



Benefits of Time Spent Outdoors in Early Childhood Education: A Systematic Review

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Several studies have provided evidence that time spent in nature (i.e., in natural environments or the outdoors) plays a beneficial role in child development by positively influencing children's cognitive processes and states (Bowler et al., 2010; Bratman et al., 2012; 2014; Cameron-Faulkner et al., 2018; Kaplan, 1995; Mitchell et al.). However, to date, no study has looked systematically at the overall literature addressing the benefits nature plays in early childhood education, primarily through outdoor learning or time spent outside in natural environments. The purpose of the current study is to provide a systematic review of the empirical literature evaluating outcomes linked to children spending time outdoors through outdoor play, forests, gardens, or school playgrounds. A systematic search of PsycINFO was conducted to identify critical studies linking the outdoors with outcomes during early childhood. Inclusion criteria were as follows: research studies conducted with children enrolled in early childhood education programs (age 2-5-year-olds) related to nature base experiences in the United States and peer-reviewed articles written in English. This search yielded 12 empirical studies. Codes were developed to examine a) what outcomes have been measured for children spending time outdoors in their early childhood education settings and b) what approaches were used to measure these outcomes. The two most measured outcomes included in studies were children's behavior (N = 3; 25%) and educational or learning outcomes (N = 3; 25%). Most activities were child-led (N= 6, 50%) while children engaged in free-play (N = 5, 29%) and physical activities (N= 5, 29%). The most common method utilized was a quasi-experimental design (N=5, 29%), followed by secondary research designs (N=2, 16%). A few studies used rigorous methods to examine the links between children spending time outdoors and their specific beneficial outcomes. Implications for future research in this area are discussed.

Keywords: *early childhood education, green space, natural environment, outdoor learning, ecopsychology*

Introduction

Children who spend time in outdoor spaces, including greenery, landscapes, forests, and gardens, are known to benefit from various positive health and educational outcomes (Scott et al., 2018). There are several avenues through which spending time outdoors improves these outcomes in young children. Bodily movement is essential for improving mental health, obesity rates, brain development, attention, sleep, and motor development; at least 60 minutes of physical activity is recommended in early childhood (CDC, 2023). Outdoor exposure may also increase Vitamin D absorption through the sun, release stress, and heighten children's attention in academic settings (Head Start ECLKC, 2019). This effect is significant for children who struggle to pay attention in classroom settings or perform academic tasks. Children who have difficulty with attention in school environments are likely to underperform academically (Rabiner, 2013), thus spending time outdoors may help them focus on school-related tasks.

The outdoors also allows children the ability to interact with one another through creative play; consequently, playing outdoors may also help improve self-control, improve social interactions, and reduce aggression (Keniger et al., 2013). However, the extent to which the relationship between spending time outdoors improves school readiness outcomes for young children is unclear. Therefore, it is vital to understand how young children may benefit from outdoor experiences throughout their early childhood education to promote their academic growth and success.

Early Childhood is a Time of Great Growth and Exploration

Young children are typically able to absorb new information from their environment quickly. At the developmental age of 4 to 5 years old, they often progress through a heightened state of curiosity and exploration (Lundy & Smith, 2021). During this developmental period, children are also developing their school readiness skills and are expected to learn how to regulate their attention and behavior to meet classroom expectations (Andrews et al., 2022). Children also develop their executive functioning and self-regulation skills (i.e., the ability to retain attention, focus, process information, follow and recall instruction, multi-task, etc.-) which helps them in their learning and ability to attend to lessons while meeting classroom expectations. Developing proficient executive functioning skills is critical for them to engage and understand the concepts presented. Time spent outdoors during school hours provides an appropriate space for younger children to experience lower regulatory requirements, as they have more opportunities for free play in a less structured environment during scheduled recess. A study that evaluated how playing in the outdoors affects children's behavior during classroom tasks discovered the intensity of activity during play prior to learning time was positively linked to on-task behavior (Lundy & Smith, 2021). As children experience free play, they frequently engage in physical activity, which helps them to regulate their behavior when they return to classroom settings with higher regulatory requirements (Koepp et al., 2022).

