

CHAPTER 1

KEEP ME CURIOUS!



**“And though she be but little,
she is fierce.”**
William Shakespeare,
A Midsummer Night's Dream

Violeta García, PhD

Children are born with an innate curiosity to explore their surroundings. The very first stage in girls' lives is loaded with opportunities to discover, to focus, to engage, to explore, and to eventually make problem-solving a core skill even before they can crawl.

You've probably noticed that when babies interact with their parents, they stare. This powerful stare indicates that girls are seeking new information. As they continue to grow, babies start to mirror behavior. By participating in “serve and return,” a concept that describes how a child interacts with her caretaker and the caretaker responds, babies gain new skills.

Shonkoff and Bales conducted a study with caregivers focusing on infant interactions with their mothers and they found that when the mother did not respond to their infant, the baby displayed signs of stress.¹

Every interaction during this early learning stage builds a foundation to create the neural connections that help children develop self-awareness, interest in the natural and physical world, numeracy skills, age-appropriate spatial reasoning skills, and experience science, technology, engineering, and math learning and skill development.²

By age five, girls' experiences with their parents/ caregivers and community can foster opportunities that will help them enter pathways to future STEM opportunities. Keep in mind that at the most basic level, a child's environment has to support health, optimal well-being, and development. The National Association for the Education of Young Children has established developmentally appropriate practices for infants, toddlers,³ and preschoolers,⁴ which parents and caregivers can apply in a variety of settings to engage girls in STEM. Most of these activities or tips in this guide are intended to be flexible, so please make accommodations and scaffold as necessary.

OUTCOMES BY AGE 5

As girls, including girls from diverse backgrounds who have been historically under-represented in STEM, reach age 5, they:

- Retain interest in the natural world
- Know how to ask open-ended questions
- Remain curious about STEM concepts and topics
- Actively participate in STEM learning opportunities
- Experience the practices of STEM
- Develop numeracy skills
- Develop age-appropriate spatial reasoning skills
- Are exposed to early STEM opportunities
- Are exposed to female STEM professionals and entrepreneurs
- Are exposed to STEM professionals from diverse groups who have historically been under-represented in STEM careers

This chapter begins with a brief introduction to the world of newborns and how STEM learning takes place during this formative stage. We proceed with the changes happening as girls become mobile and move into toddlerhood. We explore activities that foster STEM learning, including concepts that girls can experience at this stage and skills that they can practice early in their lives, such as questioning, observing, and testing predictions. We also provide a brief explanation of the importance of each outcome and include suggestions and activities for ways parents, educators, and community-based organizations can build a strong STEM ecosystem of experiences. We hope that this will help inspire, prepare, and motivate girls to enter and stay in STEM pathways as they begin in their educational journey.

STEM learning naturally occurs in early childhood. By being more intentional, we can more readily recognize and boost learning for girls from birth to age 5.

NEWBORNS AND STEM

Exposing newborns to the awe and beauty of the world is an essential foundation for their development. They learn from those in their immediate environment: they learn how best to ask for milk, to be changed, and to play. Eventually, they begin to mimic behavior that elicits certain responses, such as giggling to make a parent smile. They respond to funny faces and cuddles from parents and caregivers.

Early exposure to books, stories, and language helps baby girls thrive. By the time a child learns to verbalize her needs and wants, she amazes her caregivers with the number of words that she knows. Every interaction helps her develop skills that will serve her as she pursues more formal exploration of the natural and physical world. Consider this baby girl as an emerging young scientist!



TRY THIS!

- ☐ Count your little one's body parts, such as fingers and toes, to start associating numbers that represent objects in her environment.
- ☐ Describe the colors in her world.
- ☐ Think out loud. Ask questions that you are wondering about and describe your everyday actions to your child.
- ☐ Have conversation with your newborn and respond by mimicking her sounds and facial expression. Describe her actions.
- ☐ Add your own ideas!



READ ALL ABOUT IT!

There are many STEM books for early childhood that support conceptual understanding such as books about color, numbers, and relationships. Here are a few of our favorites.

Ten Little Fingers and Ten Little Toes by Mem Fox

My Colors, My World/Mis Colores, Mi Mundo by Maya Christina Gonzalez

The Very Hungry Caterpillar by Eric Carle

My Granny Went to Market by Stella Blackstone

Colors by Julia Pimsleur Levine (English/Spanish/French)

Continue the conversation. Add books that inspire learning concepts such as numbers, colors, and sequencing.



