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Early childhood education quality is an increasingly important area of investigation as many studies have pointed to long-term relationships between childcare quality and children's outcomes, including social and cognitive skills (Lin & Magnuson, 2018; Sammons et al, 2015; Hestenes et al., 2014; Peisner-Feinberg et al., 2003). More recently, outdoor environments have become another piece of the quality puzzle. Past research highlights associations between childcare outdoor environment design and physical characteristics and young children's physical, social, cognitive, and emotional development (Kemple et al., 2016; Li et al., 2016; Ludwig & Rauch, 2018). However, fewer studies have analyzed specifically the extent to which outdoor environment quality relates to young children's outcomes. Moreover, most of these studies remain atheoretical and conducted in other countries. The present study investigated how quality in outdoor learning environments contributed above and beyond classroom global quality to impact preschoolers' cognitive and social skills utilizing Bronfenbrenner and Morris' (2006) bioecological theory, Gibson's (1979) affordance theory, and Kaplan's (1995) attention restoration theory. The study included a randomized sample of 92 licensed childcare programs and 405 preschool children located across North Carolina, United States. POEMS (DeBord et al., 2005) and ECERS-R (Harms et al., 2005) were utilized to measure outdoor quality and classroom quality, respectively. A Natural Elements subscale, derived from POEMS items, specifically assessed the presence of natural elements in the outdoor settings. Children's scores on the FIST (Jacques & Zelazo, 2001) assessment of executive functioning served as a measure of cognitive outcomes, while preschoolers' social skills were measured using both a direct conceptual perspective taking task (Taylor, 1988), and teacher ratings using the SSIS (Gresham & Elliott, 2008) Social Skills and Problem Behaviors subscales. Multilevel analyses showed that outdoor environment quality in childcare settings predicted children's abstraction and flexible thinking above and beyond classroom global levels of quality. In addition, correlation analyses revealed an association between children's participation in outdoor environments with more natural elements and fewer behavior problems as rated by their teachers. Future research on the potential of childcare outdoor environments to support young children's development might

benefit from utilizing longitudinal designs and ecological theories of human development that shed light on the interactions occurring between individuals and context and the mutual effect of these elements in producing change over time.

WHAT ABOUT THE IMPACT OF OUTDOOR QUALITY? THE UNIQUE ASSOCIATIONS BETWEEN OUTDOOR QUALITY AND PRESCHOOL CHILDREN'S COGNITIVE AND SOCIAL SKILLS

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Blenda Luize Chor Rodrigues

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Dr. Linda Lott Hestenes

Committee Chair

DEDICATION

To Koru, the ever-changing movement of life.

APPROVAL PAGE

This thesis written by Blenda Luize Chor Rodrigues has been approved by the following committee of the Faculty of The Graduate School at The University of North Carolina at Greensboro.

Committee Chair _____
Dr. Linda Lott Hestenes

Committee Members _____
Dr. Catherine Scott-Little

_____
Dr. Karen La Paro

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CHAPTER I: INTRODUCTION

Childcare programs have become important places of investigation as children spend increasingly more time in these environments. According to the OECD (2017) report, 66% of 4-year-old children were enrolled in early childhood education in 2015 in the United States. This percentage is even higher for children who are 5- and 6-years-old, reaching to 91% and 98% respectively. In addition, preschoolers with employed mothers spend on average 36 hours per week in childcare, whereas those with unemployed mothers spend 21 hours per week in these settings (US Census Bureau, 2011). Research has pointed to the relationship between childcare quality and children's outcomes, including social and emotional skills (Hestenes et al., 2014), cognitive development (Lin & Magnuson, 2018; Peisner-Feinberg et al., 2003), language development (Mashburn et al., 2008; NICHD Early Child Care Network, 2002), and school readiness (Howes et al., 2008). Some of these studies have indicated long-term effects of attending high quality childcare programs on children's school trajectories (Sammons et al, 2015).

The definition of quality is often problematic because it relies on the scale being used to measure childcare environmental quality (La Paro et al., 2012). In the United States, the Early Childhood Environment Rating Scale-Revised (ECERS-R; Harms et al., 2005) is a widely used tool across the U.S. and it is usually considered as one standard and meaning of quality. The traditional conceptualization of quality entails two main aspects addressed in many scales measuring classroom quality. The first is structural quality, related to teacher-child ratios, group composition, and staff qualifications. The second is process quality, related to interactive activities or experiences, which encompass teacher-child interactions and language stimulation by teachers. When both aspects are combined, they are usually called a measure of "global quality" (Philips & Howes, 1987; Vandell & Wolfe, 2000).

As research points to the importance of outdoor environments in understanding young children's development and learning, these settings have become another piece of the quality puzzle within childcare. Research has explored physical characteristics of the outdoor environments and its

relationship to children's physical, social, cognitive, emotional development (Kemple et al., 2016; Rivkvin, 2000; Harrison, 2008) and health (Soderstrom et al. 2012; Cosco et al., 2014), pointing to positive contributions when the outdoor environment is equipped with age-appropriate materials (Striniste & Moore, 1989), natural elements (Nedovic & Morrissey 2013), and utilized in a fairly regular basis (Back et al. 2016). Therefore, some researchers and practitioners have begun to think about the outdoors in the same way as indoor classrooms (e.g., dividing outdoor areas in centers).

Consequently, outdoor area standards have become not only part of licensing requirements for childcare centers, but also a component of quality in some states' Quality Rating and Improvement Systems (QRIS). Regulations related to licensing and quality differ widely across states. According to the National Resource Center for Health and Safety in Child Care and Early Education, 38 states and the District of Columbia require that childcare centers provide daily outdoor time, weather and health permitting. The time required by each state varies from 30 minutes (e.g., North Carolina) up to two hours (e.g., Mississippi and the District of Columbia) per day. States' mandatory regulations for outdoor areas in childcare also differ in the amount of space minimally required. In most states (e.g., North Carolina, Alaska, Louisiana) the minimum space requirement is of 75 square feet per child. Georgia requires a minimum of 100 square feet of outdoor play area for each child, whereas Florida mandates only 45 square feet per child. Only seven states in the U.S. (i.e., TX, NC, IN, NY, MI, OK, and WI) use QRIS standards to encourage the enhancement of outdoor learning areas' provision and use. Texas' QRIS is one of the few which provides detailed quality standards for outdoor environments in childcare, including suggestions of equipment, materials, and areas of interest (e.g., music, quiet area). The remaining states rely on Environmental Rating Scales (ERS) or leave the quality of outdoor settings completely unaddressed in terms of quality ratings (Cooper, 2015).