From a developmental standpoint, social-emotional skills (e.g., children's abilities to play with others, respectfully, use kind words, take turns, and cope with different emotions) in early childhood are linked to overall positive child development. Various studies have examined how social skills and play are intercon-

nected, and a few studies have examined pretend play in outdoor environments, where free play is more frequent. For example, Li et al. (2016) found that outdoor play promotes social skill development and encourages play behavior. Outdoor spaces also promote positive youth developmental outcomes for children in low-income families. Bates et al. (2018) examined the levels of physical activity and social interactions in new green schoolyards from low-income urban neighborhoods. The authors noted that children who were in the green schoolyard had higher levels of physical activity over sedentary activity and were engaged socially with their peers. They suggested that green schoolyards promote positive developmental outcomes by increasing physical activity and positive peer interactions among children. As such, outdoor play may be essential for fostering children's early social skills.

Curiosity and learning also play a significant role in a child's academic performance and achievement. As children naturally engage in play, they often explore their environment and propose questions (Bento & Dias, 2017). Their naturally curious traits may be used to encourage learning new ideas, concepts, or lessons (Bento & Dias, 2017). Storing new information and retrieving learned information from different environments is one of the effective methods for learning (Sternberg & Sternberg, 2017). Sternberg and Sternberg (2017) explain how recall is affected when one learns concepts and practices recalling learned concepts in different environments (e.g., inside the classroom, at home, outdoors, grocery shopping, on the bus, etc.). Traditionally, children learn inside a classroom setting with tables, chairs, boards, paper, and pencils. If children are taken to alternative environments, their awareness of the material presented to them may become more tangible and easier to understand, which could help younger students apply everyday lessons to real-life applications. For example, if preschoolers are learning about insects in their science lesson, they could explore an outdoor space and attempt to identify real insects they may have learned in the classroom.

Complex concepts may also be learned in outdoor environments through outdoor play. Haywood-Bird (2017) used an ethnographic design to examine how children experience outdoor play in a sample of twenty-five 2.5 to 5-year-olds attending a Waldorf-inspired private preschool. The author found that the outdoors provided many opportunities for children to grow socially and cognitively and gain confidence by making their own choices and using their imagination in play. This study suggests that examining children's perspectives during outdoor play could further help teachers and early childhood workers with a holistic understanding of a child's development (Haywood-Bird, 2017).

Spending time outdoors may also improve attention-deficit/hyperactivity disorder (ADHD) symptoms in young children. Kou and Taylor (2014) examined the impact of natural settings on diverse subpopulations of children diagnosed with ADHD. Parents were asked to rate their children's symptoms based on the after-effects of common after-school and weekend activities. The after-effects of green outdoor settings were compared to build outdoor and indoor settings. Results indicated "green outdoor" (defined as a natural park, farm, green backyard, or neighborhood space) activities significantly reduced ADHD symptoms among children in a national sample compared to indoor settings, including activities matched across other settings, such as urban greenery and "built outdoor" (defined as parking lots, downtown areas, or neighborhoods that lack green spaces; Kuo & Taylor, 2004).

Physical Activity and Time Spent Outdoors Promotes Children's Development and Wellbeing

In addition to providing children opportunities to explore and learn, physical activity and spending time outdoors is also beneficial to children's overall well-being. Previous studies have examined physical activity or active motor functions and found that they contribute to healthy physical development among children (Figueroa & An, 2017). Studies have also examined how the likelihood of developing positive outcomes varied among the physical activities conducted indoors versus outdoors (Noseworthy et al., 2023). Literature has addressed the impact nature holds on the well-being of others (e.g., reduced symptoms of depression and distress, etc.; Gascon et al., 2015; Haluza et al., 2014). Several studies have linked playing outdoors and engaging in physical activities to developing math and literacy skills in elementary-aged children (Becker et al., 2018). Studies also demonstrated post outdoor play, children retained their attention for a greater period while completing tasks inside the classroom compared to indoor play (Andrews et al., 2022). Research has provided supporting evidence linking exposure to nature (trees, grass, parks) to improved children's physical, mental, and cognitive health and behavioral functions (Kelz et al., 2015). Natural environments have been linked to influencing psychological or cognitive processing (e.g., increased energy level and cognitive task performance, less anxiety, and negative affect (Bowler et al., 2010; Bratman et al., 2012; Cameron-Faulkner et al., 2018; Hartig et. al, 2014; Kaplan, 1995). However, studies have yet to look at the current literature to understand the benefits nature may play in early childhood education, primarily through time spent outside in natural environments.