SHE'S ON THE MOVE! ENTERING TODDLERHOOD

Between six and nine months, girls begin to move. This is an exercise in trial and error. She rolls and realizes that movement occurred. She is now in a new location. She tips over and gets back up. This constant trial and error sets the foundation for further exploration. She begins to question, to add new variables that she can test. Will this object keep me from falling? What is the best way to go down those steps? While she may not verbalize these types of question at this stage, one can see that young children are indeed testing and trying in every interaction they have with their environment.

Her observation skills and inquiry abilities develop through sensory experiences: looking, listening, touching, feeling, and tasting. She has to touch things and put them in her mouth. She might hit and throw an object to learn about its behavior. Does it make a sound? Does it break? She also begins to sort information in her environment, which includes exploring attributes such as size, shapes, numbers, and colors. All of these discoveries are foundational to future STEM learning.

At this stage, math examples have to be concrete. For example, she can relate to having one ball, or one cupcake. By the time she reaches toddlerhood, around two years, she begins to understand that two cupcakes are more than one. She also begins to develop spatial reasoning abilities. This may happen when she falls down a step and she learns to sit and scoot down instead, or when she tries to pick up a block that is at the bottom of a pile.



TRY THIS!

- ❑ Help her use her whole body to learn. Count her nose, her eyes, her fingers, her legs, and her arms.
- ❑ Engage her senses. Have her explore colors by mixing them and making new colors. Try different materials with different textures and describe the similarities and differences.
- ❑ Offer three-dimensional shapes for her to explore and sort.
- ❑ Interact with her by playing with blocks to develop spatial reasoning skills.
- ❑ Go out in nature and find shapes and textures in her environment.
- ❑ Tell stories. You don't always have to have books to tell stories. Tell her stories about what you loved to do as a child. Use sequence words (first, then, last) to tell your story. You can also tell stories about your day.
 - * **For example**, you can tell a story as it's happening by tracking a sequence of events. "First, we're going to eat breakfast, then we will take the garbage outside, then we will go to the zoo." Later in the day you may say, "We're having so much fun at the zoo now. After the zoo, we'll go to the grocery store." By continually tracking events throughout the day, children can learn the experience of time and before/after.

HOW CAN WE HELP YOUNG GIRLS RETAIN INTEREST IN THE NATURAL WORLD?

Adults can cultivate the natural curiosity in young girls. This curiosity can be fostered indoors, but can also be fostered outdoors. At home, we can provide young girls with materials found around the house that they can touch, feel, and even chew on. Outdoors, we can do the same. Children are curious. They want to use all their senses to explore the environment. Sometimes, adults' desire to keep kids clean and tidy may limit their children's ability to explore.

Parents and caregivers might tell their children not to get dirty or remind them that if they climb a tree they might get hurt. While this is possible, children stand to gain skills and confidence through risk-taking. When young children succeed at what may appear to be a very challenging task for their age and ability, they learn that they are capable human beings. Give kids opportunities to explore. When you explore with your child, you can help her develop the ability to ask good questions.



START HERE!

Connections to Environmental Education

Get the Materials: Educators can receive the complete *Environmental Experiences for Early Childhood* materials by attending a Project Learning Tree training, [in person](#) or [online](#). Resources available are great for parents and anyone who works with young children. The activities are fun and easy-to-do. They encourage families to take children outdoors in ways that are exciting, safe, and full of learning.

Build a Garden: Have your child design a small garden and plan where they want to plant. Have them care for the plants and document change over time. Then use the fruits and veggies grown to make a meal or two.

Read: *Ten Seeds* by Ruth Brown.



WHAT ARE EFFECTIVE WAYS TO HELP YOUNG GIRLS ASK OPEN-ENDED QUESTIONS?

Before children can verbalize their wants and needs, they cry to express a need; later, they may point to communicate. This is a great time to start to model different types of questions. When children start speaking, they want to know what things are called and start asking convergent questions, or those that have a clear answer. For example, a girl may ask what day of the week today is, or if it's sunny outside. These types of questions, while essential, are called closed-ended questions and they do not provide opportunities for deeper thinking. To develop the deeper thinking skills of a future scientist, adults can also introduce girls to questions that do not have a right or wrong answer. These are called divergent questions, or open-ended questions. Children at this stage love “why” questions and “What’s this” questions. Take the opportunity to explore together to find answers.



START HERE!