Most of the studies investigating outdoor learning environments in early childhood programs have been conducted in Scandinavian countries, such as Sweden, Denmark, Finland, and Norway (Lee-Hammond & Waller, 2014), or in nature-based schools (e.g., Frost, 2001; Zamzow & Ernst, 2020). Historically, early childhood education in these countries have paid more attention to the benefits of outdoor environments to young children and childcare facilities have been designed

to provide children with playful experiences in nature. Outdoor life is considered a cultural value in Scandinavian countries, rooted even in Scandinavians' self-image as a nature loving people (Sandell & Sörlin, 2008). The term *friluftsliv* is utilized in Norway and Sweden to indicate a philosophy of reconnecting with nature and the old Scandinavian outdoor tradition (Gelter, 2000). This philosophy was reinforced throughout the 1900 century as a way to foster people's good health through recreation in nature, such as skiing, to support coping with urban and industrial development (Miner, 1990). Therefore, Scandinavian countries have context specificities related to outdoor experiences that reflect on early childhood education aims, standards, and practices, making research results differ from other countries such as the United States.

In this sense, there is a gap in the literature as it concerns other nations aims and practices related to outdoor experiences in early childhood education. The present study intends to fill some of these gaps by understanding how outdoor learning environments may contribute above and beyond classrooms global levels quality to impact young children's cognitive and social skills utilizing a randomized sample of childcare programs located across North Carolina, United States.

There are three theoretical frameworks guiding this investigation. The first is Bronfenbrenner's bioecological theory (Bronfenbrenner & Morris, 2006). This theory allows researchers to understand how different systems influence children's development. The main element of this theory is proximal processes, considered as the engines of development. These processes are influenced by individuals' characteristics, context, time, social and cultural values. Policies related to outdoor areas in childcare are, for instance, a part of what is framed within this theory as a macrosystem. These regulations trickle down to classroom and individuals' level by changing the periodicity children go outdoors, the amount of time they spend outside, and ultimately the interactions within and with the outdoor setting. Thus, the bioecological theory offers insights on how different systems, from micro to macro levels, may influence the quality of proximal processes young children engage in outdoor environments and affect their development.

Even though the bioecological theory emphasizes the role of the environment in children's developmental outcomes as they influence proximal processes (Bronfenbrenner, 1999), it does not offer enough elements to theorize aspects of the environment itself that can be related to development. In this sense, affordance theory (J. Gibson, 1977) and attention restoration theory (Kaplan, 1995) will support conceptualizing how outdoor environments may contribute to children's cognitive and social development. Affordance theory brings an ecological approach to perception by posing that we perceive and pay attention to objects' and environments' affordances, rather than their qualities. Affordance exists, therefore, at the intersection—and interaction—between the subject and the environment. For example, a swing will be considered "swing-able" if it is possible to swing. Thus, it allows to gain insight on children's perceptions of outdoor areas (Cosco, 2006). On the other hand, Attention Restoration Theory (ART) posits that interactions with natural environments have the potential to restore ones' attention by reducing mental fatigue. Therefore, this theory provides a rationale to support one of the hypotheses raised in this study that outdoor areas with more natural elements (e.g., sand boxes, loose natural materials) may contribute to better children's cognitive outcomes.

The following section provides a more in-depth explanation of each of these theories while offering further examples of how they relate to the problem under investigation. Next, a review of the literature about outdoor environments in childcare and children's cognitive and social outcomes is provided. Following that, the methods chapter describes the design of the present study, information about the sample and measurements. The last two chapters present the results and discuss them in light of the three theoretical frameworks utilized and the recent literature reviewed.

CHAPTER II: THEORETICAL FOUNDATION

The present study stands on a variety of theoretical sources to grasp and conceptualize how outdoor learning environments in childcare programs may contribute to young children's cognitive and social emotional development. These include bioecological systems theory (Bronfenbrenner & Morris, 1998), affordance theory (Gibson, 1977), and attention restoration theory (Kaplan, 1995). These theories will support explaining how the quality of outdoor learning environments in childcare, the interactions between young children, their peers, as well as the environment itself and its affordances (i.e., materials, design), may contribute to their cognitive and social skills above and beyond classroom global levels of quality.

The bioecological systems theory describes human development as a phenomenon of continuity and change that happens through complex interactions between individuals and the context across time (Bronfenbrenner & Morris, 2006). This theory proposes a model with four main components, called Process-Person-Context-Time (PPCT). The model entails processes, persons' characteristics, context, and time, while understanding the existence of a synergistic interconnection among these elements and influence on the developmental outcome of interest. Bronfenbrenner and Morris (2006) stated in the first proposition of the bioecological theory the importance of enduring forms of interactions in a person's most immediate environment, termed as *proximal processes*. Proximal processes were defined as "processes of progressively more complex reciprocal interaction" (Bronfenbrenner & Morris, 1998, p. 996) which occur between individuals and the persons, objects, and symbols in their most immediate environments. Such processes vary systematically in terms of their form, power, context, and direction as a joint function of persons' characteristics, the environment—both immediate and remote—and time.