Current Study

Less time spent outdoors in the United States has been found to be associated with adverse health and mental health effects (e.g., obesity, depression, attention deficit disorder; (Louv et al., 2008). Child advocates emphasize that "children are disconnecting from the natural world," and this is referred to as a condition called "nature-deficit disorder" (Louv et al., 2008). Some research suggests lack of exposure to natural environments influences higher rates of obesity, depression, and attention disorders (Milano, 2007). Literature indicates spending time outdoors improves children's overall health. Young children are likely to improve their overall fitness by engaging in physical play, practicing their motor skills (e.g., walking, running, climbing, crawling), and growing healthier and stronger hearts, lungs, and muscles, as children tend to frequently move their bodies outdoors (Head Start ECLKC, 2019). Spending time outdoors is also linked to improving immunity against diseases, and access to vitamin D, which is crucial for healthy calcium absorption, teeth, and bones (Einstein, 2009). Spending time outdoors may also regulate sleep cycles as natural sunlight improves sleeping patterns, and children are also less likely to be nearsighted as natural light helps develop eyes (Aamodt & Chang, 2011). Although there are many potential benefits for young children spending time outdoors, no study to date has examined the overall literature evaluating how time spent outdoors and in natural settings impacts young children in early educational settings. Subsequently, the goal of the current study was to systematically review the literature to date to determine a) what outcomes have been measured for children spending time outdoors in their early childhood education settings and b) what approaches were used to measure these outcomes.

Methods

Procedures

Studies included in the review were identified as follows: The first author conducted an electronic search using PsycINFO on January 11th, 2022, to identify key studies investigating the use of outdoor time in promoting early childhood development. Two types of search terms were used: (a) child age (early education, early childhood, Head Start, Preschool, PreK) and (b) nature of time spent outdoors (green space, natural environment, outdoor learning, outdoor class). The exact search terms were as follows: (“Early Education” OR “Early Childhood” OR “Head Start” OR Preschool OR PreK*) AND (Green space* OR Natural Environment* OR Outdoor Learn* OR Outdoor Class*).

Three inclusion criteria were used to evaluate the following articles from the first search: (a) the intervention or the study was delivered to at least one child in the developmental stage of early childhood (i.e., 2-5-years-old); (b) data collected in the United States written in English; and (c) peer-reviewed journal. Of the 912 articles identified by the original search, the first author excluded 875 records after reviewing titles for potential eligibility. After reviewing the abstracts from the remaining 37 articles, 10 more records were excluded for not meeting the inclusion criteria. Following this review, 27 articles were selected for potentially meeting the criteria. After reviewing the full manuscripts, a final total of 12 articles meeting the inclusion criteria were found. Excluded articles from the original search may be acquired by the first author.

Coding Procedures

The research team collaborated to develop a coding system to evaluate the outcomes studied, the content and characteristics of time spent outdoors, and the design and methods of the reviewed studies. Specific codes in each of these categories are outlined below.

Outcomes Studied. Because time spent outdoors may promote self-regulation and social functioning and decrease symptoms of certain mental health disorders like ADHD (Keniger et al., 2013; Kuo & Taylor, 2004), the types of child outcomes were coded for each article. The codes generated for this category were: executive functioning, on-task classroom behavior, social-emotional and behavioral development, positive youth development outcomes, educational/learning, and social skills (See **Table 1**). The methods of measuring the outcomes were also reported via free-response.

