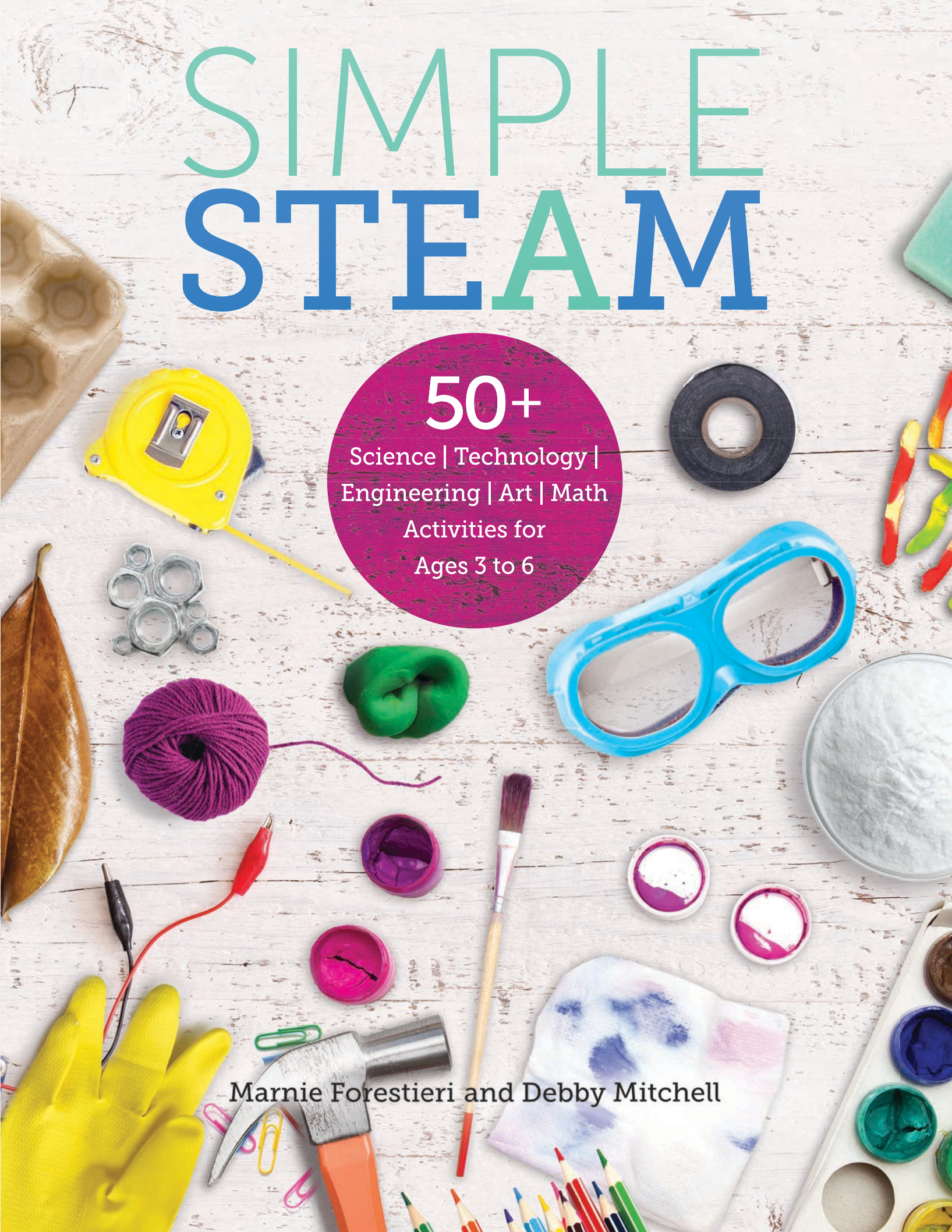
SIMPLE STEAM

50+
Science | Technology | Engineering | Art | Math Activities for Ages 3 to 6



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SIMPLE STEAM

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INTRODUCTION

"Preschool years should be about play, joy, and fun."
—Dr. Deirdre Englehart

You bring a defenseless baby home, and in the blink of an eye your little one transforms into an active toddler, then a persistent preschooler, and ends up becoming a challenging teenager. Some of us enjoy the experience so much that we try it again and again just to realize that it doesn't get easier.