Bronfenbrenner and Morris (2006) claimed that proximal processes are the principal engines of development. Because of that, the first "P" of the PPCT model refers to proximal processes. Children's interactions with peers and teachers during outdoor play time, as well as objects, spaces, and features of the outdoor environment itself, qualify as proximal processes that could influence their development. The second "P" indicates persons' characteristics, which were categorized into three types: force, resource, and demand. Force relates to whether individuals can initiate and sustain proximal processes (i.e., generative force), such as being curious or

responsive to other's initiatives, or characteristics that can hamper or interrupt them (i.e., disruptive force), such as being easily distractible, impulsive or explosive. Resource characteristics, on the other hand, pertain to a person's abilities to effectively engage in proximal processes, which include skills and knowledge. Resource characteristics that may limit proximal processes are, for instance, reoccurring illness and brain disfunction. As it pertains specifically to outdoor settings, an example would be children with different levels of skills and experiences in outdoor environments. Some might have had opportunities to spend time outdoors before arriving at childcare and might know how to play outside or have physical skills to make use of outdoor materials. Finally, demand characteristics are those easily identifiable qualities of the developing person, such as age, gender, skin color, or temperament, that can invite or discourage the social environment in establishing proximal processes (Rosa & Tudge, 2013). Taken together, children's characteristics such as age, skin color, skills, energy levels, preferences, and personality can influence reciprocal interactions with teachers and peers during outdoor play time, as well as with the outdoor environment itself (i.e., equipment or materials such as swings, slides, mud, paint, and so forth).

The third component, context, refers to different environments in which the developing individual is embedded. Bronfenbrenner and Morris (2006) distinguished three ecological layers to characterize different systems influencing individuals' development over time. The microsystem represents the most immediate and proximal setting in which a person is situated and interacts face-to-face with others, such as the home, the school, the workplace, or the outdoor environment. The mesosystem is defined as the interrelations between two or more microsystems in which the developing person actively participates, such as the relations among home and school, or family, work, and social life. The main difference between these two systems is that the mesosystem considers activities and interpersonal roles occurring across settings, rather than within a single microsystem (Rosa & Tudge, 2013). Children's outdoor experiences in contexts other than the childcare centers (e.g., at home, parks, forests), interact with their experiences in the center. For example, parents' concerns about safety might be different from those adopted by teachers, which might influence different ways children engage with the outdoor area. The third layer, called the exosystem, is an ecological setting in which the developing person is not actively participating but still experiences its influences. The amount of

time children spend outside, for instance, might be explained by the childcare directors' emphasis on outdoor play, the curriculum of the program, or even teachers' decisions to incorporate outdoor activities as part of their planning.

Lastly, the fourth component of the PPCT model, time, consists of three levels: microtime, mesotime, and macrotime. Microtime refers to the continuity and discontinuity of proximal processes, mesotime is the periodicity in which proximal processes occur (e.g., daily, weekly, monthly). Macrotime refers to the political, economic, social, educational, and belief expectations and trends of a subculture or a culture within a historical time. The amount of time children engage in interactions with teachers and peers outside, as well as with the outdoor environment itself, pertains to the microtime level. The frequency children engage in outdoor activities during the week or month would be considered at the mesotime level. As it relates to the macrotime, social and political trends within a country might influence how outdoor settings are designed. According to Frost et al. (2012) in the United States, for example, outdoor areas were manufactured with playground equipment, such as swings, slides, and merry-go-rounds, as it became a business in the first decades of the 20th century. Another example is the substitution of metal structures for artificial plastic equipment over the decades as safety regulations changed in the U.S. (Frost et al., 2001). Accordingly, statewide regulations about how long children should play outside and guidelines for space available also influence on children's outdoor play. Cultural values related to benefits of outdoor play for young children might influence the amount of time they spend outdoors, as well as in which weather conditions they are allowed to play outside. In Finland, for example, regardless of low temperatures and snow, young children can play outside, and they are even encouraged to do so (Fjortof, 2001).

The theory adds that, to be effective, proximal processes must occur regularly and over prolonged periods of time. Even though proximal processes are always happening at a microsystem level (e.g., classroom, home, museum), where a developing person can have a face-to-face interaction with other persons, objects, and symbols, the microsystem in which proximal processes occur receive influences from other systems' levels (i.e., meso and exo) and time (i.e., micro, meso, and macro). For instance, features of a childcare classroom, such as activities centers, toys, books, are shaped by the programs' curriculum, which in turn may fall into states'

and countries' educational standards for early childhood education. Ultimately, these standards are part of societal beliefs situated in a specific historical time about how early childhood education should look, what young children should learn, and which kind of experiences they should be exposed to. The amount of time enduring teacher-child and child-child interactions last is also affect by the schedule of the program, such as the time allotted for specific activities inside of the classroom (e.g., storytelling time, free play time) or for outdoor play. All these elements—programs' curricula, educational standards, societal beliefs about early childhood—are not directly present at the microsystem level but, nonetheless, they affect characteristics of the microsystem, such as the classroom set up and materials, and, thereby, proximal processes. Thus, characteristics of microsystems (e.g., design, materials available, noise, stability) set the foundation to allow and support effective proximal processes to occur.

Bronfenbrenner (1999) discussed the importance of the quality of environments to children's development. He observed differences in children's developmental outcomes related to the quality of physical environments and the interactions— proximal processes— at play in such settings. Even though the bioecological model considers proximal processes as progressively more complex and reciprocal interactions with other persons, objects, and symbols, most of Bronfenbrenner's theory-related publications did not give too much attention to proximal processes with objects, or the environment itself (i.e., its affordance). He seemed more focused on the proximal processes individuals engage with other individuals. Because of that, as a way to expand and deepen the analysis of how outdoor learning environments in childcare may contribute to children's cognitive and social development, Gibson's (1977) affordance theory and Kaplan's (1995) attention restoration theory are included in this study.

James Gibson's (1977) affordance theory brings an ecological approach to perception by looking at the relationship between the individual and the physical environment. This approach considers individuals and environments as interactive systems that can be understood under three concepts: *affordance, information* gathered from the environment, and how children *pickup information* from the environment. The main premise of this theory is that we perceive and pay attention to objects and environmental affordances, rather than their qualities. The affordance exists in the intersection—and interaction—between the subject and the environment. For example, an object

in the outdoor area will be considered “climb-able” if it is possible to climb. Potential affordances exist even though individuals may not yet perceive them, as J. Gibson (1979) explained: “The observer may or may not perceive or attend to the affordance according to his needs, but the affordance, being invariant, is always there to be perceived. The object offers what it does because it is what it is” (p. 139). In this sense, individuals’ actions in the environment (e.g., movements, manipulating objects) is what leads them to realize its affordances (i.e., actualized affordances).