Table 1*Operational Definitions for Outcomes Studied*

Term	Definition
Executive Functioning	The ability to regulate emotions, perform higher-order thinking, and organize information.
On-task Classroom Behavior	Completing classroom-setting assignments with appropriate attentional behavior.
Positive Youth Development Outcomes	Increased physical activity, prosocial behavior, and perceptions of safety.
Outdoor Educational/Learning	The ability to learn in the classroom taught lessons in outdoor environments (e.g., science-related concepts: insect identification, plant identification, temperature, wind, etc.).
Social-Emotional Behavior Development	The ability to self-regulate emotions and appropriate behavior in classroom settings (e.g., effectively express ongoing emotions and control behaviors related to their emotions).
ADHD Symptoms	Level of ADHD symptoms (e.g., restlessness, lack of attention, hyperactivity, inability to take turns, inability to complete tasks, etc.).
Play and Access to Adults	The ability to play safely in an outdoor environment or green space with proximity to adults.

Content and Characteristics of Time Spent Outdoors. Codes regarding the program setting description, activity location, kind of activity, and amount of time spent outdoors were developed to evaluate the context and characteristics of the time spent outdoors. Codes were developed to specify whether the location of the activity was in an urban, suburban, or unspecified area, as well as what center, school, or facility was running the activity. These codes included private schools, public schools, afterschool programs, educational centers, daycares, preschools, or unspecified. The settings in which the outdoor activities occurred were identified to be playgrounds, gardens, nature preserves, nature trails, parks, forests, or unspecified outdoor settings. The nature or type of the activity was also coded as physical activity, free-play, child-led, or outdoor learning (see **Table 2**). Frequency and the amount of time spent outdoors were reported as “how often and for how long.” For example, “Children spend time outdoors twice a week for 16 weeks for 30 minutes each session.” If specific times were not included in the article, raters reported “N/A.” When a code could not be determined based on the information provided in an article, it was coded as “not included.”

Table 2

Operational Definitions for Reported Outdoor Activity

Term	Definition
Physical	Running, walking, climbing, or using motor skills to engage in physical activities.
Free-Play	Creative, imaginative play led by the child.
Outdoor Learning	Children acquire skills in the outdoors (e.g., peer-play interactions, motor skills, social skills, concepts of the natural world, etc.-).

Design and Methods

Codes were also developed around the study design to provide descriptive data supporting the review. The codes included the number of participants, individuals leading the activity (parent, teacher, child or children, youth worker or volunteer, or other family members), and study design (randomized controlled trial, quasi-experimental group comparison, single case, open trial).

Inter-Rater Reliability

To establish inter-rater reliability, the first and second authors coded two randomly selected articles (17%) of the 12 studies with the objective of a minimum of 80% coding similarity across variables in each article. The average rate of agreement was 87.5% (Article 1: 85%, Article 2: 90%). Any discrepancies were resolved after a thorough discussion. The remaining articles were independently coded. The first author examined four articles and the second author examined the other five articles.

Data Analysis

Both authors used a Qualtrics-linked survey to code the selected articles. The first author reviewed responses, and discrepancies were discussed before updating responses on Qualtrics. Once all coding was complete, data were transferred into an Excel sheet, and descriptive statistics were calculated manually by the second author. The number and percentage of reviewed articles, including each code, were calculated for outcomes measured, setting description, activity location, kind of activity, activity leader, and design of the study.

Results

Twelve unique articles examining outdoor experiences during early childhood education were identified using search criteria. Articles were coded to describe the outcomes of spending time outdoors that have been empirically researched and the types of approaches used to measure these outcomes. Seven codes in

the study are mutually exclusive categories: utilized methodology, number of participants, location description (e.g., urban, suburban, city, other, or non-specified), setting description (e.g., private school, public school, after-school program, educational center, daycare, nature preserve, preschool, other, or non-specified), activity lead (e.g., teacher-lead, parent-lead, child-lead, certified teacher, youth worker or volunteer, family members, child or children, other, or non-specified), frequency and amount of time spent outdoors, and outdoor setting (e.g., playground, garden, nature preserve, trail, park, forest, other, non-specified). See **Table 7** for outdoor setting, **Table 9** for activities led, and **Table 10** for time spent outdoors. The remaining codes have the possibility for one study to include various components of a single code resulting in percentages greater than 100%. See **Table 3** for all included studies and **Table 8** for outdoor activity.

