



A TOOLKIT FOR EXECUTIVE
FUNCTION IN CHILDREN

NATURE + OCCUPATIONAL THERAPY

IMAGINE...

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Imagine that you're at work on a stressful day. Multiple clients have cancelled, so you're going to take a break. You walk out the side door to the wooded park just next to your building. Stepping into the light breeze, you savor the quiet and look at the bubbling stream winding into the distance. Feet crunching on last fall's leaves, you take a quick 15-minute walk through the forest, watching the occasional bird dart around, letting your mind go blank. You let your feet take you all the way around the short loop trail.

When you're back at work, you can feel your relaxed shoulders and more deliberate interactions with your clients. Somehow, your documentation comes more easily and you're able to better remember the details of each session.

So many of us have had an experience similar to this, whether at work or at home. Why does it work? Because nature is highly therapeutic. It boosts our health and function in every domain: cognitive, physical, mental, emotional, and even social. A plethora of research supports this idea. This toolkit narrows down the research to one particular area of cognitive function that occupational therapists are concerned with: executive function.



PURPOSE:

1. To give you evidence-based information on how and why nature benefits children's executive function
2. To provide handouts for teacher and parents with information on nature and child outcomes
3. To give you ideas on how to incorporate contact with nature into practice
4. To provide links to additional resources

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WHAT IS EXECUTIVE FUNCTION?

It's more than just paying attention...

Executive functions (EFs) refer to a group of mental processes. Just as an air traffic control system at a bustling airport manages the arrivals and departures of many airplanes on multiple runways, executive function skills allow us to retain and work with information in our brains, focus our attention, filter distractions, and switch mental gears. Executive functions fit in three main categories.

Inhibition: controlling one's emotions, behavior, thoughts and attention

Working Memory: holding information in the mind to generate goals and plans or complete a task, including following complex instructions

Cognitive Flexibility: mentally switching between different concepts

...AND WHY DOES IT MATTER?

Executive functions predict a child's health, wealth and quality of life in the future!

The bottom line is that well-oiled executive functions (EFs) are necessary for optimal participation in roles and routines. That's why OTs care about them!

We use executive functions for reasoning, planning, remembering, using self-control, and solving problems. Almost everything we do in our daily lives involves at least one of these skills.

Early in life, working executive functions predict health, wealth, and quality of life later on. Besides that, we know that executive functions are essential to learning.

Executive functions can be trained through therapy, and are particularly malleable at early ages. So what can we conclude?

It is imperative to work on executive functions at early ages, when interventions are likely to have the greatest effect with the least investment of time and effort. By working on executive functions at early ages, we promote not only a child's current learning and well-being, but also their quality of life in the future!

NATURE AND EXECUTIVE FUNCTION

Recent research shows that contact with nature improves these three specific areas of EF.

**working memory,
cognitive flexibility,
& attentional control**



HOW?

Researchers generally point to three ways to explain why nature has such therapeutic benefits.

Attention Restoration Theory

This theory explains that people have to purposefully try to pay attention and avoid getting distracted. When we keep using mental effort to pay attention/avoid distraction, we become fatigued and decrease our ability to focus well. Short exposures to green space restore this ability to focus. How? Natural environments have a few key features that help restore focusing abilities. They 1) provide a sense of being away, 2) contain fascinating rich natural stimuli that engage effortless attention, and 3) allow us to act without constantly monitoring our behavior, as is required in class, at the dinner table, or at the grocery.

Stress Reduction Theory

This theory describes how exposure to (non-threatening) natural environments reduces stress. How? In human history, we depended on the natural environment for well being and survival. So when we are in a place without natural features, our body has higher stress- we aren't near features that we evolutionarily needed to survive. The fix for this stress? Exposure to natural environments. And when we are less stressed, we have more mental energy available for executive functioning.

The Biophilia Hypothesis

This evolutionary hypothesis proposes that because our ancestors were completely dependent on nature for well being and survival, the innate need to connect with nature is still part of who we are. Although difficult to test, studies support human's visual preference for natural environments over built ones, and the attraction for nature is present across diverse cultures.

PERKS!



Why nature instead of some other intervention, you (or a parent, or a teacher) ask?

First and most importantly, contact with nature is a proven, effective intervention.

Engagement with nature is also inexpensive, carries no negative social stigma, benefits people regardless of age, gender, and income, and benefits us at a wide range of exposures- from a camping trip to a walk in the park to a potted plant on the windowsill.

YOUR CLIENT'S BRAIN ON NATURE

Time to get into the nitty gritty. What exactly happens to children when they are in contact with nature?

They use their whole bodies. The combination of gross and fine motor skills needed to interact with an outdoor environment (for example, balance to navigate uneven terrains, and fine motor dexterity to build a fairy house out of small sticks) provides a more dynamic challenge to the body. Not only that, but children are more active when they play outdoors as compared to indoors.

They play more creatively. Natural playscapes, live plants, views of nature and even the color green are associated with increases in children's creativity. Consider this: objects in nature (such as a branch or a shell) don't have any inherent function or usefulness. This object flexibility inspires kids to use their imaginations, challenge their thinking, and test their physical limits. Also, simple visual exposure to nature works wonders for the creative mind.

They enjoy a more balanced sensory experience. A child can hear a bird chirping, touch the grass in his bare feet, and feel the warmth of the sunlight while maintaining a calm, relaxed state. On the other hand, indoor environments (such as decorated and loud classrooms, colorful play spaces, and indoor party arenas) may overpower the senses and send a child into a fight-flight response.

Although nature can be overpowering to the senses in some cases, natural stimuli tend to be more gentle, preventative, and in many cases, restorative.