For ideas on different types of questions visit Desired Results – Open-ended Questions in English and Spanish as well as other helpful [resources](#).

Open-ended questions are questions that have multiple answers and can be answered in multiple ways. This type of question stimulates children to use more language, see multiple ways of solving problems, and encourages creative thinking. This resource suggests educators and caregivers ask questions such as “What does this remind you of?” and “What would happen if...”

The Boston Children’s Museum [STEM Sprouts Teaching Resource Guide](#) also has good examples of “what” questions that can help children deepen their thinking. Question examples include “What do you notice about how it’s moving?” “What else have you seen other kids try?”

Children ask many different types of questions. Adults can also help children ask different types of questions to deepen their thinking and curiosity about the natural world. There are questions with exact answers and questions that require complex answers. There are also questions that do not yet have answers. Parents, caregivers, and educators can foster question development along a continuum of questions that have answers, to questions that children can build on and explore throughout their lifetime. After all, these are the children who we hope will have the drive, the curiosity, and the opportunity to push their thinking to new limits. It is during these children's lifetime that we anticipate and hope to find the cure to global problems such as cancer, global climate change, and tackling the dramatic reduction of global biodiversity. Read the following Try This! section for question ideas.



Children explore what things do, how they move, and what happens when they push, pull, tug, or throw those things. As they enter toddlerhood, children begin to ask lots and lots of questions. Caregivers have the opportunity to stimulate children's minds and encourage them to continue to ask questions.



TRY THIS!

Start with "What" questions.

What do you see?

Younger children benefit from questions that they can answer from direct observation.

You can build on the type of question by asking *What would happen if we....?*

This presents an opportunity to experiment with new tools, materials, or things.

Closed-ended questions

- What day is it today?
- What color is your shirt?
- What would happen if we added sugar to the water?
- What would happen if we mixed the yellow paint with the blue paint?

Open-ended questions/statements

- Tell me about...
- What do you feel, see, hear, taste, and smell?
- What does this remind you of?
- How can keeping our environment clean help us?



READ ALL ABOUT IT!

[*Improve Your Verbal Questioning*](#) by Kenneth E. Vogler⁵

[*The use of productive questions in the early childhood classroom*](#) by Rachel Alice Dengler.⁶

Lift the Flap Questions & Answers by Katie Daynes

The resources listed above focus on questioning strategies that can be helpful for parents and for caregivers working with young children.

WHAT STEM CONCEPTS AND TOPICS ARE RELEVANT FOR GIRLS FROM BIRTH TO AGE 5?

STEM learning happens when children are exposed to key ideas, or concepts, in science, technology, engineering, and math, and as educators help children understand the connections of these ideas to their daily lives. It continues when children build foundational 21st-century skills⁷, such as communication, collaboration, critical thinking, and creativity.⁸ You can find specific STEM standards adopted by the Colorado State Legislature per grade level, starting in [preschool](#).⁹ You can also find examples of developmentally appropriate learning targets through the [National Association for the Education of Young Children](#).¹⁰



READ ALL ABOUT IT!

This is a list of organizations and governing bodies that set recommendations or have a large influence for setting early childhood developmental benchmarks.

- Colorado Early Learning and Development Guidelines <https://www.cde.state.co.us/early/eldgs>
- Developmentally Appropriate Practice: Focus on Preschool published by the National Association for the Education of Young Children. <https://store.naeyc.org/store/developmentally-appropriate-practice-focus-preschoolers>
- *Teaching STEM in the Early Years: Activities for Integrating Science, Technology, Engineering, and Mathematics* by Sally Moomaw. <https://www.amazon.com/Teaching-STEM-Early-Years-Integrating/dp/1605541214>
- Zero to Three <http://www.zerotothree.org/>
- Too Small to Fail <http://toosmall.org/>
- National Association for the Education of Young Children, For Families <http://families.naeyc.org/>
- Colorado Office of Early Childhood. Early Learning and Development Guidelines <http://earlylearningco.org/>



STEM Concepts By Age 5

Concepts are key ideas that children can explore and understand in science, technology, engineering, and mathematics. These big ideas include quantities, numbers, classification, order, shapes, colors, attributes of objects, cause and effect, living things, environment, life cycles, change over time, earth materials, and daily and seasonal changes. Young children can learn about topics like plants, butterflies, simple machines, and weather.

