

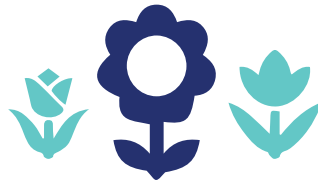
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OUTDOOR STEM LEARNING
WITH YOUNG CHILDREN



Lea Ann Christenson, PhD, and Jenny James, MA



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Lea Ann Christenson, PhD, and Jenny James, MA

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Introduction

Let us introduce ourselves. I'm Lea Ann Christenson. Currently, I am an Associate Professor in the Department of Early Childhood Education at Towson University in Maryland. My career in education started as a kindergarten teacher at a public school in the Santa Cruz Mountains of California. A Life Lab class garden was a regular part of the school's curriculum—we offered hands-on science, technology, engineering, and math instruction before the term *STEM* was coined. I also taught first and second grade and English as a second language and served as an assistant principal of an elementary school before moving to Maryland, where I earned my doctorate in curriculum and instruction, with an emphasis on early literacy. Over the past ten years, I have had opportunities to collaborate and conduct research and to offer professional development with educators in the United States, Denmark, El Salvador, Zimbabwe, Nepal, and China.

I'm Jenny James. I am an early childhood advocate, author, and director of a Lutheran school in Maryland, where I use STEM skills daily in the administration of the preschool. Over my forty-year career, I worked as a helper in a family child-care home, a teacher in numerous child-care centers and preschools, a family counselor and project manager for a child-care resource and referral agency, and the child-care training coordinator for the state of Maryland. I strive to inspire teachers to find their inner creative, spontaneous selves so that they can deliver exciting learning experiences that they and their students will remember. My interest in outdoor learning was influenced by my own childhood experiences mixing pretend potions with water, leaves, and dirt. I remember the pride in creating something new, working with tools that grown-ups use, and the feeling that I was doing something that mattered. In my career, I have observed the transformative qualities that being outdoors brings to children and adults alike. I believe that child-led play under the guidance of a supportive teacher leads to deep, joyful learning, and I want to share that joy with the readers of this book. Like many of our readers, we share a love of teaching, teachers,



children, and their families. Many teachers agree that their love of children, their own creative energy, or their desire to make a difference inspired them to choose the profession (Karakış, 2021). However, when it comes to teaching STEM subjects, research shows that many teachers lack confidence and interest in adding STEM to their lessons (Adams et al., 2014). These feelings of uncertainty about teaching science, technology, engineering, and math, along with the unpredictable nature of outdoor learning,

may keep some teachers indoors. We want to break

down the barriers that deter teachers from digging into STEM, so that they can confidently embrace outdoor STEM learning. Teachers will discover the spark of STEM learning as we share how outdoor STEM education is supported by philosophers and theorists, past and present, of early childhood development. We hope this understanding will motivate teachers to see outdoor STEM learning experiences as equal partners to the typical block, art, and dramatic play experiences included in most early learning classrooms.

We contend that STEM lessons for young children are more interesting for teachers and students when those lessons are tweaked and redefined to take place outside. Consider the number of times a teacher creates a lesson plan that will take place outdoors. For most teachers, there would be very few. Why is that? Control. Indoors, teachers are trained to control the materials, room arrangement, scheduling, and messiness. This is often called “good classroom management.” Administrators praise these organized environments, but some do not understand that this is not necessarily the best way for young children to learn. A wise teacher knows how to manage her class while offering opportunities for true exploration. Too often, teachers will find comfort in the control and will miss opportunities for learners to take the lead.

Are you one of those teachers? You’re in good company! All teachers experience tension between exploration and the pressure to meet standards, have children pass “readiness” assessments, and maintain discipline. Think about the times that your lesson plans have gone awry. Perhaps it started to snow, and you lost your audience to the pretty flakes falling on the playground. Or maybe someone discovered a spider in the classroom while you were teaching a math lesson. In those moments, it takes flexibility for a teacher to adapt lessons to meet students where they are. Instead of going on with the planned lesson, what

would happen if you taught the skills you wanted to teach through the lens of serendipitous events? These kinds of experiences are even more likely to occur outdoors, where the learning can be more meaningful and authentic and can connect to children's wonder. What do you wonder about snow? How can we find out? How many legs does the spider have? Let's count them!

It is this type of flexibility, love of wonder, and ability to adapt that is necessary to teach STEM to young children. So, if you chose the teaching profession because of your love of children, and you can embrace your own sense of wonder, then you are on your way to becoming an effective outdoor STEM teacher!

How This Book Is Organized

Can you meet standards and still nurture learners who can think critically, collaborate, communicate, and create? Yes! Using our combined experiences with children, teachers, community stakeholders, families, and student teachers, we offer teachers and administrators the tools to organize outdoor STEM lessons that promote twenty-first-century skills.




