



# Investigation and Discovery

## Introduction

Children are natural explorers, ready to touch, taste, smell, look at, and listen to all the things around them. Everywhere that children go, they are curious about the things around them. This curiosity leads to questions that can spark important exploration and learning, especially in math and science.

Science is the study of the natural world and the process of finding out about the world and how everything in it works. Math includes exploring numbers, quantity, space, patterns, and relationships. Math is a problem-solving process.

Opportunities for science and math learning are all around us; for example, when a child wants to investigate the water coming out of the faucet, the snow tracked in on her winter boots, or the cereal floating in her bowl. Routine occurrences like these are natural opportunities for parents and caregivers to help their children to discover and explore with all of their senses.

By showing their children how math and science are part of daily experiences, parents and caregivers convey that math and science are important and exciting. By supporting their children's curiosity and helping their children to ask questions, look for answers, make observations, and explore with all their senses, parents and caregivers show their toddlers how to think like mathematicians and scientists. This process also helps children develop important skills for future learning: Children who are confident questioners, explorers, and problem-solvers will arrive at school with many of the tools necessary to thrive.

This workshop is designed to help parents, families, and caregivers take advantage of the opportunities to explore math and science during daily routines both indoors and outdoors. Through discussions, hands-on activities, take-home resources, and the "Investigation and Discovery" video, you'll find everything you need to:

- Emphasize the importance of recognizing opportunities for learning in everyday experiences.
- Demonstrate how science and math learning can emerge out of children's interests and daily routines.
- Show that science and math learning can happen when children are invited to explore the world with all of their senses and to think about their observations.

- Highlight the significance of child-led exploration in math and science.
- Explore the importance of asking questions and using rich math and science talk.
- Emphasize the joy and importance of hands-on discovery.
- Lead participants in reflecting on how they can apply what they have learned with their own children.
- Try out and practice new ideas with participants.

The Investigation and Discovery workshop has been divided into the following sections:

- **Your Young Explorer**—This section provides information on how to use children's interests and questions as a starting place for science and math investigations.
- **Science All Around**—This section explores opportunities for science exploration and science talk both indoors and outdoors.
- **Math Moments**—This section explores the math learning that can happen at home and on-the-go and highlights ways to incorporate math talk into daily routines.

As you lead this workshop you'll be using the "Investigation and Discovery" video, which is 7 minutes and 18 seconds in length. In this video you'll meet:

- Kendra (age 3) as she takes a walk with her family.
- Cora (age 4) and her sister Pepper (age 2) as they explore ramps.
- Joaquin (age 4) and his older brother Tariq (age 12) as they build block structures.
- Marli (age 3) as she cooks with her mom.

## Preparing for the Workshop

- Read the *Parenting Videos Workshop Overview*, found online in this workshop's Resources section, which contains helpful tips and information about the workshop series.

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- Make copies of the following *Tips for Parents*, available in English and Spanish and found online in this workshop's Tips section. Have them available for participants to pick up before the workshop begins or distribute them at the end.
  - *Everyday Math*
  - *Indoor Science Fun*
  - *Outdoor Science Fun*
- Watch the "Investigation and Discovery" video. Take notes as you watch (and as you read through this guide). Keep a notebook of additional ideas and questions. You know your group best and can adapt the workshop to fit the needs and interests of the participants.
- Do an icebreaker activity. Say the word *science* and ask participants to call out any words that come to mind. Ask, *What do you think of when you hear the word science?* Do the same with the word *math*. Write participants' responses on a whiteboard, chalk board, or on a large sheet of paper.
- Gather the supplies you need for the Trying It Out activities, including pencils, pens, paper, and sticky notes, as well as refreshments. For "Count On Collections" you will also need brown paper bags (one per participant).
- If you are providing a series of workshops, have a flyer ready with future topics, dates, and times.

## Section One: Your Young Explorer

### Leading Your Group

Begin by discussing ways that science and math can emerge out of children's interests and activities. You can mention:

- Your child is a natural explorer and you can support her investigations.
- Opportunities for math and science learning are everywhere. You don't need to go out of your way to find them.
- Science learning refers to the natural world and all the things in it (that is, all the things that have not been made by humans). It is a process of figuring out how things work and why. (Refer to examples mentioned by participants in your icebreaker activity.)