Lastly, as this toolkit seeks to teach, children's **executive functioning is enhanced**. Children are more likely to set their own goals, problem solve, focus attention and demonstrate cognitive flexibility when playing in natural outdoor environments. In one study, a 20-minute walk in the park decreased ADD/ADHD symptoms significantly more than a walk in town. Short walks in the park have even been shown to be as effective at reducing ADD/ADHD symptoms as the peak effects of methylphenidates (ADHD medications). Several meta-analyses (representing the highest level of research quality) indicate powerful benefits to cognitive flexibility and working memory as well as attention.

So how much nature is enough?

Research shows that people experience executive function benefits from contact with nature after short walks outside (15 min), viewing images of nature scenes (less than 2 min), having a regular view of trees outside the window, having recess in a natural area, and more. The charts at the end of this document provide specific information from research studies on the relationship between different exposure types, durations, and EF outcomes.

THERAPY IN NATURE

So what should I do during therapy sessions?

Since play is a primary occupation for children, it is useful to consider themes of play in nature. These themes are practically universal, exhibited in children's play regardless of socioeconomic status, ethnicity, ecosystem, and even developmental period. Yes, that means they still apply to older children! These **outdoor play themes** can help you develop treatment ideas that engage the minds and bodies of your clients.

1. Making forts in special places
2. Playing hunting and gathering games
3. Shaping small worlds
4. Developing friendships with animals
5. Constructing adventures
6. Creating fantasies
7. Following paths and figuring out shortcuts

Research also suggests incorporating the notion of **loose parts play** into outdoor therapy sessions. Loose parts play means that children are playing with open-ended materials, such as sticks. A stick can be a wand, a beam in a fort, a sword, or a horse to ride on. Open-ended materials invite creative play, whereas manufactured toys, such as a toy car, encourage children to act out familiar scenarios that are filled with predictability. When children engage in loose parts play with items like logs, sand, snow, seed pods or buckets, the play (and therapy!) possibilities are endless. See the section 'Want a Physical Toolkit?' (pg 25) for loose parts ideas.

The following pages can help provide ideas of nature-based activities that can be used to promote EF outcomes. For each age group, an occupational therapist reference is provided first. This is followed by a parent/teacher handout for the same age group. These ideas represent recommendations from the research studies listed in the data charts beginning page 32, as well as EF activity recommendations from Harvard University's Center for the Developing Child. Please note that studies have not been done on the effectiveness of *every* specific activity listed. Please refer to the evidence charts in the addendum to find specific activities and outdoor settings that have been linked to EF outcomes. **And remember- simply taking an indoor therapy session outside can have powerful benefits!** It doesn't necessarily matter that you're working on an "indoor" activity like handwriting or buttoning.

Are you a provider in an urban area with limited nature access? Many of these activities can be adapted to be done indoors or in urban parks. Keep in mind that even having a plant in an indoor space can improve EF outcomes!

CHILDREN, NATURE AND ATTENTION

We know that being outside is good for children. It increases physical activity, decreases anxiety and stress, and fosters creativity. But did you know that time in nature also helps children improve their attention? There are two main explanations of how this works. The combination of the sights, sounds, and features of the natural environment restores the ability to pay attention, as described by Attention Restoration Theory. In addition, time in nature reduces stress, which allows mental effort to be used toward paying attention instead. This is described in Stress Reduction Theory.

So what exactly does this increased ability to pay attention look like? In one study, children with ADHD took a short walk in a park. The effects of this walk on attention were as strong as the peak effects of methylphenidates (ADHD medications). In another study, children enjoyed a short school lesson outside. For the remainder of the day, these kids needed significantly fewer redirections to class and interrupted the teacher far less. Playing on more natural playgrounds is also associated with increased attention span in preschoolers.



1

PLAY OUTSIDE

The more "rugged" the better, but even a park with a few trees will do! Take children to local parks, state parks, outdoor playgrounds, the field across the street, and out to your own backyard. Let them play with natural materials like water, mud, twigs, seed pods, and stones.

2

GO ON A WALK

Even 20-minute walks tree-lined areas, as opposed to urban areas, significantly improve children's ability to pay attention afterward. This is an easy one to add into your daily or weekend routine.

3

KEEP A PLANT INSIDE

This is a great option for those of us in the middle of an urban area. Having potted plants in your visual space is known to improve performance on attention tasks. For more fun, have the child help pick, pot, and water the plant(s)!

4

LESSONS OUTDOORS

Contrary to the expectations of some teachers, a lesson outdoors can actually boost rather than hinder student's attention for the rest of the day. Google search 'forest schools' or read Ming Kuo's research article *Do Lessons in Nature Boost Subsequent Classroom Engagement?* (2018) for more information.

5

PICTURES OF NATURE

That's right- even *pictures* of nature help boost attentional capacity. Tape or hang up some images of beaches, forests, mountains or lakes. Having children look at nature pictures on purpose for even a few seconds increases the power of this strategy.

6

START A GARDEN

Whether a set of pots on the windowsill or actual plant beds in the ground, helping plan, plant, and take care of a garden can improve attention span and teach kids planning, observation, and responsibility skills. Even better, the kids might get to enjoy the pride of tasting their own produce or picking their own flowers!

7

TAKE THE SCENIC ROUTE

Have a few extra minutes to spare or a Sunday afternoon to kill? Reroute through a scenic area on the way home from school, or take a relaxing drive on the weekend. "Green" commutes to school are associated with larger attention spans.

8

GUIDED RELAXATION

Take mindfulness, yoga, or other stretching exercises outdoors. Spread out a blanket in the grass and breathe deeply. Think about relaxing every muscle in your body. Have your child or students follow along.

0-18 MONTHS

Early in life, children's executive function development is highly dependent on the caregiver-child bond. Although infants may have limited direct interaction with nature (as compared to older children) they can experience benefits of contact with nature simply by the fact that contact with nature can powerfully benefit caregiver well being and provide a nurturing environment in which to strengthen the caregiver-child bond.