Table 3

Reported Approaches (Assessments) Used to Measure Outcomes

Article	Approach/Assessments	Outcomes
Koepp et al. (2022) <i>Preschoolers' executive functions following indoor and outdoor free play.</i>	Task-based assessments and classroom observations.	Executive functions.
Rosiek et al. (2022) <i>A Comparison of the Effects of Outdoor Physical Activity in Indoor Classroom-Based Activities on Measures of Executive Function in Preschoolers.</i>	Pre- and post-cognitive tasks.	Executive functions and classroom behaviors.
Lundy et al. (2021) <i>Effects of Active Outdoor Play on Preschool Children's on-Task Classroom Behavior</i>	On-task behaviors and devices for movement.	On-task behaviors in a classroom.
Bates et al. (2018) <i>Green schoolyards in low-income urban neighborhoods: Natural spaces for positive youth development outcomes</i>	Behavioral mapping methodology, observational assessments, and survey administration.	Positive youth development outcomes.
Marin et al. (2018) <i>"Look it, this is how you know:" Family forest walks as a context for knowledge-building about the natural world.</i>	Observations through video coding, observations in handwritten field notebooks (in real-time), children's perspectives interpreted through their actions and dialogue, and interviews conducted with parents.	Educational or learning outcomes.

Haywood-Bird et al. (2017) <i>Playing with power: An outdoor classroom exploration</i>	Observations in handwritten field notebook (in real-time). Child's perspectives were interpreted through their actions and dialogue, not direct interviews. Interviews were conducted with parents.	Educational or learning outcomes.
Zimmerman et al. (2016) <i>Family learning outdoors: Guided participation on a nature walk</i>	Video recordings (17 hours from 12 walks), 527 photos, interviews, and field notes from each walk.	Social interactions during outdoor play and educational or learning outcomes.
Li et al. (2016) <i>Links between preschool children's social skills and observed pretend play in outdoor childcare environments</i>	The McLoyd rating scale for pretend play (unofficial) and the Social Skill Rating System were used to measure.	Social-emotional skills.
McClain et al. (2016) <i>Social contexts of development in natural outdoor environments: Children's motor activities, personal challenges and peer interactions at the river and the creek</i>	A unique original coding system survey.	Social- emotional and behavioral development.
Taylor et al. (2011) <i>Could exposure to everyday green spaces help treat ADHD? Evidence from children's play settings.</i>	An internet-based survey of parents.	ADHD symptoms.
Kuo et al. (2004) <i>A Potential Natural Treatment for Attention-Deficit/Hyperactivity Disorder: Evidence from a National Study</i>	A unique original coding system survey.	ADHD symptoms.
Taylor et al. (1998) <i>Growing up in the inner city: Green spaces as places to grow</i>	A unique original coding system survey.	Play and access to adults (as facilitators to healthy development).

Outcomes Studied

Studies reported examining a variety of outcomes surrounding children spending time outdoors. The most reported outcomes measured was on-task classroom behavior and educational learning (25% of articles reviewed). This was followed by executive function (17%), social-emotional and behavioral development (17%), reduced ADHD symptoms (17%), play and access to adults (as facilitators to healthy development; 8%), and positive youth development outcomes (8%). See **Table 4**.

Table 4*Reported Outcomes from Each Article*

Types of Reported Outcomes	Executive Functioning	On-task Classroom Behavior	Positive Youth Development Outcomes	Educational Learning	Social-Emotional & Behavioral Development	ADHD Symptoms	Play and Access to Adults
Number of Articles	2	3	1	3	2	2	1
Percentages	17%	25%	8%	25%	17%	17%	8%

Design and Methods

Reviewed studies were coded for their specific design methods, including the tools or assessments used to measure their outcomes. Most studies used a quasi-experimental group comparison design (42%), followed by a secondary research study (17%). The remaining studies used single-case experimental designs (8%), descriptive (8%), case-study (8%), ethnographic research (8%), and micro-ethnographic (8%) (See **Table 5**).

