

LET'S TALK, READ AND SING ABOUT STEM!

TIPS FOR PRESCHOOL TEACHERS & PROVIDERS



From birth, children are curious. You can build on that natural curiosity by developing their interest in **science, technology, engineering and math (STEM)**. Use daily routines to build on skills and concepts in math and science. By talking, reading, singing, playing, signing or using other ways to communicate – whatever works best for your preschoolers – you can help develop their STEM skills through play and exploration. Easy ways to promote young children’s natural abilities as scientists and engineers is by encouraging them to document their observations by drawing, painting, or recording their voices describe what they are noticing; constructing towers with blocks or other objects; and talking about the changes in nature – like the weather!

Use the **bold STEM words** in these tips to build **early science, technology, engineering, and math skills** with young children every day. It’s never too early to start! Research shows that having a strong foundation in early math, for example, can lead to higher achievement in both math *and* reading later in school.¹ In addition, interacting with many different materials in early childhood prepares students for science and engineering later in school.

Partner with families and encourage them to try these strategies at home, including in their home language. Demonstrating the value of a child’s home language is critical for fostering a strong sense of self, and research has shown that students who are bilingual have certain cognitive and social benefits that facilitate success in school and life.²

For children with disabilities or developmental delays, communicate with other service providers and keep each other informed about the strategies you are using to make their language environment richer.

While we provide some tips below, we know every child is unique, and it is important to keep in mind that no 3-, 4- or 5-year-old is the same. As always, you should do what is best and most developmentally appropriate for each child.

WHAT IS STEM?

“STEM” stands for **science, technology, engineering and math**. STEM can refer to the subjects individually or one or more working together, but can also mean a way of doing things that includes solving problems, asking questions, and exploring the world around us.

For example, children learn about the concept of technology when they’re exploring tools or simple machines and investigating how they work. These can be items they use every day like a pair of scissors, or things they might see like the wheels of a car as they walk outside.

For young children, we focus on STEM through exploration, play, and building curiosity about the natural world and the way things work. STEM learning is important for everyone and can happen anytime, anywhere. The real-life skills that people develop when learning STEM help make everyone better problem-solvers and learners.

For children who are learning English as an additional language, talk about **STEM** in the children’s **home language**, in English, or both. Research shows that bilingual children have greater mental flexibility, which may be helpful in understanding math concepts.

Source: Zelasko, N., & Antunez, B. (2000). If your child learns in two languages. National Clearinghouse for Bilingual Education.

LET'S TALK STEM TIPS

STEM is about discovery. Be co-discoverers with your child! For many adults, STEM can be intimidating, especially if they didn't have much exposure to math or science as a child or found it difficult in school. STEM is about **exploring the world** around us and **asking questions** about **how or why something works**. It's a lot of what you, as a teacher, are already doing. Children are great at this! As their partners in learning, you can make STEM part of children's intentional play activities. Remember what it was like when you were younger (or even now) to look at the world with wonder and awe – that's what children need to be encouraged to do. It's helpful for adults to remember how amazing the world can be and make time to explore it too!