Executive Function Goals

- Basic self-control
- Begin establishing working memory
- Begin establishing focused attention
- Joint attention

Here's a list of activities to get you started...

Hiding Games

These games challenge working memory- where did the object go, now that it is hidden?

- **Natural Nursery:** lay out a blanket and let the child discover elements of interest like birds and shadows. Select an object like a leaf or flower, hide it, and encourage the baby to look for it.

Lap Games

These predictable games use very basic rules, and incorporate repetition. This helps infants remember and manage their own behavior to fits the game's rules. Enjoy while sitting outside on a blanket.

- **Peek-a-Boo:** an opportunity for infants to practice basic self control and working memory skills.
- **Pat-a-Cake**
- **Eensy Weensy Spider**

Sensory Activities

Use these activities to promote joint attention and shared joy in natural textures and more.

- **Touch Walk:** go on a walk and help the child touch pieces of nature like tree bark, grass, stones or water.

Imitation Games

Infants love these games, and they have the benefit of encouraging infants to track your actions, wait their turn, and then mimic your behavior. This engages attention, working memory and self-control.

- **Animal Sounds:** mimic birds chirping, squirrels chattering, and other sounds you hear while playing outside. When you see an animal, make its noises and encourage your child to imitate them.
- **Animal Wiggles:** do the same as above, except with animal movements. Flutter like a butterfly or wiggle your fingers like a bug crawling.
- **Nature Towers:** stack items like stones or leaves and encourage your child to imitate you. Knock them down and rebuild.

Daily Routines

Encourage parents to move some of these activities outdoors, where parents can de-stress, eliminate technology distractions, and focus on bonding with their child.

- **Feeding/nursing**
- **Carrying:** parents will be carrying and cuddling with the baby anyway, just take these daily activities outdoors!
- **Naps:** although this one doesn't involve active interaction with a child, it gives an opportunity for parents to enjoy the outdoors and practice some self-care while their child sleeps. Keep the child protected from the sun and biting insects.

NATURE FOR BABIES/TODDLERS

Early in life, children's executive function development is highly dependent on the caregiver-child bond. Although infants may have limited direct interaction with nature (as compared to older children) they can experience benefits of contact with nature simply by the fact that contact with nature can powerfully benefit caregiver well being and provide a nurturing environment in which to strengthen the caregiver-child bond.

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- **Nature Towers:** stack items like stones or leaves and encourage your child to imitate you. Knock them down and rebuild.

Daily Routines

Transition some of these daily activities outdoors to the porch, the yard, or the park, where you can de-stress, eliminate technology distractions, and focus on bonding with your child.

- **Feeding/nursing**
- **Carrying:** you will be carrying and cuddling with the baby anyway, just take it outside!
- **Naps:** although this one doesn't involve active interaction with your child, it gives an opportunity for you to enjoy the outdoors and practice some self-care while your child sleeps. Keep the child in the shade and protected from biting insects.

OT recommendation:

18-36 MONTHS

During this stage, children are rapidly developing language skills. Language skills play an important role in the development of executive function because it helps children identify their thoughts and actions, reflect on them, and make plans they both use and hold in their minds. Language also aids children in understanding and following increasingly complex rules. These rules are used to regulate behavior and participate in games.

Executive Function Goals

- Simple imaginary play
- Simple games
- Turn-taking
- Matching/sorting tasks

Here's a list of activities to get you started...

Shared Attention

- **Splash:** visit any body of water and make a game of tossing in items like pebbles, sticks, and leaves. Make a game of gathering types of materials to toss in the water.
- **Happy Trails:** have a child lead you along a pathway, follow the edge of natural border like a field or stream, or follow animal tracks (real or ones you made). This is even more fun in the snow.
- **Puddle Jumpers:** little kids love to squelch in the mud and splash in puddles! Use this opportunity to talk about the sensations and sounds of mud and water.

Matching/Sorting

- **Matching:** collect two of several nature items (sticks, grass, pebbles, etc.) and spread them out on a flat surface. Match them up.
- **Scavenger Hunt:** Lay found nature items (handful of dirt, leaf, flower, seedpod) from nearby down on a blanket, bandana or pathway. See if you and the child can find a matching handful of dirt/leaf/seedpod etc. and put the found items beside each other.

Inhibition

- **Musical statues/Freeze dance**
- **Ring Around the Rosie:** wait until the song says to fall down! Try this in the grass, the snow, the sand, or if you're really adventurous, the mud!

Other Active Games

- **Obstacle Course:** challenge working memory, attention and inhibition by crawling under the branch, jumping over the puddle, picking up a rock and dropping in the bucket, all in order!
- **Animal Walks:** Invite children to move like different animals on your walk. Bears walk slowly on all fours, frogs and bunnies hop, deer prance, birds flap, etc.

NATURE FOR TODDLERS

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OT recommendation:

3-6 YEARS

Children's executive function skills develop very rapidly at this stage, so it is important to adapt activities to match the skills of each child. Younger children will require more structure, while older children can be more independent. Ultimately, our goal is to help children to shift towards greater independence during this period, so as the child matures, reduce the amount of support you provide.

Executive Function Goals

- Increased independence in executive functioning
- More complex imaginary play
- Take basic care of self (dressing, toileting, feeding)

Here's a list of activities to get you started...