STEM Skills By Age 5

STEM skills are things that children should be able to do. For example, by age five, girls should be able to build structures with blocks; say and follow directions; gather, collect, and describe materials; record information; use tools such as magnifying glasses, scales, and rulers in investigation and play; make and record by drawing, acting out, or describing observations; count and represent objects; match a quantity with a numeral; sort, match, and group shapes; and use words to describe attributes of objects.

STEM PRACTICES

[STEM practices](#)¹¹ are habits of mind that scientists, engineers, people who work in information technology, and mathematicians exhibit. These are special skills that are extremely important to STEM and are also beneficial for other areas of life.

In addition to the skills listed above, STEM professionals:

1. Ask questions and define problems
2. Develop and use models
3. Plan and conduct investigations
4. Analyze and interpret data
5. Use mathematics and computational thinking
6. Construct explanations and design solutions
7. Engage in argument from evidence
8. Obtain, evaluate, and communicate information



While a preschooler may not yet exhibit all the practices above in a formal way, learning to think like a scientist or an engineer starts during these formative years. We can build a solid foundation for young girls to be able to immerse themselves in these practices.

By age five, children can be curious about new tasks and challenges; able to explore and experiment; able to show capacity for invention and imagination; able to ask questions based on discoveries made while playing; able to organize objects in different ways to learn about the objects and group of objects; able to use appropriate mathematics tools strategically; and able to use numbers to count and order objects.



TOOLBOX

Basic Science Process Skills

Observing - using the senses to gather information about an object or event. Example: Describing a pencil as yellow.

Inferring - making an "educated guess" about an object or event based on previously gathered data or information. Example: Saying that the person who used a pencil made a lot of mistakes because the eraser was well-worn.

Measuring - using both standard and non-standard measures or estimates to describe the dimensions of an object or event. Example: Using a meter stick to measure the length of a table in centimeters.

Communicating - using words or graphic symbols to describe an action, object, or event. Example: Describing the change in height of a plant over time in writing or through a graph.

Classifying - grouping or ordering objects or events into categories based on properties or criteria. Example: Placing all rocks having certain grain size or hardness into one group.

Predicting - stating the outcome of a future event based on a pattern of evidence. Example: Predicting the height of a plant in two weeks' time based on a graph of its growth during the previous four weeks.

Excerpted from [Research Matters to the Science Teacher by Dr. Michael Padilla](https://www.narst.org/publications/research/skill.cfm)
<https://www.narst.org/publications/research/skill.cfm>.

Caregivers can encourage these habits of mind by asking questions, fostering curiosity, providing opportunities for exploration, and providing opportunities for children to share what they are learning about the natural world. As girls continue to experience STEM practices, they will see themselves as people who can solve problems, search for information, think analytically, and defend their arguments with reasoning. All this prepares them to solve 21st-century challenges.¹² St. Vrain Spark! Discovery Preschool is one example of a school that helps learners develop STEM skills, learn STEM concepts, and apply design thinking to solve real problems (see Box 1.1).

BOX 1.1. IN THE SPOTLIGHT:

St. Vrain Spark! Discovery Preschool

Since August 2013, Spark! Discovery Preschool has been serving preschoolers in St. Vrain Valley Schools. Spark! Discovery Preschool is a Science, Technology, Engineering, and Mathematics focused preschool. Their STEM model was inspired by a program called Innovation Academy for a Smarter Planet, a unique, multi-year partnership between IBM, CU Teach, Skyline High School STEM, and St. Vrain Valley Schools, which Paige Gordon, Spark! Discovery's Administrator, directed and developed in its first four years of existence.

Spark! Discovery Preschool's mission is to ignite creative thinking, innovation, problem solving, and discovery to encourage every young learner's curiosity and joy of lifelong learning in order to influence an ever-changing world. Preschoolers experience six collaboratively developed units of STEM throughout the two-year preschool experience. These highly engaging units focus on solving relevant problems, integration and connectedness of concepts, the development of STEM-based dispositions (such as risk-taking, empathy, creativity, etc.), 21st-century skills, and inquiry-based learning strategies.



Learn more at <http://sdpk.svvsd.org/>



HOW CAN WE ENGAGE GIRLS IN STEM LEARNING OPPORTUNITIES?

Caregivers play a critical role in exposing girls to STEM learning opportunities and, with knowledge of the opportunities available, can incorporate STEM into everyday activities. Let's look at Maya's interaction with her dad.

