



CHILDREN'S  
HOME  
SOCIETY OF  
CALIFORNIA

SCIENCE TECHNOLOGY ENGINEERING MATH

# STEM



*Making Connections in Learning*

# SCIENCE



## WHAT DOES S.T.E.M. MEAN?

The acronym S.T.E.M. stands for Science, Technology, Engineering, and Math. The term S.T.E.M. originally came from the National Science Foundation (NSF) and was used by the United States government to describe careers that made it easier for immigrants to get work visas. It is currently used by educators to describe learning experiences where the concepts of science, technology, engineering, and mathematics are integrated or connected to each other.

## WHY IS S.T.E.M. IMPORTANT?

Children develop their curiosity and critical thinking skills by exploring S.T.E.M. activities. The largest amount of employment growth both world-wide and in the United States is in careers that rely on degrees in S.T.E.M. fields. This includes jobs in the medical field, mechanical engineering, computer programming, and software development. New advances in these careers will depend on workers who are curious critical thinkers.

## HOW IS S.T.E.M. TAUGHT IN THE CLASSROOM?

Many early childhood programs and public schools from kindergarten through high school have adopted S.T.E.M. learning as part of their philosophy, curriculum, and evaluation. Teachers may design the room for more connected learning, develop activities that promote skills in all four areas of S.T.E.M., and use observations of S.T.E.M. work to check children's learning. Some schools have also added letters to S.T.E.M. to describe the areas of learning that are the focus of their program such as S.T.E.A.M. for science, technology, engineering, arts, and math, or S.T.R.E.A.M. for science, technology, reading, engineering, arts, and math. Talk to your child's teacher to find out how S.T.E.M. is taught in their program.

**Scientific inquiry** describes the skills children use to learn about the natural and physical world. Children observe, question, describe, measure, compare, contrast, and classify to organize information, make predictions, document progress, reflect on their work, and draw conclusions based on evidence. Children use these skills as they learn about the following branches of science.



**Physical Science** involves learning about the properties of objects such as size, shape, rigidity, texture, and cause and effect. Children are learning **Life Science** concepts when they explore and identify natural objects such as rocks, seashells, plants, flowers, trees, water, animals, and insects. When they investigate natural processes such as weather, temperature, or the seasons, they are practicing **Earth Science** skills.



# TECHNOLOGY



Technology is about using tools and solving problems. At first, children need an adult's help to identify problems. For example, "I see a problem. I see that the square block is not connecting to the round block. I wonder if we can work together to solve this." This encourages children to **practice identifying problems and try a variety of solutions.**



Today when we hear the word technology, we think of smart phones or computers, but remember that technology began with the creation of simple tools such as pencils, paper, and the plumbing for toilets.

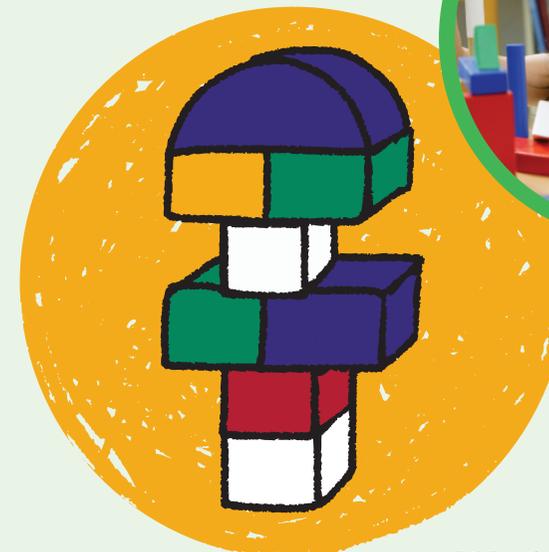
**Technology connects well with physical science and engineering.** Children practice technology by using tools to change or improve what they already understand. This includes using a ramp to make cars race faster, using binoculars to study birds, or using a computer to research or design a project.