Walks and Hikes

- **A Plain Old Walk:** even a walk through your tree-lined neighborhood or nearby park can have great benefits!
- **Child-Led Hike:** give your child a chance to follow their curiosity at their own pace of exploration.
- **Listening Walk:** compare and contrast sounds, and talk about why you hear different sounds in different places.
- **Animal Tracks:** follow animal tracks (real ones or tracks you made), or a deer trail. This is even more fun in the snow. Talk about where the animal might have been going and why.
- **Animal Walks:** Invite children to move like different animals on your walk. Bears walk slowly on all fours, frogs and bunnies hop, deer prance, birds flap, etc.
- **Animal Adventure:** as you embark on your walk, pretend you're animals going on an adventure. Construct a story and live it out as you walk, hop, or flutter down the path.
- **Owl Eyes/Deer Ears:** cup your hands behind your ears to help magnify the sound. Make an "O" with each hand and place it around your eyes. Both actions will show you a whole other world!
- **Belly Hike:** that's right, lay on your bellies and inch just a few feet across the ground. Young children are fond of tiny objects, and they will be delighted to see what they find!

- **Go Barefoot!:** this is a great sensory experience that increases a child's awareness of their surroundings.

Active Games

- **Obstacle Course:** duck under a branch, hop over a puddle, swing from a tree, the possibilities are endless!
- **Treasure Hunt**
- **Scavenger Hunt:** the Internet has plentiful resources and templates for nature-based scavenger hunts.
- **Camouflage:** cover yourself with leaves, mud, or hide behind a tree while playing hide and seek.
- **Water Races:** carry water in any container (a bucket, shell, cup, etc.) to the finish line as fast as you can without spilling any.
- **Puddle Jumpers:** little kids love to squelch in the mud and splash in puddles! Use this opportunity to talk about the sensations and sounds of mud and water.

Hands On Activities

- **Flip:** use a stick or a rock to simply turn or roll things over and discover who and what's living underneath!
- **Collect 10:** collect 10 of anything- leaves, rocks, bugs, things that are crunchy, things that are green, etc. In another variation, collect items of every color of the rainbow.

3-6 YEARS

Hands On Activities Cont'd

- **Leaf Matching:** pick out a few leaves from a small area and place them on a bandana. Have the child search the area and try to find matching leaves.
- **Leaf Races:** select a leaf, stick, or other object that will float, and then drop them in a creek at the "starting line". See whose leaf goes down the creek the fastest!
- **Rede:** in this Tanzanian game, players sit in a circle around a mound of sand. An upright stick is stuck into the top of the mound. Players take turns removing a handful of sand from around the stick. When the stick falls over, the player must run to home base before other players can tag them!
- **Fairy Houses:** select a little space of the ground or a pot, and use twigs, leaves, flowers and more to create homes for the fairies.
- **Plant a Garden:** do you have dirt, seeds, pots and a water source? Have a child help you plan, plant, and water a garden. Even a few pots on the windowsill have therapeutic benefits!
- **Crayon Rubbings:** make crayon rubbings of interesting textures around you- gravel, tree bark, pine needles, etc. You can also make this into a guessing game- where did this rubbing come from?
- **Sand/Mud Letters:** take sticks and do some gross motor writing or drawing in the sand and mud.
- **Nest Building:** use found nature materials to make a nest. The nest can be made to fit favorite toys and stuffed animals too.
- **Leaf Jewelry:** bring string or cord outside and poke holes into leaves to string them into a necklace. This can also be done with shells, flowers, and more.
- **Indoor Treehouse:** can't go out? Make a little house with popsicle sticks or toothpicks in the dirt of a potted plant (the "tree" of the "treehouse").
- **Press Flowers:** pick flowers and press them. Come back in a session a few weeks later to see what you've made!
- **Paint with Mud:** goopy, as opposed to thin, mud works the best for this. Brushes can be real brushes, Q-tips, leaves, bunches of grass, sticks, or fingers. You can paint a canvas, a piece of paper, the sidewalk, or a tree. Stick in extra grass or leaves to adorn the work of art.
- **Mini-Pond:** you need a plastic tub, sand and/or rocks, and water. Bury the tub so it is mostly in the ground, weigh it down with sand and rocks, place rocks up to the surface in at least one area so critters can get out, and fill it with water. Check our WildlifeWatch.org/uk for more details.
- **Fort Building:** build a fort with branches, rope, spare pieces of fabric, and more. If it's winter, build a snowfort. You can press snow into small plastic tubs to make "bricks" for building.

Remember, some of the best challenges and inspiration to executive function come from free play outdoors. Make sure to recommend outdoor free play to families!

NATURE FOR PRESCHOOLERS

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- **Press Flowers:** pick flowers and press them. Come back in a session a few weeks later to see what you've made!
- **Dollies Adventure:** take dolls or other favorite toys outside, where nature items (a stump) can become anything (a chair, house, trampoline, or tea party table).
- **Sand/Mud Letters:** take sticks and do some gross motor writing or drawing in the sand and mud.
- **Nest Building:** use found nature materials to make a nest. The nest can be made to fit favorite toys and stuffed animals too.
- **Paint with Mud:** goopy, as opposed to thin, mud works the best for this. Brushes can be real brushes, Q-tips, leaves, bunches of grass or fingers. You can paint a canvas, a piece of paper, the sidewalk, or a tree. Stick in extra grass or leaves to adorn the work of art.
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- **Indoor Treehouse:** can't go out? Make a little house with popsicle sticks or toothpicks in the dirt of a potted plant (the "tree" of the "treehouse").
- **Crayon Rubbings:** make crayon rubbings of interesting textures around you- gravel, tree bark, pine needles, etc. You can also make this into a guessing game- where did this rubbing come from?

OT recommendation:

7-12 YEARS

Play in nature, especially in middle childhood, is key to developing capacities for creativity, problem-solving, and intellectual and emotional development. In this period, cognitive flexibility begins to reach maturity. In this period, children start to understand how to apply executive function skills across a variety of contexts.

