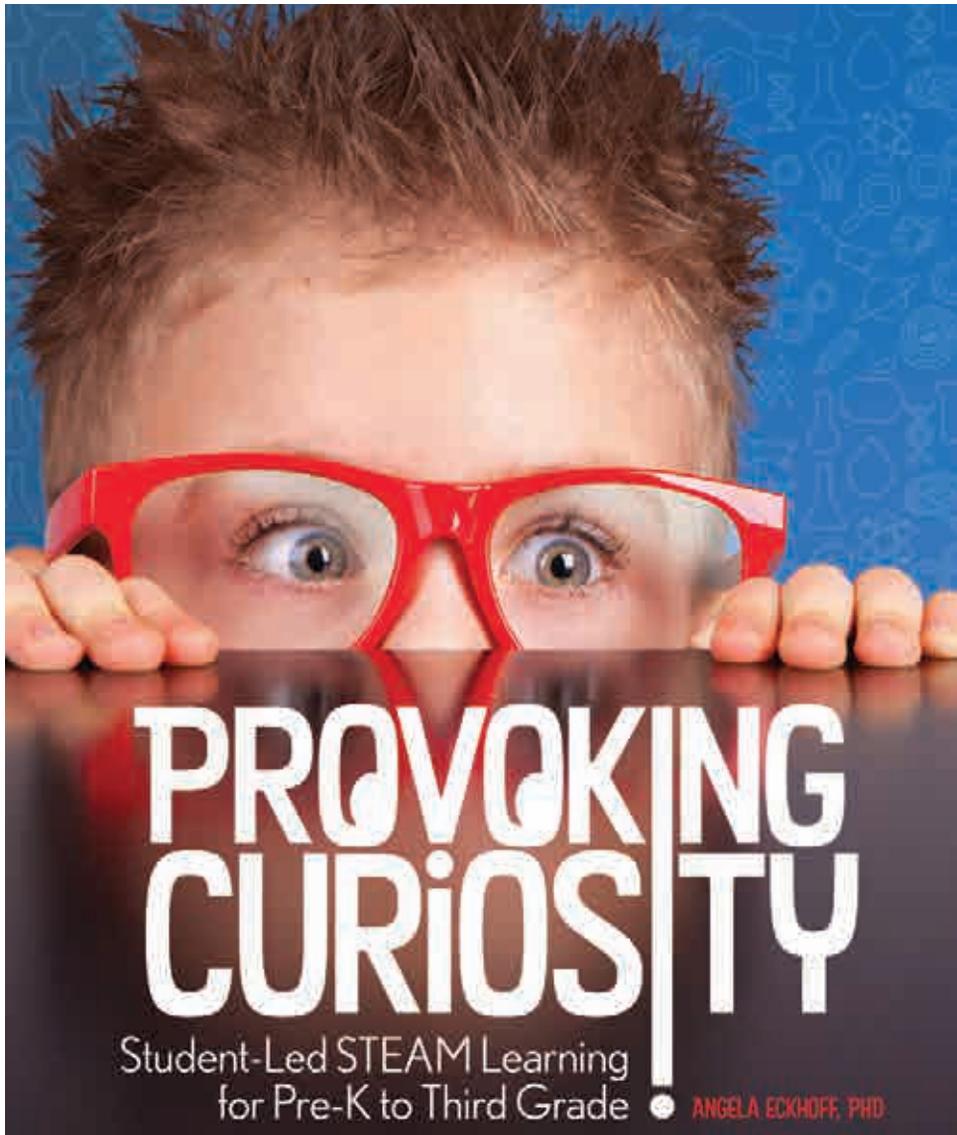




# PROVOKING CURIOSITY

Student-Led STEAM Learning  
for Pre-K to Third Grade

● ANGELA ECKHOFF, PHD

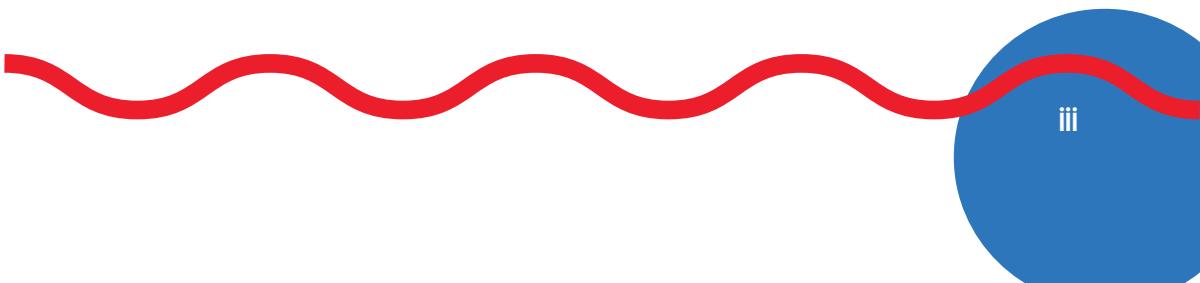


by Angela Eckhoff, PhD

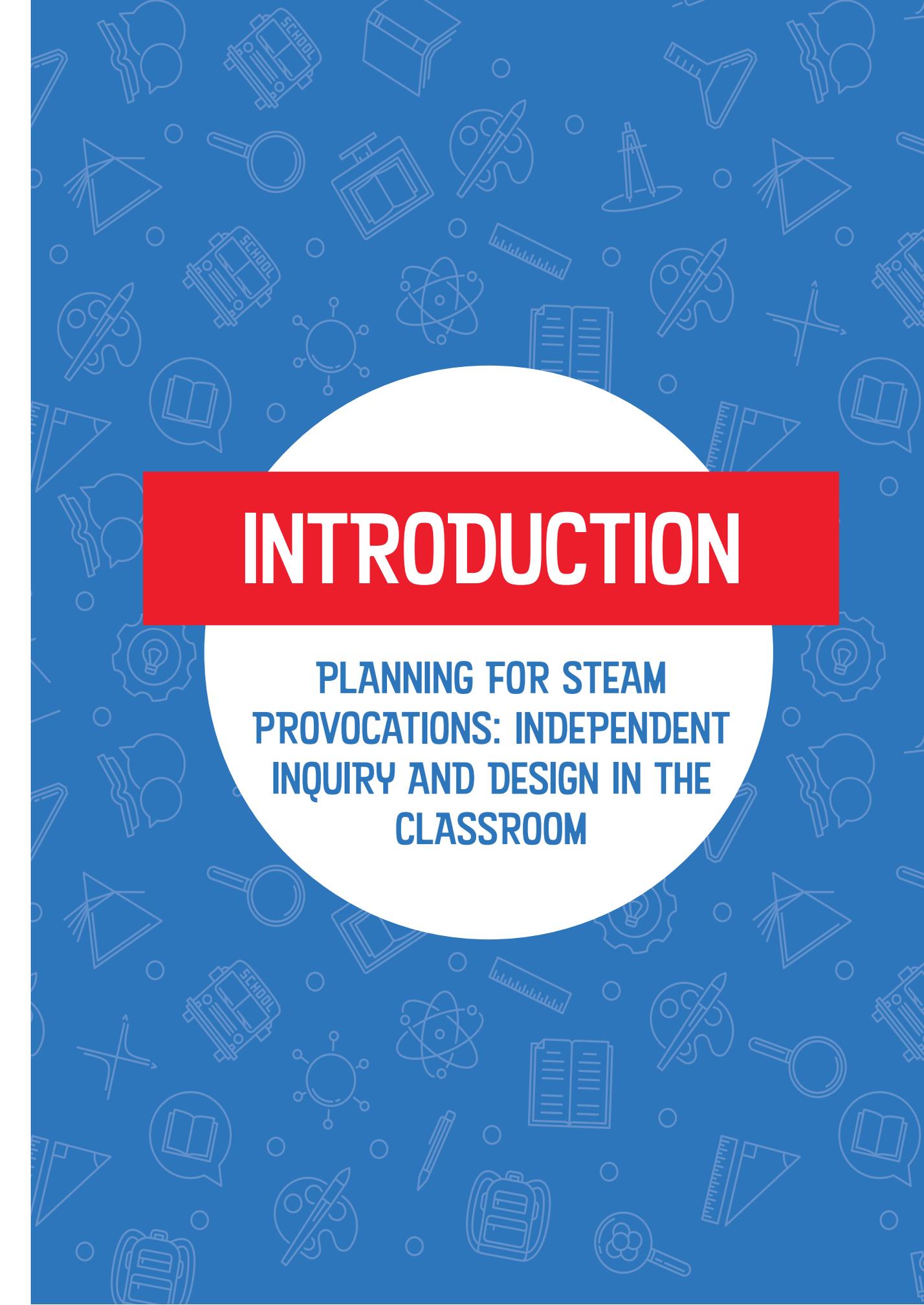
  
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The background is a solid blue color with a repeating pattern of white line-art icons. These icons represent various educational fields: science (microscope, atom, lightbulb, gear), art (palette, pencil, compass), mathematics (ruler, protractor, graphing axes), and general education (school bus, books, magnifying glass, speech bubbles, backpack).

# INTRODUCTION

**PLANNING FOR STEAM  
PROVOCATIONS: INDEPENDENT  
INQUIRY AND DESIGN IN THE  
CLASSROOM**

**T**he best lesson plan designed by the most experienced teacher is no match for a child who decides not to engage in the act of learning. One of the first lessons I learned as a new teacher was that no matter how exciting my planned lessons were, I could not make a child learn. I could provide an interesting experience full of engaging content and hands-on materials, but the cognitive act of learning was under each child's control. Our minds are our own, and, therefore, children control what they choose to focus on, what they seek to better understand, and, ultimately, what they learn. True learning requires intention and energy on the part of the learner. No amount of telling by a teacher will support the development of new understandings for a child who is not interested.

This book offers child-centered STEAM provocations that you can use daily in your classroom during short segments of less-structured time.