According to the National Scientific Council on the Developing Child at Harvard University, "An 'environment of relationships' is crucial for the development of a child's brain architecture, which lays the foundation for later outcomes such as academic performance, mental health, and interpersonal skills." Neuroscientific contributions translate into positive interactions and resources for parents and caregivers, and with more access to technology at an early age, babies' interests are becoming more sophisticated, the questions are getting harder, and they are more tech savvy! There is no way we will keep up if we don't go back to basics. We are raising children who will have careers that don't yet exist, spell words that are not yet in the dictionary, and be challenged to solve problems we don't even have.

So what can we do to raise children who are excited about the careers of the future? The focus of STEM (science, technology, engineering, and mathematics) or STEAM (science, technology, engineering, the arts, and mathematics) at all levels of education is becoming a popular trend. An increasing number of jobs at all levels require knowledge of STEAM.

For young children, this type of learning is active and fun! Yet, research documents that by the time students reach third grade, one third of boys and girls have lost interest in science. That means millions of students have dismissed these careers or lack the confidence to believe they can do science or math. A weak early childhood experience requires remedial strategies and other interventions that are more costly and less effective.

The Twenty-First Century Movement

Educating children for the careers of the future requires an understanding of the skills that employees need to succeed in the workplace: the twenty-first century skill movement. According to studies from the Programme for International Student Assessments, or PISA, school systems are not preparing students for the abilities and skills that build the foundation for lifelong learning such as problem solving, developing deeper understanding of subjects, or literacy.

The Conference Board, Corporate Voices for Working Families, Partnership for 21st Century Skills, and the Society for Human Resource Management surveyed over four hundred employers across the United States. In a final report, "Are They Really Ready to Work? Employers' Perspectives on the Basic Knowledge and Applied Skills of New Entrants to the 21st Century US Workforce," researchers identified four critical skills required by all employers regardless of the career:

- Creativity
- Communications
- Teamwork/Collaboration
- Critical Thinking/Problem Solving

The good news is that young children are wired with all of the critical skills of the twenty-first century.

Creativity

Young children are not afraid to express themselves and try new things through different mediums or forms of art. Practice makes perfect but does not inspire innovation or creativity. The arts allow children to become original thinkers as they take risks to express themselves in different ways and find joy in their work.

Researcher Karlyn Adams has found evidence that shows that creativity and innovation do not necessarily come from knowledge or experience, but instead derive from people being able to connect to originality, experience joy in their work, and have the passion to pursue a new idea. Adams finds that when students develop their passion, they are more confident and practice important skills such as persistence and risk taking.

Communication Building

Strong communication skills at an early age build a good foundation for future school years and for the rest of a child's life. At an early age, even a quiet child may have something to say when you connect to her. Communication skills are promoted when you build a child's confidence, encourage a child to find her own voice, and provide a variety of experiences to use descriptive words to promote understanding and communicate ideas. Using words, providing a literacy-rich environment, and offering books on STEAM topics provide young children with the tools for expressing their ideas.

Collaboration

Young children enjoy working together to solve a problem or talking with peers to find a solution. Peer-based work is easier with preschoolers as they are natural collaborators. Researcher Robert J. Sternberg has identified three main aspects that make up a positive learning environment: the creative, the analytical, and the practical. A successful learning environment allows children to generate ideas that are novel, lets children judge the value of their own ideas, and helps them understand their ideas as relevant to everyday contexts.

Furthermore, introducing young children to activities related to social and character development, such as empathy, composure, and choice, will allow children to understand the foundation of collaborating with others to achieve a higher purpose.

A gifted child without social skills rarely connects at all levels or comes up with innovations or fixes for problems. It takes a team of people to create something original, fix broken systems, or transform a nation. And to be a team player, children need to understand the rules of engaging and working with other team members.

Critical Thinking

Critical-thinking skills help us make decisions. These skills fully develop during adolescence, but the foundations of good thinking are rooted in early childhood experiences. When children are exposed to an environment that allows a child to value ideas, evaluate strengths and weaknesses, and think of ways to create solutions, they have opportunities to engage in the learning process, come up with solutions to problems, and connect to real-world situations.