Executive Function Goals

- Steadily increase complexity of games and activities
- Begin applying EF skills across contexts
- Start to organize own time and responsibilities

Here's a list of activities to get you started...but remember, some of the best inspiration and challenges to executive function comes from free play outdoors!

Walks and Hikes

- **A Plain Old Walk:** even a walk through your tree-lined neighborhood or nearby park can have great benefits!
- **Child-Led Hike:** give your child a chance to follow their curiosity at their own pace of exploration.
- **Listening Walk:** compare and contrast sounds, and talk about why you hear different sounds in different places. Make a "noise map" of your neighborhood.
- **Animal Tracks:** follow animal tracks (real ones or tracks you made), or a deer trail. This is even more fun in the snow. Talk about where the animal might have been going and why.
- **Animal Walks:** Invite children to move like different animals on your walk. Bears walk slowly on all fours, frogs and bunnies hop, deer prance, birds flap, etc. With older children, pick more sophisticated movements- owls regurgitating pellets or birds ruffling their feathers.
- **Animal Adventure:** as you embark on your walk, pretend you're animals going on an adventure. Construct a story and live it out as you walk, hop, or flutter down the path.
- **Owl Eyes/Deer Ears:** cup your hands behind your ears to help magnify the sound. Make an "O" with each hand and place it around your eyes. Both actions will show you a whole other world!
- **Go Barefoot!:** this is a great sensory experience that increases a child's awareness of their surroundings.
- **Belly Hike:** that's right, lay on your bellies and inch just a few feet across the ground. Young children are fond of tiny objects, and they will be delighted to see what they find!
- **Blindfolded Hike:** tie a rope between trees to find your way along the path
- **Family Tree:** if you regularly take hikes along a certain path, pick a tree to be the special or family tree. Every time you walk by, check it for changes, take pictures, make bark rubbings, and otherwise document it.

Active Games

- **Obstacle Course:** duck under a branch, hop over a puddle, swing from a tree, the possibilities are endless!
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- **Camouflage:** cover yourself with leaves, mud, or hide behind a tree while playing hide and seek.
- **Water Races:** carry water in any container (a bucket, shell, cup, etc.) to the finish line as fast as you can without spilling any.

7-12 YEARS

Active Games cont'd

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- **Mindfulness:** find a calm spot to sit or lay down, and practice attending to sights, then sounds, then feel (like the wind). Talk or write about what you noticed.
- **Guided Relaxation:** find a calm comfy spot to lie down, and think about relaxing each part of your body one by one. Start with toes and go all the way up to eyebrows. Make sure to take deep breaths throughout.

Hands On Activities

- **Flip:** use a stick or a rock to simply turn or roll things over and discover who and what's living underneath!
- **Collect 10:** collect 10 of anything- leaves, rocks, bugs, things that are crunchy, things that are green, etc. In another variation, collect items of every color of the rainbow.
- **Cook Outdoors:** if you're adventurous and have the resources, collect edible plants (check local plant guides) or start a fire and cook simple food over it. If you are short on time, collect plants in a cup and mash them to make pretend soup. Ensure you are familiar with poisonous plants in your area, and that the child is able to understand that the soup is not to consume. Use discretion around fires.
- **Leaf Matching:** pick out a few leaves from a small area and place them on a bandana. Have the child search the area and try to find matching leaves.
- **Leaf Races:** select a leaf, stick, or other object that will float, and then drop them in a creek at the "starting line". See whose leaf goes down the creek the fastest!
- **Rede:** in this Tanzanian game, players sit in a circle around a mound of sand. An upright stick is stuck into the top of the mound. Players take turns removing a handful of sand from around the stick. When the stick falls over, the player must run to home base before other players can tag them!
- **Fairy Houses:** select a little space of the ground or a pot, and use twigs, leaves, flowers and more to create homes for the fairies.
- **Plant a Garden:** do you have dirt, seeds, pots and a water source? Have a child help you plan, plant, and water a garden. Even a few pots on the windowsill have therapeutic benefits! With older children, choose between types of plants and identify the types of conditions needed for plant growth. Try making a "pizza" garden- plant pizza ingredients like tomatoes and basil in the shape of a pizza.
- **Press Flowers:** pick flowers and press them. Come back in a session a few weeks later to see what you've made!
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- **Sliding Marbles:** find or make a slope out of dirt or snow. Poke a row of holes at the bottom. Take turns rolling marbles down the slope and trying to get them to roll in.

NATURE FOR CHILDREN

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- **Moon Walk:** hike at night by the light of a full moon. Listen for all the different night sounds, and make sure to turn out all your flashlights at least once to hear more sounds and build connection as you huddle up.

Active Games

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- **Bug Hunt:** see how many different types of bugs you can find in one trip. Write down descriptions or take pictures to keep track.
- **Rafts:** use string to tie sticks together to create a raft. Want to have frogs for passengers? Use a small plank of wood for a raft. Hammer a nail into one end and slide a candle onto the nail. Mount a screw with an eye ring into the board on the opposite end, and attach a string or fishing line. Go to a pond at night and use a flashlight to spot the reflective eyes of frogs. Light the candle, and push the raft into the water, holding on to the string to pull the raft back in. Wait and watch- the frogs will be attracted to the light.
- **Moth Broth:** put overripe fruit, sweetener (sugar or honey) and a liquid (beer, wine, or juice) into a blender. Spread the mix on trees, and come back at night to see what moths have come for dinner.

OT recommendation:



DO YOU WANT A

PHYSICAL TOOLKIT?

Keep in mind the principles of loose parts play while selecting materials for therapy outside (see page 8).

Choose items that lend themselves to a variety of uses rather than limited play schemes.



Here are two main methods for incorporating play materials outdoors, depending on the requirements of your space.