In chapter 1, we describe the richness of learning outdoors and the opportunities nature affords for STEM-based explorations. In chapter 2, we share what we call the Learning Life Cycle to use as a frame for outdoor learning. Next, in chapter 3, we explore how deep thinkers in early childhood landscapes support outdoor learning, and we show connections between indigenous ways of knowing and the prevalent theories of early childhood.

In chapter 4, you will learn how to plant the seed of experiential learning through outdoor education. Focusing on typical preschool themes, we show how to transform your lessons for the outdoors or bring nature indoors for more authentic STEM learning experiences. Chapter 5, *Growing the Roots of Wonder*, connects how activities such as simple observation can lead to many weeks of investigating an environmental topic chosen by your students. We walk you through the twenty-first-century skills of critical thinking, collaboration, communication, and creativity so that you can confidently add a sense of wonder to your lessons. Chapter 6, *Unearthing STEM in the Learning Life Cycle*, will inspire you to take STEM learning outdoors in your own unique setting or to move the outdoors in, with easily accessible materials. Journaling, charting, classifying, matching, and many other activities illustrate how teachers can support authentic learning inside and outside the classroom.

Outdoor learning is not about a state-of-the-art outdoor space. It is about putting into action instruction that embraces the natural environment. Teachers can move to more appropriate teaching of literacy and critical-thinking skills using STEM and the environment. In addition, outdoor STEM instruction can open the doors for students who are underrepresented in the STEM workforce by illuminating these disciplines at an early age and allowing them to see themselves in these fields. Chapter 7 discusses the importance of communication and stakeholder buy-in in starting an outdoor classroom. Chapter 8 provides practical ideas and tips for leveraging outdoor environments for maximum STEM learning.

In the appendices, we offer tools to help you adapt your curriculum or themes for outdoor learning and resources where you can find more ideas for rich outdoor learning. **Ready? Let's dig in!**



Chapter 1

THE RICHNESS OF OUTDOOR LEARNING

Outdoor Learning Honors the Whole Child

Outdoor environments are a perfect match for the unpredictable nature of STEM learning. Full-body, physical experiences happen outdoors. All the senses are stimulated: proprioception (the sense of one's body in space), vestibular (balance), hearing, sight, smell, taste, and touch. (By the way, the development of these are precursors to emergent literacy skills. We'll get to that in a moment.) Outdoor experiences naturally lead to collaboration because they inspire movement and the sharing of ideas. Where some children are comfortable verbally sharing ideas, others may be more comfortable participating through movement, which is much more acceptable and authentic outdoors—think of the times when you struggle with discipline in your classroom. You may be hesitant to move outdoors because you think you might lose control of the children. The opposite is likely to happen when children are engaged in movement and child-driven lessons. In his feature article “Outdoors for All: Access to Nature Is a Human Right,” Richard Louv (2021) presents the following:

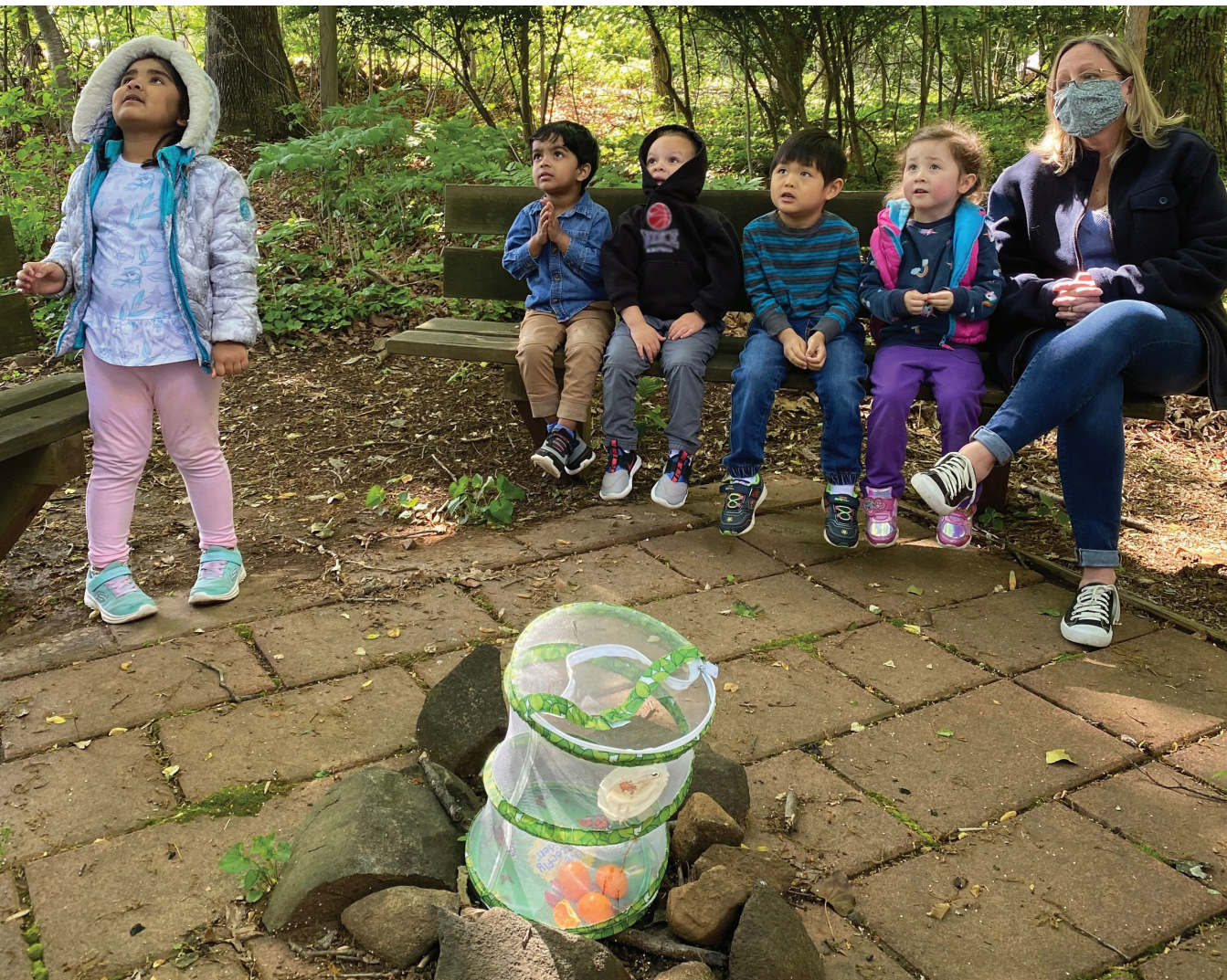
Expanding research has also shown that exposure to nature can reduce children's symptoms of attention deficit hyperactivity disorder and help prevent or reduce obesity, myopia, and vitamin D deficiency. And the research suggests that time spent in nature may improve social bonding and reduce violence, stimulate learning and creativity, help raise standardized test scores, and serve as a buffer to toxic stress, depression, and anxiety.

Moving outdoors also removes the problem of deafening acoustics—an indoor classroom can get noisy when young children are busy learning. The noise can be a barrier to some learners (and teachers). Having class outdoors allows for children to raise their voices and move, reaching more children with a wide variety of strengths: kinesthetic, verbal, artistic, and scientific. The outdoor environment will challenge the physicality of the sedentary learner and pique the interest of the active child.

Outdoor experiences give more freedom for children of different abilities to show what they know and enthusiastically add to their knowledge base. These experiences naturally lead to differentiated instruction for children who are differently abled or are dual language learners, so that they too can show their many strengths. Outdoor lessons are hands-on, authentic experiences; a knowledge of English is not necessary to meet with success.

OUTDOOR EXPLORATIONS AND LANGUAGE LEARNING

Through doing and not just listening, children build conceptual knowledge and academic vocabulary that are the foundation of critical thinking and literacy



acquisition (Shechter, Eden, and Spektor-Levy, 2021). For example, if children are engaged in outdoor water play, building bridges and moats and dams in the mud, they might not have the vocabulary yet for the things they are building. However, they have the conceptual knowledge of what each construction does to the flow of water. Under the guidance of a skillful teacher who narrates what the children are doing and provides the academic vocabulary to describe the events, all children can understand the underlying principles.

Through these types of activities, dual language learners will retain the conceptual knowledge and add English vocabulary as they become more fluent. Hands-on experiences provide conceptual knowledge to build language. A child who has a rich academic vocabulary and understanding of the world is more likely to meet with academic success in the future (Ramsook, Welch, and Bierman, 2020). Outdoor lessons are a path to this success.

OUTDOOR EXPLORATIONS AND SOCIAL-EMOTIONAL LEARNING

Outdoor opportunities support social-emotional learning (SEL) as well. Despite recent pushes in early education to teach more academics using worksheets and drills, a large body of research supports including SEL in educational programs (Mahoney, Durlak, and Weissberg, 2018). With an increased awareness of the importance of a child's emotional health, many child-care settings and schools have adopted programs to foster SEL. These programs cannot be effective, however, if SEL is limited just to a unit of study; SEL should be incorporated into every aspect of a young child's day. The major aspects of SEL—self-awareness, self-management, social awareness, relationship skills, and responsible decision making (Durlak et al., 2011)—can be authentically achieved in an outdoor-education setting infused with STEM.