Parents of young children value their children's natural abilities, the persistence to try things over and over, and the interest to research and discover ways to solve a problem. To make their own decisions, children must feel competent, be confident about those decisions, and consider the process of making decisions fun. Parents of young children are able to engage children in critical-thinking opportunities by setting expectations, allowing young children to make decisions, and encouraging children to express their preferences. Making choices builds children's sense of responsibility and ability to have an impact. Giving a toddler the option to choose between a crayon or tempera paint to produce art allows her to start making decisions for herself. To understand what inhibits critical-thinking skills, it is important to consider the environments or actions that might have a negative impact on a child's ability to make decisions. For example, environments or experiences that expose children to repetition without concrete experiences, such as worksheets, coloring-book pages, or adult-directed activities, inhibit a child's ability to make decisions or engage in the learning experience.

A Playful Approach to STEAM Learning

The components of a STEAM curriculum include the following:

- **Science** is the foundation of children's learning about their world and is also a way of thinking. Encouraging children to ask questions and to observe, predict, and explain their ideas supports the development of scientific inquiry. The skills and processes of inquiry, observation, and exploration are foundation skills for all sciences and are not limited to "science" time. Aligned with science, we integrate mathematics, arts, technology, and engineering activities as a general focus of this book.
- **Technology** for young children includes the integration of tools that are used to support children's work. Children enjoy building and creating things and are often intrigued with how stuff works. Technology is also finding out how things are constructed. Engaging your child in finding out what is inside objects such as old computers, TV sets, or toys promotes an interest in technology. Parents should be aware of the risks that come with loose parts in objects such as computers and toys, which may contain harmful substances. Make sure children are supervised at all times during activities that include taking things apart.

  There is a common misconception that technology consists of only hardware, software, apps, or videos. *Technology* refers to a wide variety of tools used to acquire new knowledge, make work easier, or perform a job. These tools can range from simple crayons, scissors, and a clipboard to more sophisticated items like digital cameras and tablets. Software, videos, and other online resources are complementary to learning about a topic. Based on the premise that children at this age learn through concrete experiences and not abstract concepts, young children need to be able to manipulate concrete objects and not be recipients of information solely from a computer or TV screen. For a young child to be able to understand an abstract concept, she must be able to integrate experiences that engage all the senses.
- **Engineering** challenges children to use their creativity and practice critical-thinking skills by encouraging them to solve practical problems using technology tools to design something better. Challenging your children to design and create new things provides foundational skills that promote engineering concepts.
- **The Arts** are vital for engaging, inspiring, and promoting a sense of innovation. Research studies of programs using performing-arts strategies in the classroom provide evidence that the arts improve children's language and literacy skills and allow them to develop innovations, initiatives, social skills, and creative representations.

  As schools and programs shift heavily to core subjects such as math or reading, there is a lack of awareness of the importance of the arts. When children produce art they are learning to take risks by expressing themselves and being original, skills needed to innovate across different subjects. Art disciplines include visual art, performance, music, dance, and so on. Integrating arts into other subjects helps children understand concepts more clearly.
- **Mathematics** often goes hand in hand with science and engineering as it gives children the language to share findings of investigations and problems. Foundational math skills include number sense, measurement, patterns and sequencing, and data analysis. Mathematics concepts are formed through concrete experiences and are embedded in all activities during the day.

Research indicates that when we engage younger children in the STEAM fields, we are promoting inquiry-based thinking and a discovery mentality. Teaching young children STEAM play is a way of teaching them how to research, think, and create as open-ended play becomes part of their early experiences. In addition to these benefits, introducing STEAM concepts using a multisensory approach and in a playful way gives young children a competitive advantage and sets a strong foundation for future study habits.

Before standardized testing begins and fun is no longer a priority, the foundational skills learned during the early years allow a child to feel confident about her abilities to do science, math, or engineering. Early experiences shape the way the brain functions and teach children a way of thinking and solving problems for life. Therefore, this wonderful window of opportunity during early childhood lays the foundation for brain development and may also lead to interest in STEAM careers.