Can't leave materials outside? Then either keep an adventure kit in a spare bag, box or wagon, or have your kiddo help pack an adventure kit as part of the session!

Adventure kits can include easily transportable items such as

- tweezers
- magnifying glass
- egg carton for collecting items
- small shovel
- small rake
- ziplock baggies for samples
- small jars or plastic containers
- string
- scissors

Do you have the good fortune of being able to leave some materials in an outdoors space? Consider including the following materials. They can be kept in plastic storage bins, wood crates, under a tarp, or scattered throughout the playspace.

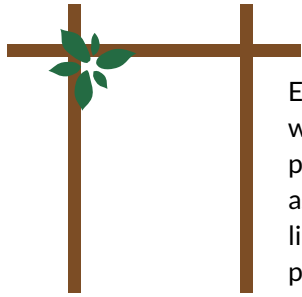
- planks of wood
- tree cookies (discs of wood)
- cut plastic tubing
- PVC pipes
- rope
- fabric pieces
- shovels
- buckets
- pie pans
- metal scoopers
- serving pitchers
- metal colanders
- baskets
- trays
- sticks
- stones
- sand



Many of these items can be rescued from home or found at thrift stores and garage sales. Rotate items to keep things fresh.

SPACE DESIGN

Lucky enough to have an outdoor space to make your own? Use these principles to help maximize the therapeutic potential of your space. These principles are primarily based off research findings in nature playscape design. For additional information, read *Nature by Design* (2017) by Victoria Carr and colleagues, and *National Guidelines for Nature Play & Learning Places* (2014) by Robin Moore.



ENTRYWAY

Engages a sense of "being away", which promotes restorative potential. This can be as simple as a rope tied between tree limbs, piles of rocks as entry posts, or branches stuck in the ground.



AREAS OF TREES

Provide varied terrain and opportunity for loose parts play with twigs, sticks, leaves and branches.

GRAVEL/SAND PITS

Talk about sensory possibilities! Dig, sift, bury, collect and create. Use a traditional sandbox, a kiddie pool, or a hole in the ground lined with tarp.

GATHERING SPACE

Helps children orient themselves in the landscape, and provides a space for leading group activities.

VARIED TOPOGRAPHY

Slopes, hills, meadows, marshes and more offer opportunities for different types of play and different challenges to the body.

PATHWAYS

Pathways offer navigational challenges and opportunities to develop spatial awareness.

HIDING PLACE

Use this space for sensory breaks or to focus on fine motor activities. Try a tent, camping gazebo, tarp or parachute, beach shelter, playhouse or garden shed.

WATER ELEMENT

Not only are many kids drawn to water play, it also has great attention restoration potential and offers endless possibilities for loose parts play. The water element can be adjacent to a muddy area for more possibilities.

WELL DEFINED BORDERS

Helps create a predictable area in which kids feel more comfortable playing and exploring. Use bushes, logs, stakes or ropes tied between trees.

RESOURCES

Connecting Children and Nature

- Children and Nature Network: childrenandnature.org
- Nature Rocks: naturerocks.org
- Natural Start: naturalstart.org
- Take a Child Outside: takeachildoutside.org
- Free Outdoor Sensory Diet Cards: theotttoolbox.com
- Kids Gardening: kidsgardening.org
- Balanced and Barefoot, by Angela Hanscom
- No Such Thing As Bad Weather, by Linda McGurk
- Last Child In the Woods, by Richard Louv
- Vitamin N, by Richard Louv
- How to Raise a Wild Child: The Art and Science of Falling in Love with Nature, by Scott Sampson
- I Love Dirt: 52 Activities to Help You and Your Kids Discover the Wonder of Nature, by Jennifer Ward
- The Nature Connection: An Outdoor Workbooks for Kids, Families and Classrooms, by Claire Leslie

Executive Function

- Activities Guide: Enhancing and Practicing Executive Function Skills with Children from Infancy to Adolescence
<https://developingchild.harvard.edu>
- Executive Function Skills for Life and Learning Video from
<https://developingchild.harvard.edu>

What do you think of this toolkit? Email natureandot@gmail.com with your questions and comments!

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- **Other recommended reading:** Cooper-Marcus, C. & Sachs, N.A. (2013). *Therapeutic Landscapes: An evidence-based approach to designing healing gardens and restorative outdoor spaces*. Hoboken, NJ: Wiley.
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Evidence Charts