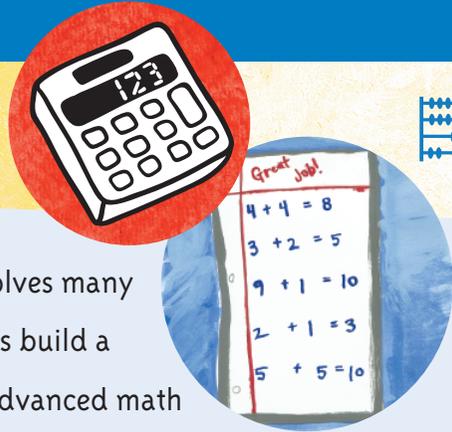
# ENGINEERING



Children learn about engineering when they have opportunities to take things apart to study how they are made and then put them back together. **Engineering involves designing, creating, solving problems, using a wide range of materials and tools, and building things that work as planned.** Engineering requires patience, persistence, and resilience. Through engineering, children learn that mistakes are a way of learning and improving. Children become engineers when they build with blocks, develop new tools, or find ways to improve something that can help others.



# MATH



Learning about math involves many different skills. These skills build a foundation for learning advanced math as children grow. From infancy well into elementary school, children practice working with **numbers**. They count objects, learn the symbols and vocabulary related to numbers, experiment with quantities (less and more), and begin to do **mathematical operations** (adding and subtracting). As children increase their knowledge of numbers, they begin to practice **estimating** (guessing size, speed, distance, or amount accurately).



Math also includes learning about measurement, shapes, colors, sizes, patterns, classifying (grouping similar objects together), and time concepts (past, present, and future). Math is used in science, technology, engineering, art, and reading. Children use measurement, numbers, and charts to do science experiments, calculators and keyboards for technology work, rulers and estimating for engineering projects, lines and shapes in art, and patterns in reading. Math is used every day in many ways.

## TIPS FOR PARENTS

- Materials for S.T.E.M. activities can usually be found around the house, or purchased at a dollar store. Using recycled or familiar items in new ways encourages the very inventiveness and curiosity that is the cornerstone of S.T.E.M. learning.
- Many public libraries have “Makerspace” rooms or events. This is an opportunity for children to engage in making S.T.E.M. based projects.
- When you schedule time for activities with your child it is an opportunity to have fun together and talk. Take advantage of those conversations to teach your child new vocabulary and extend her thinking by asking questions while you play.
- Check out books from the library and read to, or with, your child for fifteen minutes every day.
- Keep in mind that both boys and girls can learn S.T.E.M. skills. It is important to encourage all children to be passionate about S.T.E.M. learning!

## CONVERSATION STARTERS

When you ask questions to get a conversation started, try starting with the words “what” or “how.” Here are a few examples to get you started:

- What do you think will happen?
- How did you make this?
- What patterns do you see?
- How does this work?
- What do you plan to do?
- How will this help people?
- What will you need to make this work?
- How can you do that differently?
- What have you tried?  
(If something is not working)
- How can I help?



## Activities To Do with Your Child

### Activities for Infants (ages 0-1½ years)



- Roll a pair of socks together in order to make a soft ball you can roll towards your infant. She will use her eyes to track it as it rolls, and eventually she will reach for it, shake it, and explore it.
- Wash empty water or soda bottles and allow them to air dry. Fill them with interesting items such as small stones, colored water, dry beans, or dish soap and water to make bubbles. Secure the lids with glue or strong tape and roll them to your baby.
- Save and wash any metal or plastic lids from food containers (discard any with sharp edges). Place them in a bowl for your infant to compare the different sizes, textures, and sounds they make.
- Once your infant starts crawling, create a small obstacle course using pillows or folded blankets.
- Your baby can bang on pots, pans, or plastic bowls with spatulas and wooden spoons to explore different sounds and play music.
- Sing simple songs that have a pattern such as Twinkle, Twinkle, Little Star, The Itsy Bitsy Spider or Row, Row, Row Your Boat.
- Create a busy board for your infant to study when he lies on his tummy. Take a medium to large sized cardboard box and open it up so that it lays flat on the floor. Cut out pictures of scenery, animals, or use copies of family photos. Glue them to either side of the box. Cover them with clear packing tape. Add texture items such as squares of shiny foil, or cut up an old towel and tape down the edges. Cover both sides so that you can change the board easily.
- Collect material scraps. You can ask friends who sew or knit for scraps of cloth and yarn. Try to find varied textures (fuzzy, shiny, or soft). Place the materials in a tub or basket. As your infant touches the fabrics, describe their color and texture to him.