Table 5*Utilized Methodology for Coded Articles*

Types of Reported Outcomes	Quasi-Experimental Group Comparison Design	Single-case Experimental Design	Descriptive	Case study	Ethnographic	Micro Ethnographic	Secondary Research Study
Number of Articles	5	1	1	1	1	1	2
Percentages	42%	8%	8%	8%	8%	8%	16%

Participants and Location Description

Three of the 12 (25%) studies reported more than 400 participants in their study. One study reported 72 participants, and the remaining studies reported 11-28 participants. Five of the 12 studies reported urban or “other” as their location description (41%). “Other” was reported as the Southeast region of the United States and a rural nature center in the Mid-Atlantic region of the U.S. The remaining articles were coded as non-specified as they did not mention specific locations in the United States.

Setting Description

One article reported preschool as their setting description (8%), six articles reported nature preserve or non-specified (50%), and the remaining articles reported “other.” “Other” was reported as a university-based laboratory school in a southwest United States preschool program, public university, private, non-profit childcare inspired by Waldorf, and neighborhood outdoor spaces. See **Table 6**.

Table 6*Reported Setting Description*

Reported Setting Description	Preschool	Public Elementary School	Educational Center	Nature Preserve	Non-specified	Other: University-based Laboratory Schools, Public Universities, Private, Non-profit Childcare, and Neighborhood Outdoor Spaces.
Number of Articles	1	1	1	2	2	4
Percentages	8%	8%	8%	16%	16%	33%

Table 7*Reported Outdoor Setting*

Reported Outdoor Setting	Playground	Forest	Nature Preserve	Non-specified	Other: Mixed Setting:, Natural Landscape with, Playground Activities and, Trees, Dead Bug Farm, and Gardens
Number of Articles	2	3	1	2	3
Percentages	16%	25%	8%	16%	25%

Table 8*Reported outdoor activity*

Types of reported outdoor activity	Physical	Free-play	Outdoor learning	Other: Forest walks with family members and a “variety” of activities without specifications
Number of articles	5	5	1	4
Percentages	41%	41%	8%	33%

Table 9*Reported outdoor activity lead*

Reported outdoor activity lead	Child-lead	Teacher-lead	Family member(s)	Non-specified
Number of articles	6	1	2	3
Percentages	50%	8%	17%	25%

Table 10*Reported frequency of time spent outdoors and aim of the studies (open-ended responses)*

<i>Article</i>	<i>Reported Time</i>	<i>Aim/goal of the study</i>
<i>Koepp et al. (2022)</i> <i>Preschoolers' executive functions following indoor and outdoor free play.</i>	60 minutes of indoor (group 1) and outdoor play (group 2) for two weeks on one occasion.	The article examines the correlation between unstructured outdoor play with minimal regulation and controlled classroom behaviors requiring greater regulation.
<i>Rosiek et al., (2022)</i> <i>A Comparison of the Effects of Outdoor Physical Activity in Indoor Classroom-Based Activities on Measures of Executive Function in Preschoolers.</i>	30 minutes indoor /outdoor (only one group). 1-hour session in the morning and afternoon.	This study examined how physical activity in two environments (indoors and outdoors) effects on preschool children's executive functioning.
<i>Lundy et al. (2021)</i> <i>Effects of Active Outdoor Play on Preschool Children's on-Task Classroom Behavior</i>	1-hour session in the morning and afternoon.	Non-specified
<i>Bates et al. (2018)</i> <i>Green schoolyards in low-income urban neighborhoods: Natural spaces for positive youth development outcomes</i>	Non-specified	The researchers investigated the links between green spaces and low-income neighborhoods. Specifically, how green space promotes children's level of social interaction and physical activity. The study also explored Parents' and teachers' perceptions of safety including injuries, bullying, and crime.
<i>Marin et al. (2018)</i> <i>"Look it, this is how you know": Family forest walks as a context for knowledge-building about the natural world.</i>	Each walk lasted 30 min to 1 hour.	Researchers explored the theories of green spaces aiding children's learning.
<i>Haywood-Bird et al., (2017)</i> <i>Playing with power: An outdoor classroom exploration</i>	40 min	To demonstrate the influence of outdoor play and the development of children in the early practices of childhood education.