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- Math is the process of solving problems related to numbers and quantities. Math also refers to patterns, the space around us, and relationships between things. (Refer to examples mentioned by participants in your icebreaker activity.)
- By asking questions and encouraging your child to explore with all of her senses, you can help her develop critical thinking skills that will become a foundation for more advanced math and science learning.
- Your child will be most excited to explore what interests her. Follow your child's lead and build your learning adventures around whatever she is curious and excited about.
- As your child explores, continue to follow her lead. The learning adventure may not go as you had expected, but it will be more meaningful for her. For instance, if you are investigating flower petals and she suddenly wants to throw them into a puddle, go with it. Ask questions that will inspire her to wonder and explore with all of her senses, such as "Do you think the petals will sink or float?" "Will they still feel the same after they are wet?"

**Chat and Share**

Ask participants to think about something that happened recently that sparked their child's curiosity and whether it happened indoors or outdoors. This will help them begin to think about learning opportunities that occur throughout the day. You can ask:

- Thinking back on the past week, can you remember a time that your child was interested in or curious about something indoors? What sparked her curiosity outdoors?
- How could you tell she was interested?

NOTE: Write down any additional questions that you would like to include. Is there an anecdote from your own life that you can share? Add that, too.

**Watching and Learning**

Watch the entire "Investigation and Discovery" video together. (You will have an opportunity to return to various segments of the video throughout the workshop.) Before you watch, tell participants:

- In this video, you'll see young children exploring their world, indoors and outdoors.
- Notice what captures children's attention most and the math and science opportunities that emerge.

## Reviewing and Reflecting

Lead a conversation about what participants noticed in the video. You might ask:

- In the video, parents used their children's natural curiosity and interests to spark math and science learning. Kendra loves being outdoors so her family went outside for a walk that led to a leaf exploration. Marli loves to cook so her family integrated math into making pizza.
- What other learning moments did you notice? How did children's interests inspire or drive these learning moments?

## Trying It Out

**Favorite Things To Do Table.** Encourage participants to think about the things and related activities that excite their children most and to consider what opportunities for math and science learning these activities offer.

- Make a two-column table on a white board, chalkboard, or large sheet of paper. Label the columns "Indoors" and "Outdoors."
- Explain, *We are going to generate a table of your children's Favorite Things To Do by listing activities that interest and excite your children indoors and outdoors. We've already thought of a few examples from the past week.* (Write the examples in the table.)
- Say, *As you brainstorm more ideas, think about the activities you do every day and about the things or objects that grab your child's attention. Does your child love to look for trucks as you ride the bus? Does your child love to play with water in the tub?*
- Stress to participants that they should list everyday activities rather than special occurrences such as vacations or field trips.
- Give each participant a stack of sticky notes. Ask participants to write down three activities that interest and excite their child (one per sticky note).
- Ask a few participants to tell the activities they wrote down. Then have all participants post their notes in the appropriate column ("Indoors" or "Outdoors") based on where the activity takes place.
- Before participants begin, demonstrate. Say, *If your child loves finding rocks you will write "finding rocks" on a sticky note and then place it in the "Outdoors" column of the table.*

- After all participants have placed their notes explain, *I want this workshop to be relevant to you and your children. I want you to leave today feeling comfortable and confident exploring science and math in ways that will excite your child. We will be using this Favorite Things To Do table to frame our discussions. We will look at how to use the objects you see and the activities you do every day as jumping-off points for learning in science and math.*

## Section Two: Science All Around

### Leading Your Group

Share some of the many ways that science exploration can happen both indoors and outdoors. As you discuss, draw on supporting examples offered by participants in the Favorite Things To Do table. You can mention:

- Young children are naturally inquisitive and curious about the world around them. They often want to know how things work, what things do, and what will happen next, and they have lots of their own ideas to share. The more we encourage their curiosity, the more we encourage them to think and behave like scientists.
- You've listed some of your children's interests in our Favorite Things To Do table. Use these interests to help your child make science investigations and discoveries.
- Encourage your child to get hands-on in his explorations and to use all his senses—smell, touch, sight, hearing, and, when appropriate, taste. When your child explores with all of his senses he'll become more aware and his investigations and discoveries will go much deeper.
- Keep your child talking, thinking, and exploring by asking open-ended questions. These types of questions cannot be answered with a one-word response and encourage deeper thinking. For example, you might begin a question with "Why do you think that...?" "What do you notice about...?" "What if...?"
- Explore alongside your child. Talk about what you are doing, what you are thinking, and what you are wondering about. Identify a problem and try out different solutions. For example, when Tanya's son is building, she might say, "This tower is looking a little wobbly; what can we do to make it more stable so it does not fall down?" This models scientific inquiry—the process of asking a question and then investigating to find the answer.
- Look for answers together. When your child asks a question that you can't answer, it's okay to say, "I don't know." Then together find the answer—do your own experiments;

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talk to a person who knows the topic; look for books at the library; or find pictures, video, and other information online.