You are probably asking yourself, how can I promote STEAM thinking without any prior experience, content knowledge, or teaching skills? Our model is very simple. It builds on your child's natural ability to play, her interest and curiosity to learn about the world, the persistence for trying new things, and the creativity to solve problems. When a young child begins to play, she asks questions such as "What would happen if I do this?" The model offers opportunities to learn through intentional playful activities and offers a facilitator's guide, vocabulary, key concepts, and guided questions. You can revisit the experiences through reflections that connect the experience to real-world problems. The activities in this book allow you and your child to acquire new knowledge and discover the joy of researching a topic, from making predictions to creating a project.

Time and Materials

The activities in this book can help children expand learning that naturally develops while playing with materials commonly found in most homes. Each activity allows you to engage with materials in intentional activities that will seem as though you both are simply playing together.

Introducing different materials will make things interesting. Review the activity and guided questions ahead of time, and have materials readily available. Allow children to explore the materials and engage in the experiences at their own pace. At a young age, children need time and encouragement to explore, investigate, and learn.

> "Young children's learning reflects a cycle that begins with exploration with materials and then progresses as children develop concepts. This cycle of learning that occurs through explorations, inquiry and building of knowledge uses similar processes as the engineering method and scientific inquiry. It is important young children have time to observe and interact with materials during play. A variety of materials stimulate children's curiosity."
>
> — Englehart et al., 2016

The Role of the Parent

The good news is that you don't have to be an expert, a researcher, or a scientist to get your child excited about STEAM careers and STEAM thinking. Remember, most STEAM learning is about exploring and learning from your exploration—so why not explore together? The main goal is not to make sure children master a concept, but simply to allow them to explore the activity in their own way. Giving this freedom to children inspires them to make predictions and critically think about the world around them in a pressure-free setting.

As a parent, you can encourage inquiry and curiosity by talking with your children about their questions and by interacting with them during the activities. Having conversations during mealtimes and providing feedback helps to promote their thinking and learning processes. Open-ended questions provide a rich context for engaging young children in meaningful conversations to enhance their learning.

By asking the right questions to get children thinking, you will begin an amazing journey that builds their confidence and understanding of the ways to discover new knowledge.

It's okay not to have all the answers or know all the subjects. If math, science, or engineering subjects seem intimidating, you may be reluctant to discover the subjects together with your child. So the process starts with you. When you change the mind-set, you start seeing your child in a different way and you become a partner, a facilitator, and a co-researcher.

The most critical skill for parents raising twenty-first century learners is to understand that you don't need to know all the answers. Our model allows you to introduce complicated STEAM subjects in a hands-on and fun way by following the activity format in our book. So, the next time your child asks a question you can't answer, incorporate a very helpful skill that we practice on a regular basis: "I don't know the answer; why don't we find out together?"

How to Use This Book

Each chapter is focused on a specific content area and includes twelve guided learning activities. The second portion of the book shares how to develop more activities using our format.

The goal of many activities is to support children's natural interests; many activities can be introduced while you are reading to your child during breakfast or at some other convenient time. Some activities require you to be more focused or involved with your children, while others allow more flexibility and playtime.

Prepare the Activity

The first paragraph of the activity gives you an overview of the activity's learning goals and key concepts.
Prior to starting an activity, check the "What You Need" list to prepare the experience and gather the materials required. The "Talk Like an Expert" section gives you terms and definitions that will lead to more learning and rich vocabulary and communication as you do the activity with your child.

Develop the Activity

During an activity, assist, question, interact, or observe your child as needed during intentional play.

We suggest that you introduce one activity per day in different domains using the directions provided. This will help to create excitement about specific concepts and will allow you to maintain a focus on the learning goal for the day. Introduce the subject by asking your child a question or by sparking their curiosity.

In the "How to Do It" section, we offer questions you can ask to guide your child's thinking. These questions will start a conversation and engage your child in a discussion to help you understand what he knows about the topic. An important part of the process is to listen to your child's ideas and not interrupt them. At this point, guiding the process of learning is not about answering a question but about allowing your child to find the answer on his own. If needed, or if your child is interested in learning more, look up images or videos about the subject.

Read the directions aloud for your child, and collaborate as you discuss and plan how to conduct the learning experience. Your child will have the opportunity to predict and create a project in a hands-on way. Do the activity together.

When you've completed the exploration, use some of the ideas in the "Predict and Hypothesize" section to explore more ways to do the activity. This will allow your child to think creatively and consider how to redesign the experience if needed. Create a hands-on project together.