SEL is about being confident, solving problems, learning from mistakes, and working with others. As you read this book, keep the principles of SEL in mind and think about how the activities foster SEL while building critical-thinking skills and meeting the required curriculum standards.

Outdoor Learning Supports Pre-K Standards

Over the past twenty years, there has been a movement toward accountability-based teaching to make sure no learners are “left behind.” The result has been an assessment-driven curriculum and methods that are not appropriate for young children. What was once expected of first- or second-graders is now, in many cases, expected of four-year-olds. The good news is that taking learning

outdoors is a way to meet these standards in a developmentally appropriate manner.

Like their indoor counterparts, teachers who teach outside need a conceptual understanding of the curriculum standards and objectives so that they can adapt their lessons to meet the interests of their students. For those of you who are new to outdoor learning, understand that you will have a plan, but you will also be looking for ways to teach children how to explore their interests and address their wonders through the STEM subjects. You will, in effect, be showing students the importance of STEM in the way that you guide their learning about the outdoor environment. In addition, outdoor education can cover the required acquisition of benchmark skills in content areas such as social studies, music, and art, all while engaging students in environmental study.

LITERACY ACQUISITION

One of the most important areas of instruction in the early childhood classroom is literacy. The method for literacy instruction in the early grades is also possibly the most misunderstood. Over the past twenty years, literacy instruction in early childhood has focused more on rote skills, such as learning sight words, which



have little support in the research. So, what are some of the best practices around literacy instruction? Would you guess gross-motor activities?

Psychologist Jean Piaget developed a theory of how children develop intellectually. His cognitive development theory, in part, posited that a child's motor development allows the child to explore the world, and consequently, that exploration is the key to discovery (Huitt and Hummel, 2003). Recent studies have validated that earlier work, finding that proficiency in gross-motor and fine-motor skills is related to literacy acquisition (Alesi et al., 2014, 2016; Callcott, Hammond, and Hill, 2018; Zeng, 2017). For example, a child's ability to cross the midline leads to mastering concepts of print such as directionality in reading; the development of the pincer grasp leads to a child being able to grasp a writing tool. Competence in gross- and fine-motor skills is one of the foundations of literacy and can be practiced outdoors through play (Battaglia et al., 2019). Nature has opportunities for gross- and fine-motor development built in, as children naturally run, hop, jump, touch, pick up, and explore what they discover. Lessons brought to an outdoor setting further enhance these opportunities.



ORAL-LANGUAGE DEVELOPMENT

Oral language is the foundation of reading and writing. Children who have rich vocabularies are better readers and writers when they are older (Chang et al., 2020; Reed and Lee, 2020). Teachers need to provide ample time during the day for children to have deep conversations, not lectures, on topics that are of interest to them. Teachers also need to scaffold children to greater levels of understanding. Embedded in oral-language instruction are learning to be good listeners and the ability to express oneself. Hands-on experiences based on children's interests give children interesting topics and conceptual knowledge to discuss with each other and with their teachers. STEM-focused lessons give children plenty of opportunities to record their data and report their findings through shared oral presentations.

A consistent body of research over time shows that a rich and deep understanding of the world around us helps children become better readers both in the higher grades and as adults. With that understanding, individuals are able to develop a large academic vocabulary (Duff, Tomblin, and Catts, 2015). Reading is not just about the ability to decode words. It is about the ability to comprehend and think critically about what is read and then to apply it to life. Children who have many hands-on experiences in real-life situations walk away with an understanding of the world and the words to describe it.

ENGAGE CHILDREN IN OUTDOOR STEM DISCOVERIES!

- ✓ Develop children's problem-solving and critical-thinking skills
- ✓ Support children's communication and collaboration skills
- ✓ Inspire children's creativity and innovative thinking
- ✓ Meet early learning standards in literacy, math, and more

Dig In: Outdoor STEM Learning with Young Children provides strategies, ideas, real-life examples, and information to help you get children outside and learning, all while meeting required early learning standards and objectives. Explore the Learning Life Cycle and discover fresh ideas for engaging children in deeper explorations and experiences outdoors that will stick with them into kindergarten and beyond. Have more aha moments, seize learning opportunities, invite questions, and investigate answers—
while supporting rich STEM learning.



Lea Ann Christenson, PhD, is an associate professor in the department of Early Childhood Education at Towson University in Maryland. Before earning her doctorate in curriculum and instruction, she taught kindergarten and first and second grades and served as an elementary assistant principal.

Jenny James, MA, is an early childhood advocate, author, and director of a preschool in Maryland. She has served as an early childhood educator, a family counselor, a project manager for a child-care resource and referral agency, and a child-care training coordinator for the state of Maryland.




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