- Don't worry about getting messy. Getting her hands dirty often activates your child's senses and can elicit science discoveries. For example, making a mud pie might be an opportunity to learn about insects that live in the soil. A paint spill might lead your child to notice what happens when two colors mix together. Create spaces where it's okay for your child to make a mess, such as a towel spread out in your kitchen or a corner in your back yard. You might want to have towels and an extra set of dry clothes on hand.
- As your child explores you can help him build his science vocabulary. Ask him to describe what he's touching and seeing and to compare it to other things: "How does the mud feel? How does the rock feel? How are they different?" To get your child started, describe things yourself. Speak your thoughts out loud: "This rock is bumpy and that one is smooth." Then ask, "What does this other rock feel like?" By modeling science talk you help your child to build his science vocabulary and you show him how to talk about his observations.
- Help your child talk about and record his discoveries. Ask him to describe and draw pictures of the things he experiences. Take pictures to help spark a conversation later. For example, you might say, "This is a picture of that big rock you found! What did we discover when we dropped the rock in the puddle?"

**Chat and Share**

Ask participants to think about ways they have responded to their child's questions. This will encourage them to notice how a question can be the start of a science investigation. You can ask:

- Take a look at our Favorite Things To Do table. As your child engages in one of these activities, how do you know when he is curious about something? What kinds of questions does he ask?
- What's one way you have supported him in finding the answers to his questions or helped him investigate something he is curious about?

NOTE: In your notebook, write additional questions that you would like to include. Is there an anecdote from your own life that you can share? Add that, too.

**Watching and Learning**

Watch a portion of "Investigation and Discovery" together. Begin at 1:34 as Kendra walks with her family and end at 5:26 as Tariq and Joaquin build their ramp.

## Reviewing and Reflecting

Lead a conversation about what participants noticed in the video. You might say:

- Kendra is excited about going outside and likes to touch the things she sees. Her parents build on this excitement and ask questions that encourage her to make observations and investigate with all of her senses. They ask her to compare different leaves, to touch the leaves and describe how they sound, and to use the leaves in an art project. Cora and Pepper's mom makes the most of their ramp exploration by posing a question about how different types of balls will move down the ramps. She encourages the girls to come up with a hypothesis and then test it out. Tariq and Joaquin like building together so their parents make sure they have an open space to build and explore.
- What are other ways these three families build on their children's interests and encourage hands-on investigation?
- How would you support or extend the learning during these children's investigations?

## Trying It Out

**Sparking Science.** Encourage participants to think of ways they might encourage science investigation around their children's favorite activities.

- Explain, *We are going to think of ways to use our children's favorite activities as jumping-off points for science investigations.*
- Write the following questions in a visible location:
  - How could you encourage your child to explore with all her senses while engaging in this activity?
  - How could you support her in talking about and documenting her discoveries?
  - What other related topics could you encourage her to explore so that she expands on her knowledge base and interests?
- Model the process for participants. Take a sticky note from the Favorite Things To Do table and read it aloud. Together, brainstorm ways a parent or caregiver might build upon this activity to create a rich learning experience.
- Now have participants work in small groups. Ask each group to choose an activity from the table and, using the guiding questions you provided, brainstorm ways to make it a rich investigation.



- Gather together as a large group and share ideas.

## **Section Three: Math Moments**

### **Leading Your Group, Part 1**

Begin by discussing ways participants can use math to describe, count, categorize, and measure the things they see and do with their children every day. As you discuss, draw on supporting examples offered by participants in the Favorite Things To Do table. You can mention:

- Connect math to your child's real-world experiences. Numbers, shapes, and patterns will take on more meaning when they are rooted in daily occurrences. For example, at the grocery store, point out how the numbers on the price tag tell how much the item costs. Or, while outside, point out how all the tires on cars, bicycles, and busses are the same shape and then connect the shape to how the vehicles move. Ask, "What would happen if the tires were squares or triangles instead of circles?"
- Count, sort, classify, and problem solve using everyday items. For example, when Jeff is outside collecting acorns with his daughter, they create a pile together. Then Jeff divides the pile into two different-sized piles and asks his daughter questions such as "Which pile has more acorns?" or "How can we find out which pile has more acorns?" To integrate addition and subtraction he asks, "If we have two acorns and I take one away, how many are left?"
- Describe shapes, sizes, colors, and textures you see at home and while out and about. When your child is building with blocks or putting them away, talk with him about the different shapes and how he is using them. Ask, "Why did you decide to put the triangle block on the top of your building?"
- Look for and make up patterns. For example, as you walk down the street you might say, "Stomp, stomp, clap. Stomp, stomp, clap." Try repeating the pattern a few times and then ask your child to continue the pattern, "Stomp, stomp, clap. Stomp, stomp, ... What comes next?"
- Notice numbers all around you. While running errands, take turns identifying any numbers you see—on license plates or signs, for example.
- Write numbers together. For example, while cooking you might ask your child to help you write out one of the steps in your recipe, such as "Add 2 eggs." Or, point to a number in your recipe and ask her to show you how many fingers it is.

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- Measure things. Measure the heights of siblings or the distance your child jumped in the backyard. When cooking measure ingredients and talk through the process.
- Compare shapes. Notice how the shapes are similar and different. Inside, you might count the corners of a sandwich or notice that a plate has no corners at all. Outside, point out the rectangles in windows and doors, the triangles in rooftops, and the octagon in a stop sign.

### Chat and Share

Ask participants to name one way they might integrate math into an activity from your Favorite Things To Do table. You can ask:

- In looking at our table, what are some activities that seem to lend themselves well to math investigations or math talk?
- How might you add math into something you see on our table?

NOTE: In your notebook, write additional questions that you would like to include. Is there an anecdote from your own life that you can share? Add that, too.

### Watching and Learning

Watch a portion of “Investigation and Discovery” together. Begin at 5:27 as Marli and her mom make pizza and end at 6:48 as the scene ends.

### Reviewing and Reflecting

Lead a conversation about what participants noticed in the video. You might ask:

- What math concepts did Marli and her parents explore?
- How might you integrate math into your cooking and mealtime experiences?
- How might you integrate math into other daily routines, such as bedtime or bath time?

### Trying It Out

**Count On Collections.** Give parents a tool that will help build their children’s math skills as they collect favorite things.

- Point out any collecting activities included in the Favorite Things To Do table. Say, *When children are interested in something, they often want to collect it. For example, a child might want to collect rocks while playing outside or pennies around the house.*

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- Ask, *What are the things that your child likes to collect?*
- Show participants the paper bags. Explain, *This is all your child needs to start a collection. She can use this bag to collect rocks, pennies, leaves, paperclips, etc. Then together you can count each item. If your child reads numbers, give her a math challenge by writing a number on a sticky note and attaching it to the bag. Ask your child, "What number did I put on your bag?" Then help her to collect that number of her favorite things.*
- Encourage families to post new numbers on the bag each day or week.
- Explain, *Collecting the items is just the beginning. You can count or sort the items, arrange them from largest to smallest, use them to make patterns, or do addition and subtraction with them.*
- Break participants into small groups. Ask each group to think of a shape activity, a problem-solving activity, and a pattern activity they might do with their child using the collection bag.
- Gather together and invite each group to share one of their ideas.
- Suggest that participants have their children decorate the collection bags.

### Leading Your Group, Part 2

Discuss the importance of math talk. You can mention:

- As you do things with your child, use as much math talk as possible. Math talk includes words that describe size, weight, shape, and how many or how much.
- Incorporate the words *more*, *less*, *bigger*, *shorter*, and *counting* into your conversations and daily routines such as art projects, block play, snack time, and outdoor play.
- When your child hears and uses lots of math-related words on a daily basis he'll have an easier time learning and comprehending math-related concepts in school and in real life.
- One great way to inspire math talk is to ask questions that will encourage your child to explain how he solved a problem. For example, ask, "How is this shape different from that shape over there? How is it the same? How did you figure that out?" \

### Chat and Share

Ask participants to name words related to math. As they answer, record the words on a white board, chalkboard, or large, visible sheet of paper. You can ask:

- Thinking about the words we discussed, what are some math words or math talk that you use every day?
- What other math-related words could you use? For example, think about words relating to numbers, shapes, size, distance, position, etc.

Encourage participants to jot down the words to use as a resource at home.

NOTE: In your notebook, write additional questions that you would like to include. Is there an anecdote from your own life that you can share? Add that, too.