<i>Zimmerman et al., (2016)</i> <i>Family Learning Outdoors: Guided participation on a nature walk.</i>	52-minute hike.	Promotes the significance of cultural roots, and family history, and connects these concepts to learn about the earth, biology, or related subjects.
<i>Li et al. (2016)</i> <i>Links between preschool children's social skills and observed pretend play in outdoor childcare environments</i>	Observation for 45 minutes to an hour (over six days in 2 weeks).	The study furnishes descriptive data on the amount of time children play outdoors in different outdoor settings and how outdoor creative or pretend play influences children's social interactions.
<i>McClain et al. (2016)</i> <i>Social contexts of development in natural outdoor environments: Children's motor activities, personal challenges, and peer interactions at the river and the creek.</i>	50 hours of video over 16 days at a river and nine days at a creek.	Provides the comparison of various kinds of physical behaviors influenced by the outdoor settings that affect how children respond to challenges.
<i>Taylor et al., (2011) Could exposure to everyday green spaces help treat ADHD? Evidence from children's play settings.</i>	Non-specified	The study explores the theories of green space exposure or natural environments reducing ADHD symptoms.
<i>Kuo et al. (2004)</i> <i>A Potential Natural Treatment for Attention-Deficit/Hyperactivity Disorder: Evidence from a National Study</i>	Non-specified	Explores how the natural environment affects symptoms of ADHD across diverse children.
<i>Taylor et al., (1998) Growing up in the inner city: Green spaces as places to grow</i>	Non-specified	The study explores how the outdoors or vegetation is linked to supporting the development of children.

Summary of Results

Few studies have systematically measured the benefits of children spending time outdoors in their early childhood education setting. The two most common outcomes studied were related to improvements in behavior (25%) and educational or learning (25%). Outcomes related to executive functions (16.6%), social-emotional/social skills (16.6%), ADHD symptoms (16.6%), and “other” (play and access to adults as facilitators to healthy development and positive youth development; 16.6%), were studied in the same number of articles. Studies were most commonly conducted at nature preserves (25%) or “other” (50%) (i.e., private childcare programs, elementary schools, public universities, and laboratories), and outdoor activities

took place most commonly in playgrounds (30%) or “other” (30%; i.e., mixed settings like natural landscape with playground activities and trees, dead bug farm, trails, schoolyard, and gardens). Most activities were child-led (50%), while children engaged in free-play (29%) and physical activities (29%). Studies commonly used a quasi-experimental design (29%), followed by secondary research designs (16%), and various lacked rigorous methods (e.g., ethnographic and micro-ethnographic, case studies, and single-case studies) (29%). Researchers often used on-task assessments, field notes, observations, surveys, and interviews to determine the links between spending time outdoors and their specific outcomes.

Discussion

This study aimed to provide a systematic review of articles linking the outdoors with outcomes during early childhood. We were especially interested in evaluating common designs of studies, outcomes linked to children spending time outdoors through outdoor play, forests, gardens, or school playgrounds, and how these outcomes were measured. We utilized a systematic search coupled with unique codes to compile descriptive insights into the present state of this literature, hoping to furnish valuable insights to educators, researchers, and psychologists working in this area.

Outcomes Studied

The two most common outcomes studied were related to improvements in behavior and educational or learning. Outcomes related to executive functioning, social-emotional/social skills, ADHD symptoms, and “other” were studied in the same number of articles. Studies were most commonly conducted at nature preserves or “other” (i.e., private childcare programs, elementary schools, public universities, and laboratories), and outdoor activities took place most commonly in forests or “other” (i.e., mixed settings like natural landscape with playground activities and trees, dead bug farm, trails, schoolyard, and gardens). It was surprising to find common green spaces that were nature preserves, forests, or mixed green landscapes compared to preschool playgrounds or fields. We wondered if there is a distinction between the quality of the green space children are spending time in compared to traditional school playground spaces. For example, would the number of trees, flowers, bushes, or grass impact outcomes? Would the amount of time have an influence on outcomes? Measuring the amount of time children were spending outdoors was also a limitation of this systematic review, given that some studies did not report specific time frames or the frequency of time spent outdoors. It would be useful to know how quickly we could expect results from these linked beneficial outcomes and how often children should spend time outdoors during their early childhood education. Developing a standard framework for what works would be useful to programs and schools that want to implement outdoor exposure and is a direction for future research.