Maya, age 5, woke up one Sunday morning and asked her dad to take her to the zoo. Maya wanted to visit the new rhino to see if it was different than the last rhino that was there. Her dad found a list of free days at local museums and zoos that Maya's preschool had provided, and they made a plan to visit the zoo together in a few weeks. In the meantime, they went for a walk in their neighborhood and talked about what the squirrels in the park eat.

Requests like Maya's give parents and caregivers the chance to let their daughters be scientists. At the zoo, Maya will have the opportunity to make new connections to her prior knowledge from previous visits. She is also building a mental log of the animals that come and go and creating

connections between the zoo and other animals that live in the wild around her home. Her animal picture log includes bunnies, squirrels, and a snake (that she's never seen but has collected evidence [i.e. dry snake skin] to support her claim that one exists).

Parents or caregivers can take advantage of the many free days available at local cultural institutions. Mark your calendar and countdown to the date. In Denver, the [Scientific and Cultural Facilities District](#) offers a calendar that lists free days at the Denver Zoo, the Children's Museum, and other places.



TRY THIS!

- Study a snake skin if you come across one. Then, observe, discuss, and record other animal signs such as scat, chewed bark, and tracks.
- Observe and document a plant's life cycle.
- Take a hike and find one plant that you want to observe four times in one year (ideally as the seasons change).
- Visit Project Budburst Buddies at <http://budburst-buddies.org/journal-pages>. You will find games and activities that you can do with your little one. Or, you can fulfill the citizen science component by contributing your data under "report what you saw" at Project Budburst's website. You can also use this plant log with a bulb (paperwhites, tulip) to track the life cycle of a plant, although you might not be able to contribute that data to the site.
- Ask your daughter to draw her observation and you help her label the parts that she sees and any other observation she wishes to document. As she develops fine motor skills and learns to write, she will be able to label the diagram on her own.

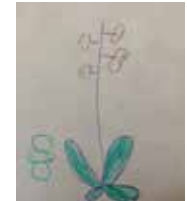
Prompt:

Draw what you see.



Prompt:

Observe carefully.



Add:

Scientific language to create a diagram.



WHAT ARE NUMERACY SKILLS AND HOW CAN WE HELP YOUNG GIRLS DEVELOP THEM?

In preschool, mathematics is best learned as an applied science. Children can experience mathematics throughout the day in many ways. Math lessons that integrate language and vocabulary development can help children recognize and make connections to describe their environment. Mathematical thinking occurs whenever we compare, sort, work with patterns, and identify shapes.¹³

Numeracy¹⁴ refers to basic concepts and skills that relate to quantities. Children have many opportunities to use numbers to represent quantities and to count. These quantities can be represented with a numeral.¹⁵ Girls can use counting to describe the size of our families, how many pets we have, how many books we own, or how many objects are in a bin.

Girls can develop numeracy skills by having fun with numbers. Children as young as two can repeat numbers and their understanding of the relationship to quantity develops soon after. Once children discover numbers, they begin to count everything around them. As they learn to compose numbers, they will make the connection that quantities can be combined to make greater quantities and that's how we add. When we take away a certain quantity, we subtract. Understanding quantities like more or less and heavier or lighter also helps children understand numbers.



Work On Math Skills Together

Help children recognize that math is all around them. For more math ideas, you can visit



(Wikimedia Commons, 2015)

[Developing Early Math Skills](https://www.zerotothree.org/resources/299-help-your-child-develop-early-math-skills)

<https://www.zerotothree.org/resources/299-help-your-child-develop-early-math-skills>

Peel a clementine and separate all the slices. Count them with your child before she starts to eat them. Count the slices each time she eats one.

You can do this activity with any fruit or vegetable that has slices or that can be sliced into multiple pieces.

Introduce the concept of zero. Zero is when we do not have any quantity present.

Recognizing that numbers are all around us and that quantities help us understand our world are critical foundational skills in STEM. In addition, children need to have opportunities to measure objects, and to observe shapes in our world and describe them in relation to one another. Having a good grasp of numbers can help children count sides of shapes and classify them based on attributes. Classification also plays an important part in pattern recognition. Young children can follow patterns, such as $\triangle \triangle \blacklozenge \triangle \triangle _ _ _$, and predict the sequence of shapes. You can also make connections to pattern recognition in music.

Caregivers may not always feel comfortable with the idea of teaching mathematical skills and concepts, however, many parents and caregivers already do! Parents, caregivers, or educators with less confidence in their abilities or less information about teaching mathematics may benefit from additional training. Community organizations that work with caregivers/parents or educators have the opportunity to provide ideas and examples of how to foster mathematical thinking and scientific literacy in the early years. Examples of organizations providing STEM professional learning include Denver's Early Childhood Council [workshops](#) and Zero to Three's [math and science resources](#).