### Trying It Out

**Get Talking.** Encourage participants to brainstorm ways they might increase math talk with their children.

- Break participants into the same small groups they were in for “Sparking Science.”
- Ask them to return to the activity they chose for “Sparking Science” and then to brainstorm ways to integrate math talk.
- Before you begin, give an example: *When Paolo's nephew is building with blocks, he might use words such as tall, taller, tallest. Paolo might ask his nephew, “Do you want to use the tallest block?” Then he might ask, “How can we find out which block is tallest?”* Ask participants what other math words might come up with block building.
- Ask the groups to write down the ideas generated from their brainstorming.
- Gather together as a large group and have the small groups share a few of their favorite ideas.

### Wrapping Up

End your session with an activity to help participants bring new knowledge home.

### Pair Share

Encourage participants to reflect upon what they have learned during your workshop.

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- Write the following questions and display them somewhere visible. Ask participants to answer the questions on a sheet of paper.
  - What is one hands-on science investigation you are excited to try with your child at home?
  - What are some questions you will ask your child as she explores?
  - What are some math words you will try to incorporate as your child does her favorite activity?
- After participants have answered the questions, ask them to turn to a partner and share their answers.
- *Say, You've formed a new community here at this workshop. I encourage you to share contact information and keep in touch. You can be a wonderful source of support and information for one another.*

As you say goodbye to your group, remind participants that opportunities to explore math and science are everywhere. You can mention:

- Children are natural explorers ready to investigate how things work and why things happen.
- Math and science are happening all around us. When children see that math and science are a part of the things they see and do every day this learning will become relevant and exciting.
- Children are eager to explore things that they are curious about. You can build science and math adventures into the activities your children are most interested in (offer examples from your Favorite Things To Do table).
- Language is key to both math and science. Incorporate math and science talk into your daily routines.
- Children learn best when they explore with all of their senses. Enjoy hands-on learning experiences together and don't be afraid to get messy.

If possible, leave time so participants can mingle and chat with one another, talk with you individually, and browse the books and other materials you've brought.

## Massachusetts Guidelines for Preschool Learning Experiences

The Investigation and Discovery workshop has been designed to meet the Massachusetts Early Learning Guidelines for Preschool Learning Experiences. The purpose of these guidelines, developed by the Massachusetts Association for the Education of Young Children for the Department of Early Education and Care (EEC) in 2003, is to provide a comprehensive view of the development of preschool aged children while documenting the experiences that support this development and school readiness. The guidelines are for families as well as early education and care professionals.

For more information about the guidelines, including definitions of terms, visit <http://www.mass.gov/edu/birth-grade-12/early-education-and-care/curriculum-and-learning/>.

This workshop aligns with the following guidelines:

### Learning in English Language Arts

Children will be able to:

- Participate actively in discussions, listen to the ideas of others, and ask and answer relevant questions.
- Communicate personal experiences or interests.
- Listen to and use formal and informal language.
- Use their own words or illustrations to describe their experiences, tell imaginative stories, or communicate information about a topic of interest.
- Generate questions and gather information to answer their questions in various ways.

### Learning in Mathematics

Children will be able to:

- Explore and describe a wide variety of concrete objects by their attributes.
- Connect many kinds/quantities of concrete objects and actions to numbers.
- Listen to and say the names of numbers in meaningful contexts.
- Use positional language and ordinal numbers (first, second, third) in everyday activities.

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- Use concrete objects to solve simple addition and subtraction problems using comparative language (more than, fewer than, same number of).
- Organize and draw conclusions from facts they have collected.
- Recognize, describe, reproduce, extend, create, and compare repeating patterns of concrete materials.
- Listen to and use comparative words to describe the relationships of objects to one another.

**Learning in Science and Technology/Engineering**

Children will be able to:

- Ask and seek out answers to questions about objects and events with the assistance of interested adults.
- Explore and describe a wide variety of natural and man-made materials through sensory experiences.
- Make predictions about changes in materials or objects based on past experience.
- Record observations and share ideas through simple forms of representation such as drawings.
- Use their senses of sight, hearing, touch, smell, and taste to explore their environment using sensory vocabulary.
- Investigate and describe or demonstrate various ways that objects can move.

**Learning in History and Social Science**

Children will be able to:

- Identify and describe cause and effect as they relate to personal experiences and age-appropriate stories.
- Observe and identify the needs and characteristics of living things: humans, animals, and plants.

### **Learning in Health Education**

Children will be able to:

- Talk about ways to solve or prevent problems and discuss situations that illustrate that actions have consequences.
- Build body awareness, strength, and coordination through locomotion activities.