Eleanor Gibson and Anne Pick (2000) expanded on the concept of affordance as it relates to children’s perceptual learning, introducing what they termed as “learning theory of affordances”. They defined perceptual learning as individuals’ increased ability to identify relevant affordances in novel experiences as a result of changes in their capabilities and in the affordances itself. Therefore, perceptual learning comprises a process of bidirectional change between the individuals’ perception and in the perceptually guided actions provided by the environment.

Sources of information include physical elements (e.g., objects, surfaces, corners) and events, such as peoples’ expressions (e.g., smiling face) or how they make use of the environment (e.g., birthday celebration). The environment is acknowledged based on the amount of information available and a perceiver’s ability to understand it. Children, for instance, perceive the environment and themselves and they move and interact with the environment, which activates their senses and provides them information about the layout of the site (Cosco, 2006). In other words, children pick up information when they run around objects, hide behind bushes, spy looking through a hole in the wall, or peek over fences.

E. Gibson and Pick (2000) described two types of information pickup, called exploratory and performatory. The first relates to children’s exploration of the environment and of their own capabilities to explore and gather information. The second corresponds to automated tasks learned in previously realized affordances, such as riding a tricycle, turning on a faucet, or swinging. That is, progressive learning of affordances depends on further exploration of the environment. In this sense, the authors claimed the need for diverse environments, full of novel

information, when considering developmental needs important to children's growth and extension of their skills.

When planning and evaluating the scale and layout of outdoor settings in childcare programs, it is crucial to consider affordances as a bidirectional relationship between children and the environment. In this sense, it is important to understand the environment through children's perceptions, rather than from only the adults' perspectives (Fjortoft & Sageie, 2000). One of the ways to consider young children's perspectives is to focus attention on whether the presence of natural elements might change their experiences in childcare outdoor areas. The two theories previously discussed do not address directly how the presence of natural elements can potentially impact children's development.

Kaplan's (1995) attention restoration theory (ART) supports conceptualizing how the presence of natural elements might interact with young children's cognitive outcomes. This theory highlights that interactions with natural environments have the potential to restore ones' attention by reducing mental fatigue. A central concept within this theory is the notion of "directed attention", which is defined as the mental effort needed to focus on events or objects while blocking out other possible distracting stimulation. Direct attention is understood as a limited resource that can be depleted after long and/or intensive use, and Kaplan's theory proposes that natural environments have the potential to facilitate recovery from attention depletion.

Fascination is an important conceptual feature of natural environments because it implies effortless bottom-up attention, enabling directed attention recovery. Typical instances of nature's fascinations are "clouds, sunsets, snow patterns, the motion of the leaves in the breeze" (Kaplan, 1993, p. 139), or waterfalls, caves, and fires (Kaplan & Kaplan, 1989). Therefore, ART holds the following assumptions: (1) nature has restorative effects on attention fatigue; (2) directed attention is restored during the recovery process; (3) natures' fascinating qualities replenish direct attention; (4) nature is restorative because it captures attention in a bottom-up and effortless manner; (5) restorative nature experiences are rooted in our evolution within natural settings (Kaplan & Berman, 2010; Kaplan & Kaplan, 1989). According to Kaplan (1983), the application of this theoretical model would consider natures' soft and fascinating characteristics

as the independent variable, the possible recovery of directed attention as the dependent variable, and natural environments' capacity of triggering bottom-up involuntary attention as the mediator of such recovery process.

Research has demonstrated differences in natures' restorative capacity depending on group characteristics, such as age (e.g., Ottosson & Grahn, 2005; Taylor & Kuo, 2009) and individuals' identities (e.g., Morton et al., 2017). However, Ohly et al. (2016), in a literature review, indicated that most restoration studies did not include control groups of low-fatigued individuals to compare with high-fatigued experimental groups. Joye and Dewitte (2018) also pointed out theoretical problems as it relates to the vagueness of concepts such as "fascination" and underexplained relationships, such as the association between a state of fascination and cognitive effortlessness.

ART is brought up in this review to support one of this study's hypothesis pertaining to whether the presence of natural elements in outdoor childcare program settings might be associated with children's cognitive outcomes. The cognitive measure of interest is preschoolers' executive functioning abilities. Executive function comprises of neurocognitive and attentional skills that serve to modulate attention—and, therefore, behavior—towards a specific goal (Zelazo, 2015). One of executive functioning domains is inhibitory control, that is, self-regulation (e.g., waiting until someone has finished talking before speaking). Kaplan and Berman (2010) claimed that directed attention fatigue might be associated with lower self-regulation. If these processes are related, depletion of self-regulation might also be restored by nature's exposure.

These three theoretical frameworks are utilized in this study to support understanding how the quality of outdoor learning environments in childcare may contribute to young children's cognitive and social outcomes above and beyond classrooms global levels of quality**.** Bronfenbrenner's bioecological theory offers a framework to conceptualize how interactions in and with outdoor environments may influence young children's development. This theory, however, does not support understanding how specific features of the outdoor area, such as its design or the presence of natural elements, may change interactions in and with this environment. And here is where affordance theory and attention restoration theory (ART) come

into to play. As stated previously, while affordance theory enables to account for environments affordances as a bidirectional relationship between children and the environment (e.g., an object is considered “climb-able” if it is possible to climb), ART allows to draw possible associations between outdoor environments with higher levels of natural elements and children’s executive functioning abilities. Therefore, each theory provides with unique elements and will support a more comprehensive and profound interpretation of how outdoor environments may contribute to children’s cognitive and social skills. The next chapter will present an overview of the ongoing literature on outdoor learning environments, discussing the theoretical frameworks generally utilized, childcare center regulations, and findings related to children’s cognitive and social outcomes.

CHAPTER III: LITERATURE REVIEW

Outdoor environments in childcare programs offer a genuine context for young children to develop a wide range of skills and learning. Research has explored physical characteristics of these environments and its relations to children's physical, social, cognitive, emotional development (Kemple et al., 2016; Rivkvin, 2000; Harrison, 2008) and health (Söderström et al. 2013; Cosco et al., 2014), pointing positive contributions when the outdoor environment is equipped with age appropriate materials (Striniste & Moore, 1989), natural elements (Nedovic & Morrissey 2013), and utilized in a fairly regular basis (Back et al. 2016).