This means that we, as educators, must devote our energies and efforts to developing learning experiences that inspire children to expand their understanding of the world. We know that to build knowledge, children must be interested in a particular content idea and must also see it as relevant to their own lives. As teachers, we play a central role in the development of children's thinking as we work to offer learning experiences and classroom environments that invite and encourage young learners to engage their minds and bodies in a quest to understand.

In spite of decades of research telling us that the mind grows through playful engagement within a supportive environment, the policies guiding early childhood and primary-grades classrooms in many schools require that teachers move through content quickly in a one-size-fits-all approach. This approach often relies upon paced curricula and prescriptive approaches to content delivery that ignore ideas of engagement through playful learning and learning through play. Often, in these same classrooms, young children spend the majority of the day focused on literacy skill development with less time for science, technology, engineering, the arts, and mathematics (STEAM). STEAM learning experiences are important to incorporate daily for young children because these activities can introduce them to new ways of thinking and can connect to their personal interests and prior knowledge.

Many teachers I've worked with over the course of my career have approached me with concerns over a lack of time to include daily STEAM experiences in their classrooms. They know that the STEAM disciplines are important, and they desperately want to find ways to meet children's needs while still meeting requirements for early literacy

skill development. This book offers a child-centered solution to that challenge—STEAM provocations that you can use regularly in your classroom during short segments of less-structured time.