TRY THIS!

Create a pattern. Use blocks or beads to create a pattern and have your child finish the pattern and explain it to you.

Go for a walk. Find a pattern in nature.

Cook a meal together to enhance STEM skills and interest. You can practice measurement, estimation, planning, collaboration, and learn about concepts such as changes in matter, heat, mixtures, and solutions. <http://kidshealth.org/en/parents/cooking-preschool.html?WT.ac=p-ra>

Read. *The Cooking Book: Fostering Young Children's Learning and Delight* by Laura J. Colker.



Natural connections between STEM disciplines and art and creative expression have created an opportunity for STEAM education. The addition of the “A” to the STEM acronym acknowledges that there is a special place to provide opportunities that foster out-of-the-box thinking and expression. An example of an organization that has embraced the STEAM approach is PBS (Public Broadcasting Service) through their early childhood programming (See Box 1.2)

BOX 1.2. IN THE SPOTLIGHT:

Fred Roger's Approach: From STEM To STEAM

Fred Rogers naturally integrated STEM concepts in his PBS program *Mister Rogers' Neighborhood*. His goal was to help children understand more about themselves and the world around them. His legacy lives on with new programs: *Daniel Tiger's Neighborhood*, *Peg+Cat*, and *Odd Squad*. Sesame Street is also embracing the STEAM approach.

<http://www.fredrogers.org/professional/video/steam/>

These programs focus on developing 21st-century skills using everyday moments such as singing in the rain and starting with the ordinary.



TRY THIS!

STEM Learning All Around

Make your own “Ways to play” list. For help getting started, check out <http://www.bostonchildrensmuseum.org/learning-resources/100-ways-play>.

Whole body movement. Show your child how to move her body to mimic the movement of leaves, machines, or other objects. Whole body movement, including yoga, is also a great way to learn math concepts and skills. There are free activities to get started. Read more at <http://www.mathandmovement.com/whatis.html>.

Create a makerspace. Set aside an area in your home with materials that can be used to design and create. Have basic tools such as scissors, tape, glue, and plenty of materials such as toilet paper tubes, cardboard/cereal boxes, egg cartons, and other common household items and let girls tinker with them. For ideas on how to start visit <http://www.naeyc.org/tyc/making-young-learners-intro>.

Read. *Rosie Revere, Engineer* by Andrea Beaty. <https://www.amazon.com/Rosie-Revere-Engineer-Andrea-Beaty/dp/1419708457>.

WHAT ARE SPATIAL REASONING SKILLS AND HOW CAN WE HELP GIRLS ACQUIRE AND PRACTICE THESE SKILLS?

Researchers have identified spatial ability as an area in which girls oftentimes lack confidence and ability. Spatial ability or spatial reasoning is the ability to manipulate objects in our heads. By five, girls should have many experiences and opportunities to describe shapes and space. Spatial awareness is one component of spatial reasoning that may facilitate future learning of STEM concepts.¹⁶ Girls and other students from groups historically under-represented in STEM fields may show a disadvantage in spatial reasoning abilities when they enter STEM fields. However, these are skills that can be taught starting at a very early age. When building with blocks, a young child develops the ability to see an object through multiple perspectives – from the top or bird's eye view, from the left side, from the right side. Later in life, this young girl will have the ability to “turn” the object in her mind—a skill that is essential in the physical sciences and engineering.

For an in-depth exploration of spatial intelligence or spatial reasoning, visit [Parenting Science](#).¹⁷ The authors note that improving spatial reasoning abilities is correlated with the ability to develop strong arithmetic skills in primary school.¹⁸



TRY THIS!

Use positional words to describe place or location of objects. For example, instead of saying "I need a cup," be more specific by describing location and say, "I need the cup that's on the table."

Positional words include the following: up/down, slow/fast, here/there, over/under, right/left, back/forth, first/last, in/out, and below/above.

Play With H₂O

Playing with water provides great sensory experiences and opportunities to practice positional words. If playing in the tub, use a toy to practice positional words such as under/over, on/in, inside/outside.



TRY THIS!

Give verbal directions to your child (4-5 years) to follow.