- **Use math concepts to talk with children.** Point out the **rectangular** side of a truck and the **circle- or triangle-shaped** sign as you wait at the bus stop or walk down the street. Help children **count** the number of students in class each day and compare that to how many are absent or **sort** a variety of everyday objects according to **size, color, shape** or **type**.
- **Look at the world around us!** Observing is important in science. Communicate throughout the day about what you **see, feel, smell, taste** or **hear** and ask students to describe the world as they observe it:
 - “Wow that is a **tall** tower! **How many** blocks did you use to make that structure? **1, 2, 3, 4.** You used **four** blocks to make that tower.”
 - “Do you have your raincoat and umbrella today? How does the raincoat protect you when it is cold and raining?”
 - “I noticed how you drew a **triangle** on top of the **square** to make a structure with a roof. How are those two shapes different?”
- **Ask open-ended questions.** Ask children to wonder about the world around them using phrases like “**What would happen if...**” Or “**I wonder...?**”
 - “I wonder if we can build a tower out of marshmallows or sticks;”
 - “What would happen if it started raining on our walk to school?”
 - “I wonder why the leaves are turning yellow and brown.”
- **Follow the child's lead.** Observe children closely and see what they are looking at, pointing to or seem curious about. STEM is about **exploration**, and when children make their own discoveries, they are making guesses or hypotheses while learning to make sense of the world around them. This empowers them to continue this type of exploration outside of the classroom.
- **Learn along with children!** You don't have to have all the right answers to help children learn about STEM. You can respond by saying, “That's a great question. How could we find out together?” It's also okay if students give answers that aren't quite right. Ask them to explain their thinking and you might find a really interesting explanation. Communicating and trying to make sense of the world – even if you don't have all the correct answers – are important STEM skills!
- **Use books.** Incorporate books about animals, nature and science. You can use STEM words during reading time to build vocabulary. Ask preschoolers if they can spot a mammal with sharp claws, an insect with six legs, or a tree with yellow flowers.
- **Sing!** Songs with repetitive **patterns** like “Old MacDonald Had a Farm,” “Wheels on the Bus,” or “Los Cinco Hermanitos,” teach children about patterns and other STEM concepts. STEM Concepts & Activities

MEASUREMENT

Children develop **measurement** skills as they explore **size, length, height** and **weight** of people and objects. For example, when children describe a baby sibling, they may say their sister is **little** and they are **big**. Encourage preschoolers to compare objects by **size, weight, length**, and other attributes. Ask them to order a set of objects by size (**smallest** to **largest**) or by length (**shortest** to **longest**). You can help children learn about measurement by asking questions like “Who is **taller**?” and “Which ball is **heavier**?”

- Children can explore and measure everyday objects together using conventional tools like rulers and a scale. They can even use non-standard instruments. For example, they can use crayons or paper clips to measure how **wide** the table is. Is it 10 or 12 crayons wide? Use a child’s feet to measure the distance from the door to the bathroom. This kind of informal measurement helps children build their skills.

COUNTING, ADDITION & SUBTRACTION

You can lay the foundation for **addition** and **subtraction** – and, much later, multiplication and division – by **counting** with children using everyday objects and throughout the day. Point out how to add by combining objects and subtract by removing objects.

- Asking specific questions can help develop in the child the concepts of **more** or **less, how many more** are needed, or how many are **left over**.
- Questions like:
 - “**How many will be left if we take one away?**”
 - “**Could we count to find out?**”
 - “**How many** forks, napkins and spoons do we need to make sure **each person gets one?**”
- To lay a foundation for later understanding of base 10 and place value, begin to **count by twos, fives, and tens**.
- Sing simple **number songs** and **nursery rhymes** like “Counting in Twos,” “One Banana, Two Bananas,” “Five Little Monkeys,” and “Tres Pececitos.”

- When outside with children, ask them to count **how many** trees, cars or houses they see. Then count the objects by twos.

SPATIAL RELATIONS

You can help children develop **spatial relationship** skills by having them **compare** shapes and sizes of objects, space and positions like **on top of** and **under**, and direction and movement—following and predicting the path of a moving object, like a rolling ball for example.

- To teach spatial awareness, have students play with puzzles, and help them recognize which pieces **match** which spaces. Ask questions that direct their focus, such as “Should that piece go at the **bottom**? The **corner**? To the **right**?”
- Help guide their activity as you play with them. Have them count blocks **as they stack them**. During outside play, ask children to describe something that is **far away** from them. Ask what is closest to them? Ask them to point out other objects that are **near** or **far**.

SHAPES

Talk with children about the names of shapes and what makes them different (e.g., rectangles, hexagon or pentagon). Sort the shapes into groups according to their qualities and by their shape (e.g., shapes with four sides, shapes with four equal sides or shapes with angles).

