapes and Spaces skills.

Exploring Shapes
Pages 102-117

Pages 102:
Read and talk about *Math and Science Skills and Concepts* and how children talk about and explore shapes.

Page 103:
A sample of books about *Shapes* (see bibliography on page 157 for more titles).

As children move around and explore their environment, they learn a lot about geometry. For young children, geometry begins with recognizing and naming the shapes and forms of familiar objects such as windows, doors, signs, wheels, buildings, trees and flowers.

Page 98:
Younger children will represent clouds in their drawings. Older children will use non-fiction books.

Page 99:
Instructions for making a wind flag can be found in the Activities section of the Mother Goose Programs website.
What's the BIG Idea?

A Typical Program
An example of how almost any picture book offers opportunities to talk about and explore shapes (see yellow box).

Shapes are labeled in boxes on pages 104-105.

Page 105:
Shapes All Around
A simple way to introduce shapes and to assess children’s knowledge about shapes. Notice the opportunity for collecting data.

Discuss the Discovery Center experience: Shapes in This Room.

Pages 106-109:
Librarians will need time to explore the shapes collection. Have them do a selection of activities from these pages.

Discuss ideas for adding shape activities to favorite programs.

Pages 110-111:
Talk about “From one librarian” on page 111: How might librarians introduce quilting activities in their programs?

The Nine-Patch Patterns activity gives children another opportunity to practice making patterns.

Pages 112-113:
Note that these activities might be better suited for school-age children.

Pages 114-115:
Challenge the group to follow the Discovery Center instructions on page 114.

Pages 116-117:
Symmetry is a concept that can be explored with older children. How might librarians try these activities in their programming?

As children learn to recognize shapes, they can also learn to use words to describe the shape. This enriches their understanding of the shape itself and they learn new vocabulary as well.

For example, a square is a figure with four equal sides and four right angles. Children won’t need to memorize all these words to understand “squareness,” but it’s important to introduce and use terms such as angle and equal, even with young children. Once you’ve introduced the words, make sure to use them whenever appropriate.
Spaces and Places
Pages 118-129

We’ve already experienced an activity from this section in the Mapmaking Discovery Center.

Page 118:
Read and talk about Math and Science Skills and Concepts and how children explore spaces and places.

Page 119:
Some books for beginning conversations and activities about spaces and places

Page 120
A Typical Program
Children practice using directional and positional words

Pages 120-123:
These activities give children more practice in giving and following directions, and in using directional and positional words. Discuss the short list of these words on page 122.

Page 121:
Because many children have heard some fairy tales over and over again, having children act them out is a perfect opportunity for them to practice using directional and positional words.

Pages 124-129:
Maps and Mapping activities
Discuss “From one librarian” on page 125. How might librarians try a mapping activity in their programs?

Discuss the Discovery Center experience. What different kinds of maps did librarians make?

Page 126:
Emphasize the importance of using the same unit block to represent the same type of object.
Page 127:
Another opportunity for children to practice making a map, this time of a walk they took.

Page 128:
An activity focused on data collection and graphic representation.

Page 129:
Discuss ways librarians might choose to do this activity in their library.

Building and Construction
Pages 130-142

Page 130:
Discuss the short essay and *Math and Science Skills and Concepts*.

Talk about the building materials librarians have in their libraries and/or the building projects they’ve done with children.

Page 131:
Remind librarians that more books are listed in the Bibliography beginning on page 143.

Page 132:
Based on the model presented in “From one librarian,” how could librarians plan a program that included families and perhaps older children?

Page 133:
Read through and discuss the activity:
Time for exploration
Open-ended questions
Math and science vocabulary
Fun challenges

Yellow box: the importance of block play.

Talk about the importance of reaching out to families and members of the community when planning programs.

In the “From one librarian” blue boxes on pages 132 and 142, you’ll see that librarians included parents, children of different ages (up to Grade 6), a school class and children from the Boys and Girls Club.

Review the information on page 23 about Connecting With Families. How else could librarians include families and other community members in their programs?
“Children who are exploring building materials [are also exploring] mathematics as they build with blocks and other materials. The blocks themselves are an array of many geometric shapes; as children build with them, they can experience these different shapes. They can also notice relationships between the unit blocks such as how many square blocks they will need to make a wall the length of one long block. They will experience the symmetry often needed to make towers balance and the patterns (such as in a brick wall) that help make structures stable...as they build towers and enclosures, there are endless opportunities for measurement. Some children will simply experience these mathematical concepts, others will talk about them, and still also may use them explicitly as they build.”
—Karen Worth, *Building Structures With Young Children*

**Page 134:**
Discuss the questions listed in this activity and note the importance of open-ended questions.

**Page 135:**
Read and talk about the information about measuring and estimating in the yellow box.

The “Copy My Design” activity gives children more opportunities to communicate and follow directions, this time for the placement of blocks or other building materials.

**Pages 136-141:**
These building activities include many different structures using many different building materials.

Read and talk about the questions included in each activity and note the importance of getting children to explain what and how they’re building their structures.

**Page 137:**
Talk together about the “From one librarian” blue box on page 138. What other community resources could librarians include in their building programs?

Review and discuss the standards list on page 130.

**Pages 140-141:**
Talk about family nights (noting the “From one librarian” blue box on page 141).

What kinds of family nights have librarians already tried?