Outdoor areas in childcare centers can provide children opportunities to play, engage in multiple physical activities, learn about language, science, math, and arts, as well as promote social and emotional skills (Kim, 2019). As opposed to an indoor classroom, in outdoor spaces young children can have opportunities for diverse hands-on experiences, such as unstructured play involving natural elements like water, sand, leaves, and mud. They can expand their vocabulary when exploring the outdoor setting with peers and adults as the outdoor may provide opportunities to use new words related to physical characteristics, such as bubbly, sticky, moisture, evaporation, funnel, slippery. Children might also be exposed to new colors, textures, and sounds, learning to identify them as teachers and peers name them. While observing toddlers unstructured outdoor play, Lee (2012) noted the presence of foundational mathematical knowledge, such as space, numbers, measurements, patterns, shapes, and classification. Li et al. (2016) examined preschoolers outdoor pretend play and social skills outcomes. The study revealed that abstract pretend play was positively correlated with cooperation, whereas social pretend play showed associations with assertiveness. The authors emphasized the aspects of the outdoor physical space, such as paved areas and loose part equipment (e.g., balls, wagons, natural elements including sticks, leaves, and mulch), as well as dramatic play materials (e.g., costumes) in providing a setting which afforded pretend play.

As it relates to the development of social skills, Burriss and Burriss (2011) claim that unstructured outdoor play in nature maximizes young children's opportunities for testing, examining, and retaining social abilities. Most importantly, the authors argue that during outdoor

play children are able to gain perspective-taking skills, which refers to when a child comprehends that their own perspective is different from the others, and others are different from their own (Taylor, 1988). That is, children begin to realize that everyone has their own feelings and thoughts, and that their own behaviors, shared thoughts and feelings have the potential to impact others' thoughts, emotions, and behaviors. This idea is also congruent with the theory of mind (Premack & Woodruff , 1978), which posits that human beings, from early ages, can attribute mental states (i.e., what we know, feel, want, and think) to themselves and to others. Having a theory of mind means that one can predict and interpret others' behaviors (Sodian, 2005).

Children's perspective-taking is relevant in the course of social development because it contributes to establishing effective interactions with others. Overall, outdoor play increases young children's opportunities to practice and challenge their social skills because it brings experiences in which they can exercise how to work in groups, how to share, how to advocate for themselves, how to negotiate, and how to solve problems and conflicts. Even though these also happen in indoor environments, the outdoors offers other experiences for children which may change the dynamic of interactions. In Shim et al. (2001), for instance, preschoolers engaged in parallel functional play outdoors six times more than in the indoor setting. The outdoor environment not only allows children to move their bodies and challenge their physical skills, but it also provides many opportunities for the unexpected. The outdoor space is ever changing and, therefore, full of surprises. A plant in the garden is bigger each day, a flower might bloom and then wither, or out of the sudden an anthill might appear on the grass. These surprises do not exist in the indoor space, which is a more stable and predictable environment. As a result, the outdoor environment calls for more exploration, investigation, and inquiry. Along with this, as opposed to indoor settings, playgrounds offer space to be messy and loud (Greenman, 1988), and to play and pretend play that are often discouraged inside of the classroom, such as war play or superhero (Frost et al., 2001). For these reasons, studying the potential of outdoor settings in contributing to young children's cognitive and social skills is a worthwhile endeavor.
The following sections will examine how the physical environment is related to children's development, what are the theories mostly utilized by research investigating outdoor environments, and the regulations in the U.S. pertaining to outdoor areas quality in childcare

centers. At the end, a summary of recent research focusing on the relationship between outdoor experiences and children's cognitive and social skills is discussed.

PHYSICAL ENVIRONMENT AND CHILDREN'S DEVELOPMENT

Theories and research have highlighted the importance of the relationship between characteristics of the physical environment and young children's development. Germinal early childhood theorists, such as Jean Piaget (1951) and Maria Montessori (1965), stressed the role of children's surrounding environments in scaffolding their learning and development. In the 1970s, studies began to investigate whether childcare may enhance cognitive development, indicating cognitive gains mainly for those children from impoverished backgrounds (Doyle, 1975). These early explorations opened a line of inquiry about childcare quality, including physical characteristics and pedagogical practices. As it relates to programs' physical environments, early research found that larger centers scored lower in classroom quality and had less cross-age interaction when compared to smaller centers (Prescott et al., 1972). In response to these findings, during the 1980s, a growing body of research focused attention on the interface between sociophysical environment and child development (Moore, 1987). For instance, the spatial organization of childcare programs and its relations to children's cognitive development was tested by Moore (1983), who indicated that in modified open-plan facilities (i.e., those with large and small activity spaces open enough to allow children to see possibilities of play yet enclosed enough to protect them from noise and visual distractions), children used significantly more activity settings in small groups, and engaged more in activities involving persons, objects, and/or educational materials when compared to closed-plan facilities (i.e., self-contained classrooms arranged along corridors or as in a house with several small interconnecting rooms).

The outdoor environment is a special subset of a childcare programs' physical environment because it offers moderate levels of stimulation, which is crucial for young children to feel motivated and to learn within the environment. Outdoor environments offer variety in terms of climate, weather, textures, surfaces, sounds, and smells, while also providing a sense of openness and freedom of expression (Greenman, 1985). In a literature review about outdoor environment designs in childcare, Striniste and Moore (1989) point out that a bi-factor approach to research on programs' playgrounds might be more effective in revealing which aspects of outdoor

environments are associated with children's outcomes. The bi-factor hypothesis states that "there are a small number of factors with global effects on development, but the majority of factors affect only one specific aspect of development" (p. 25). For example, having a variety of toys available affects young children's acquisition of new words, whereas highly responsive toys have global effects on development (e.g., Wachs & Chan, 1986). This idea is linked with the notion of *affordance* as a bidirectional interaction between the subject and the environment. We perceive and pay attention to environments' and objects' affordances, rather than their qualities (J. Gibson, 1979). Different toys might distinctly influence on children's skills because children perceive different aspects about them.