1. Have her go get an item from a location in the house.
2. Have her go outside and get an item for you. Keep an eye out if you are concerned for safety reasons.
3. Gradually increase the complexity of the directions to help her develop the ability to follow them. (Put the object in the bag, on top of the bag, under the bag, etc.)

Take turns. Have her give you directions to find an object.

Co-pilot: Ask her to give you directions on your way to and from school.

Teach her your home address and have her draw a map.

Note: younger children can follow one- or two-step directions, while older children will be able to follow multi-step directions.



EXPOSURE TO STEM PROFESSIONALS

Preparing young girls to experience concepts and skills in STEM is one component of quality STEM learning experiences. Girls also need to have opportunities to see STEM professionals as part of their communities and their lives. Schools often give girls the chance to meet professionals and learn about their communities. They may learn that firefighters help keep our cities safe, doctors and nurses help keep us healthy, mail carriers help move communication and packages, and teachers help educate our children. However, girls less often have the opportunity to meet STEM professionals outside the healthcare field, such as engineers who design roads and bridges, engineers and architects who designed their schools, and software developers who create the apps they love to use on smart devices.

WHY DO GIRLS NEED TO BE EXPOSED TO WOMEN STEM PROFESSIONALS AT THIS EARLY AGE?

Exposing children to STEM professionals who are women can help kids see established versions of who a STEM professional can be. By starting at a very early age, children grow up with a more inclusive mindset about access to STEM careers. Women in STEM will be common for young girls to see instead of outlier examples.



TRY THIS!

Invite researchers, engineers, and computer scientists, in addition to police officers, firefighters, and nurses to come talk to students during community-themed units. This is a great way to expose girls to a variety of STEM professionals. If you have the opportunity to take young kids to community sites, visit places where you typically find STEM professionals. Visit a lab, an engineering firm, or a research university.

Parents play an important role in recognizing their daughters' abilities to succeed in STEM. Mothers can be very effective STEM influencers for their daughters and help their daughters develop a science persona. When a girl sees her mother interested in STEM experiences herself, the daughter will see herself as a STEM learner, too.

WHY DOES IT MATTER IF YOUNG GIRLS ARE EXPOSED TO STEM PROFESSIONALS FROM DIVERSE GROUPS WHO HAVE HISTORICALLY BEEN UNDER-REPRESENTED IN STEM CAREERS?

Encouraging Play Across Genders And Across Cultures

Girls need to see a wide variety of STEM professionals from all walks of life. Their own identity as a future STEM professional may be influenced by seeing people who look like them, in gender, ability, and in ethnic or cultural diversity. The famous draw-a-scientist test, in which children are asked to draw a scientist, shows the persistent stereotype of a scientist as a white man with crazy hair and a lab coat.¹⁹ By exposing students to scientists of different backgrounds, we can help expand the definition and image of scientists to be more inclusive of women and people of color.

Recognition by peers that girls, including girls of color, are capable of succeeding in STEM professions is a critical component of identity development. At an early age, children need to see diverse people as creators and doers and learn how their work as STEM professionals makes our communities better. When girls see and interact with professionals from a variety of backgrounds they can broaden their understanding of STEM professionals and this helps to reinforce their own STEM identity.

Chapters 3, 4, and 5 have additional resources on connecting girls to STEM professionals from diverse backgrounds. Try starting with your local community and then reach out beyond your community to create special events to promote girls in STEM.



The Gendering Of Toys

Over the past forty years, toys have become more segregated into “boy toys” or “girl toys.” When [selecting](#)²⁰ toys for your early learner, make sure you select based on the opportunity for learning rather than based on gender labels. Question the intent of the toy. Be selective. Purchase toys that help develop spatial reasoning skills and let children create patterns, build, count, and sort. Select puzzles with pictures that probe deeper thinking and question development. Focus on toys that develop children's physical, cognitive, academic, musical, and artistic skills.²¹ These types of toys tend to be gender neutral, or not gender-typed.

Young children's innate curiosity, originality, and creativity can be developed through play using toys and further enhanced using technology. [LEGO](#)²² provides tools that can be used in the preschool learning space to get girls thinking creatively and to promote math and science skills.

My Toddler Can Use A Smartphone!

Young children are part of a technological world. Children as young as 1 or 2 have learned to swipe across smartphone screens or digital pads. Technology expands the range of tools available for children to seek information, to solve problems, to perform transformations, and to learn at their own pace.²³ Technology is here to stay. There are ways we can use these resources to develop STEM skills in young children.