In an interview titled “Play and the Hundred Languages of Children,” published in the *American Journal of Play*, Reggio expert Lella Gandini explains that the term *provocations* describes activities that do not have a predetermined outcome or a singular objective. Instead, provocations encourage children to explore materials, interactions, ideas, and ways of thinking. Provocations can take place in all areas of your classroom or can be set up at children’s workspaces. During these activities, children can work individually, with partners, or in small groups. STEAM provocations can involve materials that children can use without an adult’s constant assistance. These materials encourage children to use inquiry skills, design thinking, and creativity skills.

**Provocation:** child-driven exploration or interaction that encourages new ideas, connections, and ways of thinking

You can use the provocations in this book numerous times over the course of several days or longer as children gain experience and think through their original ideas and understandings. For young children, repetition is an important part of building new understandings and developing skills. You do not need to offer new provocation experiences each day. Observe your students, and rotate provocations or introduce new ones when the children indicate that they are ready for a change. Whether you choose one provocation for the class to complete together or you offer multiple provocations during the times of the day when you need your students to engage in thinking, exploring, and wondering, each provocation presented in this book connects to core ideas in the STEAM disciplines, centers on the development of higher-level thinking skills, and uses materials readily available in early childhood classrooms. The following are a just a few ways you can use STEAM provocations in your classroom:

- As a jump-start to the morning, with children working at tables or in centers
- As a midday experience to provide children a chance to decompress and reenergize
- As an alternative option for children who complete assigned classroom work early
- As an end-of-day experience to empower children to build their collaboration and communication skills before heading home

- As a transition time between the busier times of day, such as lunch or recess, and planned classroom work times
- As an incentive for students to build engagement throughout the day
- As an approach to remind children that learning can be enjoyable and that they can experience a variety of successes in the STEAM disciplines

## UNDERSTANDING INDEPENDENT EXPLORATIONS

One source of inspiration for this book comes from the world of museums. Science, art, history, and children’s museums all create exhibit spaces that aim to draw in visitors for short-term, investigatory experiences featuring specific content information. These exhibits are created to engage visitors of all ages and backgrounds and, ultimately, to introduce them to a new experience that empowers them to build understanding while they explore on their own or with others at the exhibit. These experiences are referred to as *informal learning experiences* because they take place outside a school environment and are not teacher directed but are based upon specific learning objectives. The following vignette shares the experiences of two boys engaged in an informal learning experience.



Flight Lab at the Virginia Air and Space Center

On the second floor of the Virginia Air and Space Center, Marcus and Cameron make their way to the front of the *Flight Lab: Design Station* exhibit. “Yes! We can make paper airplanes!” exclaims Marcus as he takes a sheet of paper from a stack sitting on the ledge of the exhibit.

“Which one are you going to make?” asks Cameron.

Both boys stop talking for a minute as they read and examine the possible designs suggested on the exhibit signage. Marcus, borrowing words from the exhibit’s descriptive text he has just read, announces that he will make the eclipse glider because it has bigger wings “for lift.” Cameron sets out to fold the jet because he is interested in speed.

As Cameron and Marcus work, they occasionally glance back at the images on the exhibit wall that detail the folds needed for each step of creating their airplanes. Once finished, the boys take their planes over to the section of the exhibit designated for test flights. Each boy takes a turn flying his airplane to see which one goes the farthest. Cameron’s jet glides down over the length of the flight space as Marcus cheers it on.



*Flight Lab* exhibit layout at the Virginia Air and Space Center

Marcus's and Cameron's interactions with *Flight Lab* illustrate how an informal learning experience can serve to build knowledge and promote children's understandings as they explore independently. *Flight Lab* strategically combines text and visual images to invite and engage learners of all ages and literacy levels. The text and images help to scaffold children's experiences and create a space where they can work independently or alongside an adult or peer. *Flight Lab* also purposefully uses the exhibit space to both invite and structure visitors' physical interactions with the materials. The paper for visitors' airplanes is stacked neatly on a low shelf, providing ample space for people to work while positioned in front of the visual display with examples of paper-airplane folding techniques. An area for testing the flight capabilities of folded planes is located off to the side of the exhibit, providing clearly delineated spaces for folding and flight. This organization helps the visitor understand which actions are appropriate and expected in each area of the exhibit. Everything a visitor needs to know and use is intentionally positioned within the exhibit.

As early educators, we can use hands-on exhibit design to inspire similar independent-investigation opportunities in our classrooms. Intentionally designed learning spaces for young children can be engaging, informative, and enjoyable, whether the space is within a school, child-care setting, or museum. The STEAM provocations in this book invite you to create opportunities for independent explorations in which children can investigate and create, just as *Flight Lab* does.

## THE ROLE OF THE ENVIRONMENT IN LEARNING

Within the field of early childhood education, contemporary ideas about early learning spaces are influenced in many ways by the seminal writings of early educators, theorists, and philosophers, including Maria Montessori, John Dewey, Lev Vygotsky, and Loris Malaguzzi. These influential thinkers shared a common understanding about children's learning: they all believed that children actively construct their knowledge and understanding of the world through their everyday experiences and interactions. As educators, we can weave together ideas from these influential writings to develop our own ideas of schools and classrooms as both physical and theoretical spaces where children can engage with others to build social and intrapersonal understanding, creative- and critical-thinking skills, content-knowledge understanding, communication and literacy skills, and motor skills. Every learning environment differs in the extent

to which children engage in opportunities to develop these diverse skill sets, but it is important for early childhood educators to understand that environment itself plays a critical role in the types of opportunities children have to play, explore, create, and investigate.