At the end of each activity, examples are provided in the "Add more STEAM activities" section to integrate the different domains and enrich the experience.

Reflections

At the end of every activity, encourage your child to share her findings with the rest of the family. Taking pictures during the activity will allow you to share the experience and engage everyone. At a later time, perhaps during dinner or when the family is together, revisit the experience. Ask your child to share what she has learned. Some activities suggest that children share their work with the rest of the family to start a conversation. The children will take pride and satisfaction with their work, and this is a way of making the learning process visible for the child and the family.

PART 1

SCIENCE

Parachutes

Explore the concepts of air resistance, gravity, force, and mass by making a parachute with your child!

Talk Like Scientists!

Discussing these terms may lead to more learning and rich vocabulary and communication.

- **Air resistance**—a pushing force that slows things down
- **Force**—a push or pull on an object; for example, how hard you throw your parachute into the air
- **Gravity**—a force that pulls things toward the earth; it keeps you on the ground so you do not float
- **Mass**—a measurement of how much matter is in an object; for example, an object's weight

What You Need

- Plastic grocery bags (If a plastic bag is not available you can use tissue paper, a coffee filter, or newspaper). Another option is to punch holes in corners of a plastic container with a lid. With a plastic container, you can change the items in the container, and thus change the weight. You can see how different weights affect the parachute.
- Something to weigh down the bag (toy, rock, etc.)
- String or yarn
- Scissors
- STEAM journal (notebook to record observations)

How to Do It

1. Spark curiosity by asking your child, "What is a parachute? Why do people use them?"
2. Listen to your child's ideas and talk about them. If needed, or if your child is interested in learning more, look up images or videos of parachutes online. Talk with your child about what you notice about the parachutes. Continue to communicate and ask questions throughout the activity.
3. Collaborate with your child to make a homemade parachute. Use a plastic grocery bag. **Safety Note: Always keep a close eye on young children when they are using plastic bags as they are a choking hazard.** If a plastic bag is not available you can use tissue paper, a coffee filter, or newspaper. The reason a plastic bag may be preferable is that you can squish and ball it up to make a good throw in the air.
4. Cut the handles of the bag so you have four areas to tie your string onto the plastic.
5. Tie a length of string or yarn to the cut handles of your plastic bag. String can be 8 to 15 inches long, depending on size of bag. Now you should have four equal strings hanging from the parachute.
6. Bring the four loose pieces together with equal lengths.
7. Tie the four strings to an object with weight (toy, rock, or other item). Another option is to punch holes in four corners of a plastic container with a lid so you change out the weighted items as you wish.
8. Throw the parachute!
9. Encourage your child's curiosity: I wonder if it will make a difference if we throw it soft or hard. Does it matter if we ball up the parachute before throwing? If we throw a plastic bag in the air without any weight, I wonder what would happen.
10. Encourage your child's critical-thinking skills: What can you tell me about making a parachute?

Predict and Hypothesize

- Problem solve with your child: I wonder what will happen if we add different weighted objects.
- Try tying different objects to the parachute, and predict and make a hypothesis about what will happen. What objects could you tie to the parachute or put into the container? Test the hypothesis by using different objects of different weights. Chart what you discover.

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LEARNING AND EXPERIMENTING CAN BE FUN AND EASY FOR ALL!

Inspire your child's learning in the fundamentals of science, technology, engineering, art, and mathematics with fun (and easy!) experiments:

- Make elephant toothpaste and at-home rain clouds to create and better understand scientific reactions.
- Build a potato-powered lightbulb to explore technology.
- Learn about engineering design elements such as coding and making blueprints.
- Grow artistic abilities by making colorful watercolor butterflies.
- Go on a nature-walk adventure to learn about geometry and sorting.

These activities, and many more, will broaden your child's learning about the educational components within the sciences and technology in an engaging and exciting way. Young children will gain a deeper understanding of how and why things work in our world.

Dr. Debby Mitchell, EdD, recently retired from teaching in the College of Education at the University of Central Florida. Her doctorate is in physical education with a focus on early childhood. Her expertise and interests include STEAM, brain research, developmentally appropriate movement activities and music, dance and rhythms, children's wellness, obesity and integrating technology into the curriculum.

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