“Young children are part of a technological world.”



TOOLBOX

Tips On Using Technology

- **Be intentional.** Choose apps carefully before downloading them. Set time limits, too. Apps that inspire learning include apps that teach children how to count, sort, and classify. There are apps that develop problem solving abilities where children have to come up with a plan to make something happen, for example, to get through to an object by cutting or manipulating objects. Technology games can also be used to arrange and position objects to develop spatial awareness.²⁴
- **Make it a quality time experience.** Interactions between child and parent are better than children's independent use of technology.
 - Lydia Plowman and her research team have studied the use and impact of technology for 3- and 4-year-olds at home.²⁵ The authors present a framework of four areas of learning that could be supported by technology: acquiring operational skills, extending knowledge, and understanding of the world, developing dispositions to learn, and understanding the role of technology in everyday life.²⁶
- **Be equitable.** Caregivers and educators making technology available in learning spaces should make sure that both boys and girls have equal opportunities to interact with the devices.²⁷
- Don't just consume. **Create.** Read the following section for more details.

Moving From Consumers Of Technology To Creators

To move from consuming technology to creating it, children as young as four or five can begin to understand coding skills and create programs. [Technology in Early Childhood](#)²⁸ is a site that has a wealth of information to help children develop skills and abilities so that they can write their own programs. Immersing children in technology does not have to mean negating play or outdoor experiences; it can be an additional way to help children develop thinking skills.



Community Organizations

Colorado is home to many community organizations that serve as partners in STEM learning, such as the Denver Zoo, the Children's Museum of Denver, the Denver Museum of Nature and Science, and the Fort Collins Museum of Discovery. There are also smaller organizations across Colorado such as Walking Mountains Science Center in Avon or the Poudre Learning Center in Greeley. To learn more about community organizations and programs in our state, visit the [Colorado Collaborative for Girls in STEM](#) (CoCoSTEM). This site will link you to

[The Connector](#), which is a comprehensive list of STEM opportunities for all ages. If you work with an organization that serves girls in STEM that is not yet listed, please register so our community members can know about the opportunities offered.

Often, STEM opportunities can be found at local libraries, colleges and universities, and right in your own backyard through organizations such as the [Girl Scouts](#), or the [Boys and Girls Clubs of America](#). Other organizations offer camps during school breaks or over the summer.



TRY THIS!

Computer Science Related Resources

- Check out PBS KIDS Super Vision. This is PBS KIDS' second app designed specifically for parents. PBS Parents Play & Learn, also available for free, offers parents simple activities that they can do with their kids to support math and literacy around specific locations such as the grocery store or the park. PBS KIDS also offers more than 30 apps for kids, designed to help build literacy, math, science, and school readiness skills and more. More information about PBS KIDS' apps is available on pbskids.org/apps.
- Expose children to coding at an early age. Check out the Code-a-Pillar <http://www.theverge.com/2016/1/5/10716994/fisher-price-thing-and-learn-code-a-pillar-toys-2016>.
- There are also other apps that teach logic to early learners such as Lightbot <https://lightbot.com/> and Kodable <https://www.kodable.com/>.



BOX 1.3. IN THE SPOTLIGHT:

Children's Museum of Denver

The museum creates extraordinary experiences that champion the wonder and joy of childhood. The [exhibits](#) are organized around major concepts that are essential to child development – explore, imagine, investigate, and create.²⁹ Visitors will find dozens of ways to build STEM practices and abilities through play.

Check the Children's Museum's website for a current schedule of free days.

Learn more at <https://www.mychildsmuseum.org/>



TRY THIS!

A Day At The Children's Museum

You made it to the museum and you're not quite sure what to do. Now what?

Try a little acting: Dramatic play at the museum – take on roles as scientists, astronauts, and engineers.

Try using your body: Have your child use whole body movement to practice positional words or by using other objects in the museum.

Try exploring science concepts: You can learn about balance, gravity, and force all in one place.

Try developing questions: Use these sentence starters: I wonder how... What do you think... What does __ do? What would happen if we__?

Most importantly, have fun while learning together!

Learning in early childhood happens constantly, through exploration, play, and daily activities. Caregivers, educators, and community organizations all have the opportunity to help girls build STEM skills and see themselves as creators, designers, and thinkers. By building a solid foundation, we hope that girls will be ready for the next stage in their STEM development trajectory.

“Learning in early childhood happens constantly, through exploration, play, and daily activities.

Have fun while learning together!”

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