Other investigations reviewed by Striniste and Moore (1989) indicated that equipment such as wide mirrors, wide easels, wheeled toys for pairs, tents, playhouses, and wide slides facilitated positive peer interactions among children under two years of age, showing that specific qualities of the environment elicit specific behavioral responses, such as positive peer-interactions. Along with that, well enclosed areas in the outdoor setting supported positive play behaviors and wheeled toys facilitated more social interactions among preschoolers. The authors also claimed that outdoor environment design can support safety by offering children a balanced amount of challenge and excitement to keep children entertained rather than bored. Greenman (1988) suggested preschoolers specifically need outdoor opportunities not only to move and be active, such as swinging, sliding, rolling, jumping, running, throwing, kicking, or riding, but also to wonder, retreat, sleep, and discover. These include places for constructive and creative play, such as building and digging.

Outdoor physical environments influence the amount and types of physical activity and play children engage. Both activities have specific contributions to children's cognitive and social development. The following subsections explore research focused on how physical activity and play outdoors support children's development, and how outdoor design might enable children to have experiences conducive to specific areas of development.

Physical Activity

Davies (1996) called attention to the benefits of physical activities the outdoor environment may provide to children and its impacts on other areas of development. Outdoor areas allow children to engage in many large muscle activities, such as running, jumping, digging or climbing. In this sense, the author pointed out the role of developing fundamental motor skills in early childhood is not only enhancing children's abilities to move easily and efficiently, but also because physical development is related to other areas of development, such as social and emotional. For instance, children's motor abilities might affect how they perceive themselves and how they are perceived and treated by others.

Recent research on this topic reinforces these relationships and adds that physical activities—especially those requiring vigorous aerobic exercises—are associated with young children's better self-esteem (Barton et al., 2015), self-regulation (Becker et al., 2014; Ludwig & Rauch, 2018), positive affect (Ludwig & Rauch., 2018), academic attainment (Khan et al., 2020), and school readiness (Becker et al., 2018; Burgess & Ernst, 2020).

Ludwig and Rauch (2018) investigated associations between 4- to 6-yearolds' self-regulation, positive affect and their everyday lives levels of physical activity during seven consecutive days. Ninety-eight children wore a tri-axial accelerometer to assess moderate to vigorous physical activity (MVPA) and, during the same time period at the evening, parents rated their children's daily self-regulation and positive affect via phone interview or completing an online questionnaire. Items entailed emotional (e.g., today, my child was frustrated when things did not work out as well as expected), behavioral (e.g., today, my child easily waited until his/her turn'), and attentional (e.g., 'today, my child concentrated easily') self-regulation.

Analyses utilizing a multilevel structural equation model revealed within-person level positive associations between higher daily MVPA and positive affect, and within- and between-person level associations of higher daily MVPA and children's self-regulation. This means all children on average who had a higher daily MVPA also had higher positive affect ratings. However, there were no significant relationships at the between-person level for positive affect. In other words, children who had higher mean MVPA throughout measurement days were not rated highly on

positive affect when compared to children who had lower mean MVPA. The study also found beneficial associations between positive affect and self-regulation. Children rated higher on positive affect also showed higher behavioral, emotional, and attention self-regulation. Even though daily MVPA was negatively correlated with emotional self-regulation, beneficial associations were encountered between positive affect and self-regulation. The study indicated that by engaging more than usual on MVPA on a given day, children displayed higher levels of positive affect and, in turn, was positively associated with better ratings on behavioral, emotional, and attentional self-regulation.

These results are relevant in the current review because self-regulation, the ability to modulate behavior, emotion, and attention, is linked with executive functioning. In addition, self-regulatory skills are required in many contexts throughout the life course and predicts outcomes in childhood and adulthood. There are three basic executive functions: working memory, inhibition, and shifting. The later refers to the ability to shift back and forth among multiple tasks or mental sets. Even though there is not enough research on the relationship between shifting and self-regulatory skills, task-switching ability might allow individuals to abandon non-optimal avenues (e.g., trying to tear a package sealing using teeth) and find alternative means to achieve the same goal (e.g., using a scissor or a knife), or switching from one goal to another (Hofmann et al., 2012). These are respectively referred as “means-shifting” and “goal-shifting”.

As it pertains to physical activity and characteristics of outdoor environments, Bjørgen (2016) did a qualitative investigation about differences in preschoolers physical activity levels as a function of affordances in a natural environment and in a kindergarten’s outdoor setting. The kindergarten outdoor space observed in this study had a variety of manufactured equipment, outdoor toys (e.g., truck, balls, shovels, buckets), swings, sandboxes, climbing racks, small trees, and varied surfaces (i.e., grass, sand, asphalt, terrain with small hills). The natural environment was 0.1-0.4 miles from the center. Part of it consisted of an open field, and the other part of woods. Children were taken to the natural environment all year round. Children were video recorded in both environments through different season of the year for 20 days, 10 days in the natural environment and 10 days in the kindergarten’s outdoor setting. Analyses considered six randomly selected days, three in each environment. Findings indicated that in the natural

environment children were engaged in moderate to high physical activity for more than one hour, on average. In contrast, in the kindergarten's outdoor setting, children showed on average low to medium physical activity levels. Only in some situations of short duration (e.g., playing catch/tag, rolling, or tobogganing) and in specific areas (e.g., on top of small hills) children had a high level of physical activity. Interestingly, results showed that during free play children displayed lower levels of physical activity, whereas playing together and shared game created higher levels of physical activity.

Bjørgen (2016) indicated that 3- to 5-year-olds need social affordances to reach higher level of physical activity and over longer periods of time. She defined social affordances as "opportunities of environments that catalyst interactions and social relationships in physical active play situations" (p. 9). Observed social affordances included invitations, imitations, responses, joint attention, scaffolding (i.e., offering strategies of how to play), and sharing moment of jointly fun. She concluded that physical environments affording social interaction affect children's intensity and duration of physical activities. Identified characteristics of the physical environments generating physical play and group interactions were large spaces for moving, challenges, and space for several children and adults to have physical-social contact.