Author, year	Study design	Country, setting	n	Study characteristics: population, age	Intervention and control characteristics: exposure type; activity; subgroup/environments; duration	Cognitive performance measures	Targeted EF	Contact with nature supports targeted EF outcome?
Berman et al., 2008 (1)	RCT	United States; downtown and campus arboretum		38 University students; m=22.62 years	Actual; walking; arboretum vs. downtown; 50'00-55'00	Digit Span Backwards	attention	yes
Berman et al., 2008 (2)	RCT	United States; laboratory		12 University students; m=24.25 years	Virtual; viewing images; natural vs. urban; 10'00	Attention Network Task; Digit Span Backwards	attention	yes
Berry et al., 2014	RCT	United States; laboratory		185 University students; m=22.88 years	Virtual; viewing images; natural vs. urban vs geometric; self-paced	Delayed Discounting Task	impulsivity	yes
Berry et al., 2015	RCT	United States; laboratory		43 University students; m=22.5 years	Virtual; viewing images; natural vs. urban; self-paced	Delayed Discounting Task; Interval Bisection Task	impulsivity	yes
Berto, 2005	RCT	Italy, laboratory		32 University student; m=23 years	Virtual; viewing images; restorative vs nonrestorative vs geometric; 00'15 vs. self-paced	Sustained Attention to Response Task	sustained attention	yes; whether in standardized time condition or self-paced
Beute & De Kort, 2014 (1)	RCT	The Netherlands, laboratory	50a	University students; m=22.2 years	Virtual; viewing images; natural vs. urban; 03'00	2-Back Task	self-regulation; higher-order executive functioning task	yes; no
Bratman et al., 2015	RCT	United States; university surrounds		60 General population; m=22.9 years	Actual; walking; taking photos; urban park vs. busy street; 50'00	Operation Span Task; Change Detection Task; Digit Span Backwards; Attention Network Task	verbal working memory; visual working memory; attention	yes; no; no
Craig et al., 2015	RCT	United States; laboratory		48 University students; m=20.1 years	Virtual; viewing images; natural vs. urban; 04'00	Sustained Attention to Response Task	sustained attention	yes: only in participants without depressive symptoms
Dadvand et al., 2015	Natural Experiment	Spain; school and residential areas		2623 School children; m=8.5 years	Actual; exposure to greenspace (residential, commute to school, school); Cognitive testing progress over 12 months	n-Back Test; Attention Network Task	working memory, attention	yes; yes
Dadvand et al., 2017	Natural Experiment	Spain; residential areas		School children; assessed at 4-5 years 1866 and 7 years	Actual; exposure to greenspace (residential); cognitive testing at 4-5 years and 7 years of age	Conners' Kiddie Continuous Performance Test; Attentional Network Task	attention	yes
Faber Taylor and Kuo, 2009	RCT	United States; local public outdoor environments		School children diagnosed with ADHD; 17 m=9.23 years	Actual; walking; urban park vs. downtown area vs. residential area	Digit Span Backwards, Stroop Color-Word Test, Symbol Digit Modalities, Vigilance Task of the Gordon Diagnostic System Model 111-R	attention; cognitive flexibility	yes; yes

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Faber Taylor et al., 2002	Natural Experiment	United States; public housing project; Chicago		169 School children; ages 6-9 years	Actual; exposure to greenspace (residential); NA	Symbol Digit Modalities; Digit Span Backwards; Alphabet Backwards; Necker Cube Pattern; Matching Familiar Figures Test; Category Matching; Stroop Color Word Test; Delay of Gratification Task	concentration; impulse inhibition; delay of gratification	yes; yes; yes; all factors related for girls but not boys
Fuegen and Breitenbecher, 2018	RCT	United States; university campus; Kentucky		181 University students, m=21.59	Actual vs. virtual; indoor exercise with virtual vs. indoor rest with virtual vs. outdoor exercise with actual vs. outdoor rest with actual; 15'00	Digit Span Backward; Symbol Digit Modalities Test	attention	yes; under conditions of rest, greater benefits of exposure to actual nature, under conditions of exercise, unclear
Gamble et al., 2014	RCT	United States; laboratory		University students, general population; 56 NR; m=20.54 years, m=69.1 years	Virtual; viewing images; natural vs. urban; 05'00	Attention Network Task; Digit Span Backwards	executive attention	yes; both age groups
Greenwood and Gatersleben, 2016	RCT	United Kingdom; high school, South West London		120 High school students; 16-18 years	Actual: relaxing vs talking with peer vs playing game on mobile phone; natural outdoor vs. small indoor room; 20'00	Necker Cube Pattern Control	attention	yes
Han, 2017	RCT	Taiwan; university campus		116 University students; m=20.85 years	Actual: walking - 'high natural' vs 'low natural'; jogging - 'high natural' vs 'low natural'; 15'00	Forward Spatial Span; Digit Span Backwards	attention	yes
Hartig et al., 1991 (a)	Quasi-experiment	United States; wilderness, residential areas, varied vacation destinations		General population; m=35.9 (wilderness), 29.2 (vacation), 31.6 (no vacation) 68	Actual: wilderness backpacking vacation vs. nonwilderness vacation vs. daily routine	proofreading task	mental restoration	yes
Hartig et al., 1991 (b)	RCT	United states; local public outdoor environment		34 University students; m=20 years	Actual; urban walk vs. nature walk vs. passive relaxation	proofreading task	mental restoration	yes
Jenkin et al., 2017	RCT	England; NR		75 Children; 8-11 years	Virtual; viewing video of natural scenes vs. viewing video of urban scenes; 03'00	Delay of Gratification; Stroop	attention; delay of gratification	no; yes
Jung, 2017	RCT	United States; laboratory		Heart failure patients, healthy matched 40 adults; m=59.2 years	Virtual; viewing images; nature scenery vs. urban views; 07'00	Multi-Source Interference Task; Digit Span Forwards; Digit Span Backwards; Trail Making Task A, B; Stroop Test	attention	yes; in healthy adults and heart failure participants
Kuo et al., 2018	Quasi-experiment	United States; classrooms	2 classrooms; exact # students NR	Third grade students; 9-10 years	Actual; classroom type; natural outdoor classroom vs. indoor classroom; 10 weeks of 30-40 min lessons	Composite Index of Classroom Engagement	attention (form: classroom engagement)	yes