## Activities To Do with Your Child

### Activities for Toddlers (ages 1½ years-3)

- Save empty boxes. These are perfect for stacking, building, or filling and dumping toys. Toddlers will learn about cause, effect, and quantity.
- Place a small amount of water in a large bowl or dish tub. Add basters, funnels, measuring cups, and spoons. Supervise your toddler while she explores volume and measurement. You can also use sand instead of water.
- Create a sensory garden. Plant edible herbs such as spearmint, peppermint, basil, or oregano in low pots. Your toddler can help with planting, watching them grow, and even tasting them. Add wind chimes to build sound awareness and a bird feeder so that they can watch birds and practice visual tracking.
- Take a couple of scarves or long ribbons, play your toddler's favorite music, and dance! Toddlers will practice body coordination, listening skills, and awareness of the space around them.
- Go for a walk outside, or visit a park, and search for bugs and insects with your toddler. You can capture them in a clear plastic container for close up viewing with a magnifying glass. Talk to your child about the way the bugs or insects look and move.
- Children can practice understanding weight and measurement by filling a box with toys and then pushing or pulling the box. They can also fill two small buckets with toys that they can lift, or if you do not have buckets you can stuff toys into adult sized socks and tie the end in a knot. Make each sock a different weight so they can compare them.
- Toddlers enjoy lining objects up. Try giving her colored blocks, or toy cars that she can line up and group together by size or color.
- Teach your toddler how to freeze dance. Start by playing a favorite song, and then stop the music and say, "Freeze!" Explain to him that when the music stops, his body needs to stop. Continue to alternate between dancing and freezing by stopping and starting the music.



## Activities To Do with Your Child

### Activities for Preschoolers (ages 3-6)

- Your child can use a muffin tin to practice sorting or grouping similar objects. She can separate small items by size, shape, or color.
- Save empty spice containers. Soak cotton balls in vanilla extract, lemon juice, grape juice, etc. Place one cotton ball in each container. Challenge your preschooler to guess what she smells. You can make two of the same scent to turn it into a matching game.
- Go on a shadow hunt outside. Talk with her about what is making the shadow and show her how to make shadow puppets on a wall by holding her hands in front of a flashlight (hold up two fingers to make a bunny).
- Make your own bubbles by adding a few squirts of dish soap to a large bowl of water. Try blowing bubbles with plastic fruit baskets, yarn tied in a loop, or pipe cleaners bent into a circle at one end. Discuss which items make the best bubbles.
- Practice scissor skills. You will need child-friendly scissors. Draw straight lines on a piece of paper and invite him to cut on the lines. Next try drawing circles and curved lines.
- When you do laundry ask your child to help sort and fold the socks, and wash cloths, hand towels, and bath towels to practice counting and recognizing sizes, colors, and patterns.
- You can help your child cut old cards or magazine pages into strips, squares, or other shapes to make interesting puzzles.
- Gather empty boxes, plastic containers, paper towel tubes, and other recyclables. Add scissors, tape, yarn, and glue. Invite your child to create whatever she would like.



## Activities To Do with Your Child

### Activities for School Ageds (ages 6-9)

- Build listening, observation, and tracking skills by playing flashlight tag. Play in the evening in a safe outdoor space. Play regular tag, except the person who is "it" tags others by shining the flashlight on them.
- Practice memory and patterning skills by playing hand clapping games. Face each other with your hands up and your palms facing. Design a clapping pattern. Add counting or rhymes as you clap.
- Play a variety of board games and card games with your child. These games build math skills.
- Design the inside of a castle. Use white paper, a pencil, a ruler, and an eraser. Draw squares, circles, rectangles, and hexagons for rooms, with bold lines to indicate doors and windows. Create secret passages and inventions people could use.
- Encourage your child to plan and cook meals with you. Teach him how to read recipes and follow instructions. Try baking breads and desserts too!
- Challenge your child to make a bridge. You need two sturdy bowls, a twelve inch ruler, twenty gumdrops, and forty toothpicks. Turn the bowls upside down and place them ten inches apart. The goal is to make a bridge out of gumdrops and toothpicks that suspends from one bowl to the other without breaking.
- Make a lava lamp. Use a plastic bottle, water, vegetable oil, food coloring, and an Alka-Seltzer tablet. Fill the bottle ¼ full with water, and then top it off with the oil. Watch them separate, and then add several drops of food coloring. Watch it sink to the bottom. Break the Alka-Seltzer tablet in two and drop in half. Once the bubbles start, add the other half and put on the lid. Talk about what you see.
- Start a small garden by growing herbs (mint, basil, or chives) and vegetables (carrots, onions, or peppers) in pots. Observe and care for the garden as it grows, and then enjoy eating the herbs and vegetables.