Children's levels of physical activity contribute not only to their cognitive and social emotional skills, but also to their health. In the United States, as in many developed countries, most people have sedentary lifestyles. As a result, obesity among north American young children is a serious issue. According to the CDC National Center for Health Statistics (NCHS) 2017 report, 13.9% of 2- to 5-year-olds were considered obese (i.e., body mass index at or above the 95th percentile of the CDC sex-specific). The US Census Bureau (2018) showed that approximately 8.74 million children were enrolled in nursery or kindergarten programs, and 64.7% of these children spend their full day in these childcare facilities. Since more than half of young children attending childcare services in the US are spending most of their time in these environments, outdoor settings play an important role in promoting young children's active lifestyle.

Play

The outdoor environment can be intentionally designed to support development in many areas. Facilities providing children a private space, for example, give them an opportunity to reconcile with thoughts and feelings, to practice skills, or to try new roles in pretend play. Shim et al. (2001) specifically looked at differences in toddlers (2-3 years old) and preschool (4-5 years old) children's play behaviors with peers in indoor and outdoor childcare environments by videotaping them in two different programs. The quality of childcare playground measured with the protocols developed by Kritchevsky, Prescott, and Walling (1969) indicated that both programs in this study had low environmental quality for both younger and older age groups. Results showed that children were more likely to engage in interactive dramatic play, the most complex form of peer play, in the outdoor areas rather than indoor. Along with that, in the outdoor space older children were more likely to engage in functional play (e.g., bouncing, shooting, or throwing a basketball) and dramatic play (e.g., pretending to be an animal or a cloud) than inside the classroom. When compared to the younger children, the older group were more likely to interact with peers outdoors. As it relates to contextual features in childcare centers, children who did not have dramatic play materials or equipment indoors were more likely to engage in dramatic play on the outdoor playground.

Recent studies have also indicated the presence of more natural elements in outdoor environments in supporting young children's play behaviors. Nedovic and Morrissey (2013) in exploring the redevelopment of a childcare center's outdoor area to increase natural features, such as adding mulch, greenery, flowers, and loose organic materials, found that children engaged in richer imaginative play, had more positive interactions, increased physical activity levels, and showed themselves as calmer and more focused on play. Yet, these results were based on teachers' interviews and reports about changes in children's play behaviors.

Dowdell et al. (2011) investigated two contrasting outdoor areas in childcare centers. The first comprised solely of plastic equipment, ground covered with a synthetic material softfall, manufactured toys, and located within a warehouse with a completely artificial internal "outdoor" environment. The second contained two separates sandpits, a tepee, a variety of logs, frog ponds, worm farm, vegetable, a campfire, and a book area called "fairy garden" set up with

cushions and a selection of books for quiet reading. They observed children between 2 and 6 years old focusing on those between 4 and 5 years old and mapped their behavior in both outdoor environments. Even though in both centers the type of children's play were similar, including solitary play, parallel play, cooperative play, play involving two people and large groups, the quality and quantity of play experiences varied markedly. Dowdell et al. (2011) indicated that in the program where children had access to an outdoor environment with more natural elements (i.e., the second one) engaged in more imaginative play than children in the first center, and play and other activities tended to endure more time allowing richer and deeper experiences to develop.

Robertson et al. (2020) concluded the same when comparing the frequency and complexity of sociodramatric play of two groups of 4-5-year-old children attending two preschools with differing outdoor spaces in terms of natural elements, resources, and spatial characteristics. Their results showed that children were frequently involved in solitary or parallel dramatic play in the sandpit, whereas sociodramatic play was only observed in the sandpit, block area, vegetable garden, and rest area, that is, areas offering private places. In the preschool where rich vegetation, loose parts, and great number of props were provided children engaged in more complex sociodramatic play and more frequently. They also observed that the outdoor preschool area with wider pathways afforded children more movement supporting mobility during sociodramatic play. In sum, the authors pointed out that balanced conjunction of man-made resources, significant vegetation and natural loose parts, opportunities for seclusion, linking pathways, and open-ended design supported more frequent and complex forms of sociodramatic play.

All the aforementioned studies stressed the contribution of the outdoor physical environment itself to children's development, but, on top of that, some posed the importance of the teachers' role in the outdoor environment (Striniste & Moore,1989; Davis, 1996; Shim et al., 2001; Dowdell et al., 2011). According to these researchers, teachers are responsible for maintaining the captivating nature of the outdoor area by adding complexity and variety of materials during outdoor play time. Along with this, teachers enrich children's play by encouraging them and

providing stimulus and feedback. Even though understanding teachers' role during outdoor play time is an important issue, this aspect is not addressed in the scope of this study.

The literature reviewed in this section points to the influence of the outdoor physical environment on children's development. Specific features of the environment such as connected pathways, the presence of natural elements, and loose parts contribute to enhance children's language and social skills by supporting, for instance, longer periods of uninterrupted play. The next section will present some of the theoretical frameworks mostly utilized by this literature to help to explain how and why these relationships exist.

THEORETICAL FRAMEWORKS MOST UTLIZED

Affordance theory (J. Gibson, 1977) and Attention Restoration theory (Kaplan, 1995) have been commonly applied in studies to conceptualize how outdoor environments contribute to children's learning and development. Affordance theory allows considering the environment through children's perspectives (Waters, 2017). Fjortft (2001) and Kyttä (2004) studies support comprehending how affordance theory enables professionals to view environments through children's experiences, which may be substantially different from the experience of adults.

Fjortft (2001) investigated how natural environments affordances stimulate children's motor fitness during play, focusing specifically on versatile play. In a quasi-experiment, she compared two groups of children between 5 and 7 years-old attending two different kindergarten schools in Norway. The experimental group comprised of 46 children was offered free play and versatile activities in a forest environment next to the kindergarten facility every day for 1-2 hours. The study began in September with a pretest of children's motor abilities and lasted for nine months, concluding with a posttest in June the following year. The author uses the concept of affordance to describe "an awareness of the environments and their functional significance, or their functional meaning" and asserts that "the central concept guiding children's examination of their environment is that of *affordance*" (p. 111). Her results pointed out a significant relation between the diversity of the landscape and children's behaviors and play performance, indicating that the more equipped, the more children engaged in versatile and creative play. In other words, multiple affordances enable different types of play for young children. She noted, for instance,

that shrubs of different species afforded shelter, hiding, social and construction play, whereas some trees, depending on branching pattern, stem diameter and flexibility, were accessible for climbing. Along with that, the experimental group showed significant gains between pretest and posttest assessments of physical and motor fitness.