**Page 142:**
Discuss this programming idea “one librarian” developed for many different-aged children over the course of several weeks.
Copy Points for Press Releases

Although you will want to include local information in press releases, here is some background information on What's the BIG Idea?™:

- What's the BIG Idea?™ is a project of Mother Goose Programs™ of the Vermont Center for the Book. Website: www.mothergooseprograms.org

- The goal of What's the BIG Idea?™ is to give public librarians ideas, programming, and materials so that libraries can become informal learning centers of science and mathematics programming and resources for young children and families.

- The title of the project comes from the concept that as children begin to encounter science and mathematics, there are areas they need to be introduced to.

- The original project was piloted by librarians from the Houston Public Library, the State of Delaware library system, the Franklin-Clinton-Essex Library System in New York and Vermont public libraries.

- The project helped libraries link up with community partners who helped them increase their science and mathematics expertise and programming. These partners ranged from local science museum educators, to local representatives of building supply stores. Quilters, carpenters and chefs were also recruited as community partners by several libraries.

- The original project was a four-year grant from the National Science Foundation. The Principal Investigator on this project was Sally Anderson, Executive Director of the Vermont Center for the Book. The Co-P.I. was Greg DeFrancis of the Montshire Museum of Science in Norwich, Vermont. Here’s what P.I. Sally Anderson had to say about the project: The library is a natural place for children and families to have informal science and math experiences. What’s the BIG Idea? gives librarians the books, materials and information they need to feel confident and competent introducing young children and their families to great books and new science and math experiences.

- The Mother Goose Programs™ approach to learning for young children always includes a combination of three elements: reading, interaction and exploration. What's the BIG Idea?™ is centered in age-appropriate books that form the springboard for exploration of a variety of science and math concepts. For example, librarians and children explore sound patterns through reading books like Brian Pinkney’s Max Found Two Sticks and investigating a variety of ways to create patterns of sound with ordinary objects.

- The Vermont Center for the Book is a non-profit 501 (c)(3) organization located in Vermont, whose programs are currently in use in 33 states, Washington, D.C. and the U.S. Virgin Islands.

- Mother Goose Programs™ enhance the development, self-esteem, and success of children by building the skills and confidence of parents, librarians, child-care providers and other educators. Mother Goose Programs™ give parents, librarians and early childhood and other educators books, professional development, training and activity guides and other materials that transform reading with children into multidimensional and powerful learning experiences in literacy and language, mathematics and science, and social studies.
Discovery Center
Part-Part-Whole

Make a shoelace circle on the floor.

Take five pom-poms and drop the pom-poms from above the circle, one at a time.

How many are inside the circle?
How many are outside the circle?

Make drawings of your sets. Continue by making sets of 7 or more pom-poms.
Discovery Center

Addition and Subtraction

Using linking cubes, counters or dominoes, make number sentences (equations) using function cards (+, -, =, etc.).

Begin with a low number such as 5 and continue to make number sentences that up to more than 5.

For example:

3 cubes + 2 cubes = 5 cubes

Practice subtraction and use the same items.
Discovery Center

Measuring This Room

The challenge: Using standard and non-standard measuring tools, estimate and measure distances and objects in and around this room. Use chart paper and writing utensils for recording data.

Some challenges: How far would you estimate this table is from the door to the lobby? How tall is the table? How tall is the children’s librarian?

Or...choose your own challenge!

Select either a unit of measure (standard unit or non-standard), find an object or distance to measure, make an estimation and then measure.
Discovery Center
What’s My Rule?

Working with a partner, explore the items and choose an attribute to sort by, without telling your partner the attribute. Put your groups (sets) into sorting loops. For example: objects made from wood, objects not made from wood.

Ask your partner: What’s my sorting rule?

Take turns choosing attributes, making sets and testing each other’s observation skills.
Discovery Center
What Do You Notice About Our Plant?

Display the plants you’re growing and place a blank journal with the plant, along with measuring tools.

Invite families to record observations (in words and drawings) about the plant every time they visit the library.

Some questions to ask:
*How has the plant changed?*
*What do they notice?*

Include books about plant growth in your display.
Discovery Center

Mapmaking Center

Set up a map-making center for children and adults. Challenges:

Make a map of a favorite story.

Draw a map of a favorite walk you’ve taken recently or one you took a long time ago: to school, church, a friend or relative’s house.
Discovery Center

Shapes in this Room

Select one shape, look around the room and go on a Shape Search.

How many of this shape can you find?

How are the shapes you found in the room different from the shape you selected?
How are they the same?

To represent data:

Draw or list some of the objects you identified in the room.
Discover Center
Building Bridges

The challenge:

Build a bridge using paper between two stacks of blocks, paper cups or books.

Test your bridge by adding small amounts of weight to it.

How can you make your bridge stronger?

Experiment with different strategies such as folding or pleating the paper and testing the bridge again.

What other materials could you use to make your bridge stronger?
Exploring the Discovery Centers

What math standards/skills did you use? (Counting, measuring, etc.)

What science standards/skills did you use? (Observing, sorting, predicting, etc.)

What ages is it most suitable for: A young child? Child/parent together? Older child?

How did the Discovery Center encourage conversation? Sharing ideas?

How could you adapt / change this Discovery Center to use in your library?
Processing the Discovery Center Experience

What other books could you use?

How could you extend each Discovery Center into several different programs?

How could you incorporate these Discovery Centers into what you’re already doing?

How could you tie this into any/all interactions with children and families?

How can you do this at your library?

What other materials could you use?

How could you adapt it for different age groups?

Which community resources might enhance the activity?

What (other) kinds of graphic representation could you do with this activity?