# S.T.E.M. Project Recipes



The following are recipes for projects that you can make with your child. For the cooking recipes, children a year old and up can help add and mix ingredients, but it is always important to supervise children when working in the kitchen, especially if recipes require the use of a stove or knife.

**Wind Chimes:** You can make wind chimes from recycled materials around the home. You can use a large plastic coffee container or liter soda bottle as a base. Cut holes around the bottom, and two holes at the top. String a piece of yarn from one top hole to the other to make a hanger. Hang a piece of yarn from each hole around the bottom. Children can string plastic beads on the yarn or tie on other recycled items. Paint the finished product and hang it up outside.

**Easy Bird Feeder:** Make a simple bird feeder with an egg carton, scissors, and birdseed. Cut off the lid of the egg carton and set it aside. Punch a small hole into each corner of the bottom tray. Cut two long pieces of yarn. String one piece of yarn from one hole to the opposite hole and secure it. Do the same with the other piece of yarn. Fill the egg cups with bird seed and hang it up outside.

**Books:** You can easily make homemade books with your child by placing your “pages” in a stack and stapling them together down the left side. If you want to avoid staples, then you can also punch holes down the left side and tie pieces of yarn through each hole to secure the book.



**Playdough:** To make playdough you will need: 1 cup flour, 1/2 cup salt, 1 cup water, 2 tablespoons oil, 2 tablespoons cream of tartar, and food coloring. Mix the flour, salt, and oil. Slowly add the water. Cook over medium heat, stirring until the dough becomes stiff. Pour it onto wax paper and let it cool. Knead the dough with your hands until it is the proper consistency. Use as is, or add a few drops of food coloring (kneading to mix it in).

**Ornament Dough:** You will need 2 cups of flour, 1 cup of salt, and between a 1/2 cup and 1 cup of water. Mix the flour and salt in a bowl. Add the water slowly until you have a dough consistency. Knead the dough. Use cookie-cutters or hands to shape the dough. Use the end of a pen to poke a hole through the ornament. Dry ornaments overnight, or bake them in the oven at 300 degrees until they are firm. Paint them and string them on yarn or ribbon. You can also use this dough to cast handprint or footprint ornaments.

**Edible Paint:** To make the paint you will need: 2 cups of cornstarch, 1 cup of cold water, 4 1/2 cups of boiling water, and food coloring. Mix the cornstarch with the cold water and stir. Pour in the boiling water, making sure you stir between each cup. Continue to stir until the mixture melts and begins to have a smooth pudding-like consistency. Pour the mixture into small mason jars and stir food coloring into each jar. Allow it to cool before use.

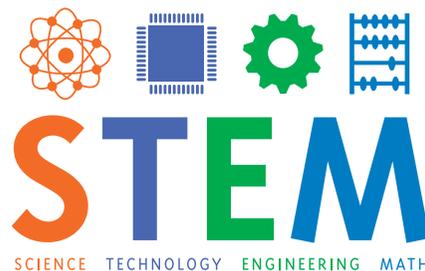
**Edible Glue:** To make this glue you will need 1 cup of flour, 1 1/2 cups of water, 1/3 cup of sugar, and 1 teaspoon of vinegar. In a saucepan mix 1 cup of flour with 1/3 cup of sugar. Add half of the water required and mix into a thick paste without clumps. Pour in the rest of the water and combine until the paste is smooth. Pour one teaspoon of vinegar and put on medium heat until the mixture starts to thicken. Cool and transfer to jar or an airtight plastic container. Store it in the refrigerator for up to six months.