- Explore shapes at learning centers or use manipulatives. Touching and playing with different shaped objects gives the child a sense of similarities or differences in shapes. Ask children to **describe** the attributes of each shape. Ask, “Can we roll or slide this shape?” “Which shapes are good for building?” This play teaches early **engineering** and **technology** skills!
- Use every opportunity to identify shapes. At snack time or when out walking, have children identify shapes. Ask, “What shape is that door?” or “What shape is that sign?” Compare shapes by asking what details the different shapes have that make them the **same** and makes them **different**. Have the child sort objects by their shape.

PATTERNS

A pattern is something that repeats more than once. Help children learn **patterns**, both with human-made and natural objects.

- Routines help preschool-aged children feel safe and secure, and also build an early understanding of patterns.
 - Develop daily routines for preschoolers to show a pattern.
 - Share songs that have **repetitive patterns**, like “Old McDonald Had a Farm,” “Juanito Cuando Baila,” and “Un Elefante Se Balanceaba.” Try rhymes with hand movement patterns, like “Head, Shoulders, Knees and Toes.”
- Make a **pattern** with coins. For example, lay out a penny, nickel, penny, nickel, penny, and nickel. As you make the pattern, ask, “**What comes next?**” Have children make their own patterns using coins or other manipulatives.
- Extend the patterns to science. Bring in objects from nature such as leaves, pinecones, and rocks or from the grocery store such as apples, oranges, pears or pictures and ask children to tell you **what patterns** they see. During outdoor time or on walks or field trips, ask children to identify **patterns** they see – either in nature or human-made. Some of these might be things they can see (shapes, colors) or things they can hear (bird calls, sirens).



OLD MACDONALD
HAD A FARM...

EARTH, PHYSICAL, AND LIFE SCIENCES

Children are naturally inquisitive and try to make sense of the world – like scientists. It’s never too early to start practicing basic science skills like **observation, prediction, and using evidence to support answers**. Preschool is also a great time to begin learning about scientific content like **weather, energy, ecosystems, plants, animals, motion, stability and life cycles**. For additional ideas and activities, make sure to download the [Helping Your Child Learn Science toolkit](#) (also in [Spanish](#)).

- Join your preschoolers in discovering the world! **Observing** is important in science. Have students draw interesting objects they observe and to describe what they see. Play “I spy” to give students the opportunity to **observe the world** around them. Look up at the clouds and talk about what they look like. Through “I spy,” children begin to build an understanding of what objects occur in nature and what objects are man-made. As one of your clues, share whether it is a **natural object** or a **man-made** one.
- Try an **investigation** together! Mix different colors of paint together to see what new colors you can create. Find simple recipes on the Internet and use household items to make gooey substances like oobleck, playdough, silly putty or slime. Talk about how these items **feel, look** and **smell**. As you make the recipe, use math words like **first, second, and third** to describe steps in the procedure. Talk about **measurements** as you use tools like measuring cups or spoons. Talk with children about how the ingredients **combine** as they are mixed together to make something new.
- Make a **weather chart** together. Discuss your weather chart and read books on weather that tell about rain, snow and clouds. Ask students, “How does weather affect daily activities?” Ask, “What should we wear when it rains? Snows?”
- Discuss different types of **animals** and **plants** with students and ask them to share about the plants and animals they know about. Talk with children about **habitats** of the animals and plants: where they live, what they eat, what they need to stay alive and the impact they have on the world.

- **Compare and contrast** the needs of one animal to the needs of another animal to start building an understanding about what plants and animals need to survive or how they might change to meet their needs. For example, “I wonder if bears could live at the **beach?**” or “I wonder if a fish could live on **land?**”
- Take walks to **observe** and **describe** the plants and animals that live in your local environment.
- Talk with children about their own homes and habitats.
- Begin to introduce the concept of **force** to your students by examining what happens when you **push or pull** an object. Use the swing set to examine what happens when you push **gently** or push **harder** – how **high** do you go? Ask your students to explain why they think that happens.