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Lee et al., 2015	RCT	Australia; laboratory	150	University students; m=20 years	Virtual; viewing city with green roof vs. viewing city without green roof; 00'40	Sustained Attention to Response Task	sustained attention	yes
Li and Sullivan, 2016	RCT	United States; high schools	94	High school students; NR	Actual; greenspace window view vs. builtspace window view vs. no window view; self-paced	Digit Span Forwards + Digit Span Backwards (summary score)	attention	yes
Lin et al., 2014	RCT	Taiwan; laboratory (classroom)	138	University students; NR	Virtual; viewing images; urban street with simulated natural stimuli vs. urban street without natural stimuli; 01'40	Digit Span Backwards	attention	yes; more powerful effect when participants were told to pay attention to trees
Lymeus et al., 2017	RCT	Sweden; small classroom	51	University students; m=25 years	Virtual; mindfulness meditation with nature images vs. conventional mindfulness meditation vs. rest with nature images; 15'00	Letter-Digit Substitution Task	attention	yes; viewing nature images reduced the attention effort required for mindfulness
Martensson et al., 2009	Natural Experiment	Sweden; preschools	198	Preschool children; 4.5-6.5 years	Actual; play on green playgrounds; degree of greenness; daily play time	Early Childhood Attention Deficit Disorders Evaluation Scale	attention	yes
McCormick, 2017	Systematic review	NA	12 studies	NA	NA; access to greenspace; NA; NA	NA	mental well-being (including attention, memory and ADHD symptoms)	yes
Ohly et al., 2016	Systematic review	NA	31 studies	NA	NA; exposure to natural environments; NA; NA	NA	attention	yes; for some aspects of attention
Pilotti et al., 2015	RCT	United States; laboratory	63	Student advisors; m=31.79 years	Virtual; viewing video of natural scenes vs. viewing video of urban scenes; 15'00	Oddball Task created for the study	attention	yes
Raanaas et al., 2011	RCT	Norway; laboratory office setting	34	University students; m=23.3	Actual; exposure to office setting with and without plants;	Reading Span Task	attention	yes
Repke et al., 2018	Natural Experiment	United States; residential areas	609	General population; m=36.39	Actual; nature accessibility and exposure from home; NA	Delay-Discounting Task	impulsivity	yes
Sahlin et al., 2016	RCT	Sweden; urban areas, nature reserve	51	General population; m=45 years	Actual; guided relaxation; outdoor natural vs. indoor; 30'00	Necker Cube Pattern Control	attention	yes

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Schutte et al., 2017	RCT	United States; urban areas		Children (four age groups); m=4.53, m=5.48. m=7.4, m=8.5 years	Actual; walking: natural vs. urban; 20'00 Actual; viewing: office setting with plants vs. magazine rack vs. neither; 15'00	Spatial Working Memory Task; Go/NoGo Task; Continuous Performance Task; Digit Span Backwards	working memory, inhibitory control, attention	no, no, yes
Shibata & Suzuki, 2004	RCT	Japan; laboratory	90	University students, NR		Word Association Task	task performance	yes; difference with female participants only
Shin et al., 2011	RCT	Korea; university surrounds, downtown urban area	60	University students; m=23.27	Actual; walking: forest vs. urban area; 50'00-55'00	Trail Making Test B	cognitive functions (including attention)	yes
Sonntag-Ostrom et al., 2014	RCT	Sweden; urban area and forest	20	Female patients with exhaustion disorder. NR	Actual; walking: forest vs. urban area; 90'00	Necker Cube Pattern Control	attention	yes
Stenfors et al., 2018	Meta-analysis	NA	567	NA	NA; NA; natural vs. urban environment	Digit Span Backwards	directed attention	yes
Stevenson et al., 2018	Systematic review	NA	42 studies	NA	NA; exposure to natural environments; NA; NA	NA	working memory, attention, cognitive flexibility, visual attention, vigilance, impulse control, processing speed	yes, yes, yes, no, no
Tanaka et al., 2013	RCT	Japan; housing	16	Females from general population; m=43.5 years	Actual; viewing: nature vs. no nature; 30'00	Advanced Trail Making Tests	cognitive function	yes
Tennessen & Cimprich, 1995	RCT	United States; university dormitories	72	University students, NR	Actual; viewing: 4 categories from all natural to all built; ???	???	attention	yes
Torquati et al., 2017	RCT	United States; natural outdoor area and indoor laboratory	10	Children; 6-11 years	Actual; viewing: natural outdoor vs. indoor; NR	Digit Span Backwards, Spatial Working Memory Task, Go/NoGo Task, Continuous Performance Task	attention, inhibitory control, spatial working memory	no, no, yes
Van den Berg & Van den Berg, 2011	RCT	The Netherlands; farms and small town	12	Children with ADHD; 9-17 years	Actual; leisure visit; farm vs. small town; morning/afternoon period	Opposite Worlds Test from the Test of Everyday Attention for Children	concentration	yes
Wallner et al., 2018	RCT	Austria; parks and forest near school	64	Students; 16-18 years	Actual; viewing during lunch break; small park vs. large park vs. forest; 60'00	d2-R Test of Attention	concentration	yes

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Wang et al., 2016	RCT	China; laboratory	140	University students, m=22.38 years	Virtual; viewing videos; natural vs. urban; 08'00	Digit Span Backwards	attention	yes
Wang et al., 2017	RCT	China; laboratory	130	University students; m=21.23 years	Virtual; viewing videos; natural vs. urban; 10'00	Taylor's Aggression Paradigm	self control (in the form of aggression)	yes
Wells, 2000	Natural Experiment	United States; residential areas	17	Children from low-income families participating in self-help housing program; 7-12 years	Actual; exposure to greenspace (residential); move to new home with ranging levels of greenspace exposure; pre-move and several months post-move	Attention Deficit Disorders Evaluation Scale	attention	yes
Weng & Chiang, 2014	RCT	Taiwan; laboratory and university surrounds	203	University students; m=19.7 years	Actual; surfing the internet indoors vs. chatting indoors vs. walking outdoors vs. exercising outdoors vs. gardening; 30'00	Necker Cube Pattern Control	attention	yes
Zijlstra et al., 2017	Natural Experiment	Spain, the Netherlands; United Kingdom	1493-1602m	General population adults; m=48 years	Actual; Residential distance to greenspace, residential surrounding greenness; NA	Color Trails Test	attention	yes

Disclaimer: please use caution and discretion when selecting and implementing these activities with children. Safety is a priority. Be aware of possible hazards involved in each activity.

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