## S.T.E.M. WEBSITES:

- PBS Kids Design Squad Global at <http://pbskids.org/designsquad/>
- Math is Everywhere Tool Kit by Sesame Street at <http://www.sesamestreet.org/toolkits/math>
- Science Kids games and activities at <http://www.sciencekids.co.nz/>
- S.T.E.M. Works resources for educators and parents at <http://stem-works.com/>
- Resource list of S.T.E.M. websites for K-12 at <http://www.mastersindatascience.org/blog/the-ultimate-stem-guide-for-kids-239-cool-sites-about-science-technology-engineering-and-math/>

## TIPS FOR EDUCATORS

- S.T.E.M. activities should incorporate at least three areas of S.T.E.M. For example, if children race cars down a ramp (physical science), they can use a stop watch (technology) to measure time, an rulers to measure distance (math).
- Meaningful interactions with children during play can extend their critical thinking and support learning. Educators can observe children at work and describe what they see or hear to increase the child's understanding or connect concepts. For example, "I see you stacked the red block on top of the blue one. What will you do next?" Ask open-ended questions that can develop into conversations.
- Remember to document children's work. Take photographs and write a few sentences to describe what is happening in each picture. Place the documentation in photo albums for the book area, or create a poster that can be displayed. Documentation is valuable because it captures each child's development and learning, and it is a tool children can use to remember, reflect on, and improve their work.
- Conduct regular self-evaluations. Reflecting on your work and looking for ways to increase your knowledge improves the quality of your program and demonstrates your professionalism. Start with some basic reflections on the environment, curriculum, and interactions such as:
  - Does this space welcome everyone?
  - Are children curious and inspired here?
  - Is S.T.E.M. present in all learning areas?
  - What would I like to learn more about?
  - Are there more ways to extend this?
  - How could I improve this experience?
- Do parents know and understand what skills children are learning and developing?



## Resources for Parents and Educators

### Books for Children

- *Astronauts Today* by Rosanna Hansen (ages 3-6)
- *Built to Last* by David Macaulay (ages 6-9)
- *Discovering Nature's Alphabet* by Krystina Castella (ages 5-9)
- *Eating Fractions* by Bruce McMillan (ages 6-9)
- *Freight Train* by Donald Crews (ages 0-6)
- *How A Seed Grows* by Helene Jordan (ages 6-9)
- *If You Give a Mouse a Cookie* by Laura J. Numeroff (ages 4-8)
- *Look Book* by Tana Hoban (ages 3-8)
- *Mouse Paint* by Ellen Stoll Walsh (ages 2-4)
- *Not a Box* by Antoinette Portis (ages 3-7)
- *Rocks, Fossils, and Arrowheads (Take Along Guides)* by Laura Evert (ages 4-7)
- *Rosie Revere, Engineer* by Andrea Beatty (ages 6-9)
- *Shapes, Shapes, Shapes* by Tana Hoban (ages 4-8)
- *Ten, Nine, Eight* by Molly Bang (ages 3-6)
- *The Dot* by Peter H. Reynolds (ages 4-9)
- *The Most Magnificent Thing* by Ashley Spires (ages 4-9)
- *The Snowy Day* by Ezra Jack Keats (ages 2-5)
- *The Very Hungry Caterpillar* by Eric Carle (ages 0-6)
- *Too Big, Too Small, Just Right* by Frances Minters (ages 2-5)
- *Who Are They?* by Tana Hoban (ages 0-3)
- *Wow! Ocean* by Robert Neubecker (ages 3-6)



### Books for Parents or Educators:

- *A Parent's Guide to S.T.E.M.* by U.S. News and World Report
- *Loose Parts: Inspiring Play in Young Children and Loose Parts 2: Inspiring Play in Infants and Toddlers* by Lisa Daly and Miriam Beloglovsky
- *STEAM Kids: 50+ Science / Technology / Engineering / Art / Math Hands-On Projects for Kids* by Anne Carey
- *STEM Sprouts Teaching Guide* by the Boston Children's Museum is a free book that can be downloaded at <http://www.bostonchildrensmuseum.org/sites/default/files/pdfs/STEMGuide.pdf>
- *Teaching S.T.E.M. In the Early Years* by Sally Moomaw, EdD



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