ENGINEERING SKILLS AND CONCEPTS

Children can explore early engineering skills through **building models, trying out new ideas,** and **designing structures.**

- Ask children about their environment – like a playground. “What **material** can we use to sit on the slide to make us go the **fastest (e.g., cardboard, newspaper, pillowcases, carpet squares)?**”
- Introduce engineering to your students by giving them loose materials such as cardboard, tubes, string, fabric and tape to **build, create** and **problem-solve together.** You can also provide simple **tools** and **machines** like **scissors, rulers, and wheels.** Give them a prompt and watch them be creative! You might ask them to build something they think could ride to get to school or help **transport** materials from one place to another. Then ask them to **explain why** they chose to build their design the way they did and what tools they used to make it easier. Then have them test out their idea. Depending upon the results, you may want to have students **redesign** and rebuild their creation. Redesign is an important piece of engineering.

TECHNOLOGY

Explore **technology** with children by observing and using simple **tools** and **machines** you find around you.

- Using toys, ask children to sort objects by those that have **wheels** and those that do not. Take the wheels off a toy car or find a broken one so children can explore or compare function. Ask “Where else can we find wheels and why are they important?”
- Let children explore tools like **screwdrivers** and **hammers** used to attach things together (plastic bottles, doors, chairs, etc.). Set up for children a problem to solve but without the use of the right tool (e.g., clean up sand table area without a broom or try to cut paper without scissors) or have children use the “wrong” tool for the job (e.g., a fork to eat soup or scissors to paint). This helps children focus on the function of the “best” tool and about other ways to solve the problem and teaches children about the purposeful structure and function of different tools.
- Have children write, dictate or draw step by step directions on how to do a task. This is a foundation of programming.
- Integrate technology devices appropriately into play and learning experiences, such as calculators, cell phones, tablets and personal computers to help children understand that these can be tools to learn, solve problems and gain information. Sometimes, they can save time or provide a different way of doing something and requiring new skills (e.g., drawing a picture, completing a puzzle, adding and subtracting).



You can find more tips like these—as well as videos, information, and more—at [Too Small to Fail](#) and [Let's Talk about Math](#). Other early childhood STEM resources can be found at the [Early Childhood Learning & Knowledge Center](#). Track the development of the children in your program and encourage families to do the same by using the [Milestones Moments Booklet](#). If you have concerns about a child's development, including their language development, talk to the child's family about it. Ask them if they have concerns and if they observe the same issues at home. With their permission, conduct a developmental and behavioral screening and encourage them to talk to their primary care provider.

For more information on developmental and behavioral screening, visit [Birth to Five: Watch Me Thrive!](#) and [Learn the Signs. Act Early](#). For more information on early learning, please visit the [National Center on Early Childhood Development, Teaching, and Learning \(NCECDTL\)](#), [Head Start's Center on Quality Teaching and Learning](#), [Early Head Start National Resource Center](#) and the U.S. Department of Education early learning webpage.

For more information on working with young children who are learning more than one language, please visit [Head Start's National Center for Cultural and Linguistic Responsiveness](#) and the [National Clearinghouse for English Language Acquisition \(NCELA\)](#). For more information on making the language environment richer for children with developmental disabilities or delays, please visit the [Center for Early Literacy Learning](#), and [Facts about Developmental Disabilities](#). For resources on building language, see the [Talk, Read, and Sing Together Every Day!](#) tip sheets.

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NOTES

1. K. Denton and J. West, "Children's Reading and Mathematics Achievement in Kindergarten and First Grade (Washington, DC: U.S. Government Printing Office, 2002). A. Claessens and others, "Kindergarten skills and fifth-grade achievement: Evidence from the ECLS-K," *Economics of Education Review* 28(4) (2009): 415–427. G. Duncan and others, "School readiness and later achievement," *Developmental Psychology* 43(6) (2007): 1428–46.
2. Diaz, R. (1985). *The intellectual power of bilingualism*. In Southwest Hispanic Research Institute, *Second language learning by young children*. Albuquerque, NM: University of New Mexico. Zelasko, N., & Antunez, B. (2000). *If your child learns in two languages*. National Clearinghouse for Bilingual Education. Retrieved from http://www.ncele.gwu.edu/files/uploads/9/IfYourChildLearnsInTwoLangs_English.pdf