Design and Methods & Reported Approaches Used to Measure Outcomes

The most common experimental design was quasi-experimental, followed by secondary research designs. Researchers often used on-task assessments, field notes, observations, surveys, and interviews to determine the links between spending time outdoors and their specific outcomes. Overall, a small number

of studies used rigorous methods to examine the links between children spending time outdoors and their specific beneficial outcomes. Future rigorous research is needed in this area to better establish an evidence base for the benefits of incorporating outdoor learning in early childhood.

Content and Characteristics of Time Spent Outdoors

Most activities were child-led while children engaged in free-play and physical activities. Many studies lacked clarification on how frequently children were spending time outside or how much time they spent outside, and if they followed a specific activity. Most articles commonly reported children spend from 30 to 40 minutes outdoors without specifying their outdoor routine (e.g., weekly, bi-weekly, for four weeks, etc.). Studies focused on mostly physical activity to regulate children's behavior instead of incorporating meditation or relaxing outdoor activities (e.g., yoga). Future research should look at outcomes based on how often and for how long children spend time outdoors. Studies should also examine how effective traditional school-related physical activities (e.g., running, playing sports, physical games, etc.) are compared to non-traditional school-related physical activities (e.g., yoga, mediational walks, breathing exercises, etc.) for improving outcomes.

Participants and Location Description

Only three of the 12 studies (25%) reported a large pool of participants (400 children or more). The remaining studies had 78 or fewer participants. The studies also did not report on participants' demographics. We would have liked to examine how children from diverse linguistic, cultural, and socioeconomic backgrounds may benefit from spending time outdoors and if these findings could be used to help prevent common mental health challenges (e.g., ADHD, emotional regulation, stress, anxiety, and depression) that often hinder children's wellbeing and academic success. Future research should include a collection of demographic data to better understand the current state of literature addressing children from diverse backgrounds, including their socioeconomic status, race/ethnicity, and gender.

Limitations and Future Directions

Several limitations warrant consideration throughout the evaluation of the study's findings. Despite conducting a comprehensive examination of the literature, it is possible eligible articles were inadvertently omitted. For example, there may be relevant studies that were never published and outdoor learning practices that have not been formally studied, which we could not include in this review. This study was also limited to the reported findings of each study's authors. Future rigorous research is needed in this area to better establish an evidence base for the benefits of incorporating outdoor learning in early childhood. Studies may also want to examine how the amount of time spent outdoors impacts different outcomes and focus on educational activities conducted outdoors. Researchers may also explore how outcomes differ across linguistically and culturally diverse populations and how they may vary outside of the United States. Many studies were excluded because they were conducted in other countries. Future studies could examine the various challenges and solutions regarding integrating outdoor spaces into school systems and early child-

hood education globally and utilize findings to create a comparable framework for the United States.

Conclusion

Preschoolers are in a crucial developmental stage where they are learning to regulate their behavior and meet classroom expectations (Andrews et al., 2022). Given that preschool children have more opportunities for outdoor experiences compared to K-5th grade, it is important to understand outcomes from time spent outdoors during children's developmental stages. Our study examined the current literature on the potentially beneficial outcomes children experience when they spend time outdoors during their early developmental years (2-5 years old) and how these outcomes were measured (based on their study design or approach to gathering findings). Overall, our study provides a holistic view of the major gaps in the current literature, which we hope will help guide future research in this area. We believe the outdoors may play a crucial role in shaping children's outcomes across domains, but more rigorous research is greatly needed.

Declarations

We have no known conflict of interest to disclose.

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