As noted in her books *The Absorbent Mind* and *The Discovery of the Child*, Maria Montessori is widely credited with introducing educators to the importance of creating a welcoming environment for children with child-sized furnishings. She is also credited with creating learning materials based upon her knowledge of children’s development, natural curiosity, and interests. Having accessible materials and furnishings within a classroom promotes children’s independent access to learning materials and provides opportunities for them to explore their environment at their own pace. In her writings, Montessori stresses that the learning environment should not overwhelm children with colors, textures, or excess materials. Rather, spaces for learning should feel orderly and welcoming.

To extend the idea of child-sized and child-centered learning materials, we can draw upon ideas from the Reggio Emilia approach to early learning. In “Play and the Hundred Languages of Children,” Lella Gandini notes that the idea of learning provocations was introduced to the early childhood community by Loris Malaguzzi and scholars from Reggio Emilia, Italy, after World War II. The careful treatment that Reggio educators devote to their classrooms alerts us to the possibilities the environment holds for supporting and shaping the ideas, questions, and understandings of many different types of learners.

In a first-grade classroom, students who finish assigned work before their classmates are encouraged to choose a STEAM learning experience to explore on their own. For the past week, the class has focused on earth science, learning about different types of weather and the characteristics of each type.

Levi has chosen to spend time on an arts-based science provocation. The teacher has placed several easels and sets of liquid watercolors near the classroom windows to encourage the students to think about the connections between the outdoors, the weather, and the arts. The paints are in clear jars and carefully lined up along the window’s edge to allow the light to shine through them. Each color has its own paintbrush, and paper is stacked neatly beside the paint on a low table that all students can access. A sign next to the materials provides a provocation-invitation question: “Can you paint the weather?”



### Watercolor paints for science explorations

Levi attaches his paper under the clip at the top of an easel and selects several jars of paint to place within the ledge at the bottom of the easel. Once his materials are in place, he moves a low stool in front of his easel, sits down, and glances out the window. The window faces the small flower garden on the school grounds. As Levi looks out the window and back to his blank paper, he begins to paint a bright, blue skyline reflective of the warm, sunny scene in the flower garden just outside.

Levi spends about ten minutes painting alongside a peer before their teacher announces that it is time to move on to the next class experience. Levi places his painting on a nearby shelf to dry, knowing that he can resume his work during his next opportunity to be inspired by the scene outside the window.



Painting the weather

## GUIDED REFLECTION

- What elements of Montessori's emphasis on accessible, child-sized materials can you find in Levi's classroom?
- What is the content emphasis of the Reggio-inspired provocation activity in this example?
- How does the teacher's placement of materials and furniture help to support the students' independence as they work within this learning center?
- Where can you find evidence of Levi's independent thinking and exploration during the experience?

# IGNITE CHILDREN'S PASSION FOR EASY AND ENGAGING STEAM ACTIVITIES.

Sure, you know that children learn best through hands-on explorations that capture their interest and imagination. But how does that actually work in a real classroom? With jam-packed days and mounting expectations, you're pressed for time and pushed to follow standards-based curriculums. It's no wonder you struggle to incorporate engaging STEAM explorations each day.

*Provoking Curiosity* brings teachers of children from preschool through 3rd grade new and easy-to-execute STEAM learning experiences. Each activity is developmentally appropriate and engages children—individually, in small groups, or in one large group—to think, explore, and wonder. Each exploration builds on core ideas in the STEAM disciplines, develops higher-level thinking skills, and uses readily available materials in early childhood classrooms.

Use STEAM provocations throughout your busy day:

- 🌀 Jump-start the morning
- 🌀 Decompress and reenergize midday
- 🌀 Occupy children who complete assigned classroom work early
- 🌀 Incentivize children to complete a goal
- 🌀 Transition between the busier times of day and planned classroom work times
- 🌀 End the day empowering children to build their collaboration and communication skills before heading home

The inviting STEAM explorations in *Provoking Curiosity* will remind children that learning can be enjoyable and that they are capable of success in the STEAM disciplines.

# FULL STEAM AHEAD!



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