Kyttä (2004) investigated how the degree of independent mobility and the number of actualized affordances covaried in four varying types of children's environments, which consisted of neighborhoods with many levels of urbanization. Mobility was considered in three aspects: geographical range, mobility license (i.e., parents' rules of what children can do and where they can go), and actual mobility (i.e., children's actual movements over a period of time). She defined *potential affordances* as those available to be perceived in relation to a specified individual, while *actualized affordances* are those revealed in the actions of an individual or through self-report. In this study, 223 children between 8 and 9 years old answered to questionaries and interviews. The results showed that the more mobility licenses children have, the more likely they were to actualize affordances in the neighborhood. The environment in which children had high independent mobility and characterized by high number of actualized affordances was considered an "ideal" context for children's development. As stated by the author, "children are able to interact effectively with their environment and utilize opportunities within the environment to perform independently at a level appropriate to their physical and cognitive abilities" (Kyttä, 2004, p. 194). The study concluded that the covariation between actualized affordances and the degree of independent mobility are a significant indicator of child-friendly environments.

The theory of affordances continues to be largely utilized in recent research about outdoor environments for young children. Investigations have been analyzing which affordances outdoor settings in childcare are specifically related children's sociodramatic play (Morrissey et al., 2017), physical activity (Sando & Sandseter, 2020), social play (Larrea et al., 2019), and risk play (Kleppe, 2018). Morrissey et al. (2017) compared a highly naturalized and a traditional outdoor space. The highly naturalized environment had logs, rocks, plantings, gravel paths, vegetable garden, and a chicken run, with minimal man-made materials and equipment. The authors concluded that affordance of open-ended natural materials (e.g., loose parts), flexible

playscapes, and spaces where children felt greater sense of seclusion and quietness (e.g., tent cubby, old full-sized table underneath) supported more complex sociodramatic play processes among 4- to 5-year-olds that persisted longer, involved higher levels of object substitution (e.g., sand as cake ingredients), imaginative transformations (e.g., use of gesture or words to indicate imaginary objects, such as spraying an imaginary cleaner bottle), metacommunication (i.e., use of language to plan and organize play by assigning roles or tasks, deciding the use of spaces or materials, such as saying 'This will be our spacecraft'), and more fantasy play themes (e.g., astronaut, princess, pirate) as opposed to domestic ones (e.g., family roles).

Larrea et al. (2019) utilized the Affordance Scale (Kyttä, 2002) to examine associations between preschool outdoor environment levels of affordance availability and children's social play. Eighteen early childhood education centers and 173 children were part of this investigation. The measure includes affordances of cycling, running, skipping, swinging, role playing, being in peace and quiet, molding, playing rule games or home, and following/sharing adults' activities. The analysis showed that low affordance availability was associated with fewer group play behaviors and more parallel social play. As it relates specifically to affordances driving young children's physical activity, Sando and Sandseter (2020) pointed out that fixed functional equipment (e.g., climbing towers, slides, swings) and pathways, which functioned as running or cycling track, and road for cars—depending on the play context and the child's intentions—provided episodes of high physical activity. Hence, recent outdoor research utilizing the affordance theory has been revealing how specific features of the outdoor environment can promote and enhance children experiences of play and physical activity, which in turn may contribute to their developmental growth.

To a less extent, research on outdoor environments in childcare has also been utilizing attention restoration theory (ART) to understand the extent to which natural environments can restore children's ability to concentrate (Kaplan, 1995). According to Ohly et al. (2016) and Stevenson et al. (2018) systematic reviews on investigations applying ART, there are very few studies looking at young children in childcare settings. Both reviews point out research with children between 7 and 12 years of age (e.g., Taylor, 2002; Schuttle et al., 2017), with ADHD (e.g., Taylor, 2009; van den Berg, 2011), and the presence of nature in their communities, apartments,

or neighborhoods (e.g., Taylor et al., 2002) or experiments involving walking in natural versus urban environments (e.g., Schuttle et al., 2017). I have only found two studies utilizing ART that focus on young children, of which one examined the association between amount of time children attending childcare spent outdoors and their cognitive and behavioral development (Ulset et al., 2017). The other study examined the restorative effects of nature on children's executive functioning by comparing attention restoration after an urban versus a park-like area walk (Schuttle et al., 2017).

The longitudinal study of Ulset et al. (2017) followed 562 children for four years during preschool and the first year of elementary school (i.e., children aged between 3 and 7 years). Inattention and hyperactivity were measured utilizing a questionnaire answered by childcare and school teachers. Executive functions of attention and short-term memory were assessed with the digit span task of the Weschler Intelligence Scale for Children (WISC-IV) when children were 40-52 months and 52-64 months. The results showed a positive association between outdoor hours and children's digit span scores, and a negative association between outdoor hours and inattention hyperactivity symptoms. That is, the more time children spent outdoors in childcare centers and first grade schools, the less inattention and hyperactivity symptoms they displayed. The authors concluded that outdoor time in preschool contributed to support children's development of attention skills and protected against inattention and hyperactivity symptoms. Schuttle et al. (2017) examined whether preschool (4- to 5-year-olds) and school-aged children (7- to 8-year-olds) had their attention skills restored after walking along urban streets versus walking in a park-like area. All children completed an activity to fatigue attention, followed by a 20-minute urban or a nature walk, and finally completed assessments of working memory, inhibitory control, and attention. Even though school-aged children performed significantly better on the attention task compared to preschoolers following a park-like walk, but not walking along urban streets, the authors concluded that young children can benefit from time in nature. Preschoolers spatial working memory was more stable following the nature walk than the urban walk. Preschoolers assigned to a nature walk also responded significantly faster to the attention assessment.

Yet, it is necessary to acknowledge the cultural aspect embedded within the designs of outdoor spaces in childcare, which might also change interactions teachers and children have in this environment. The investigations cited above are from Norway (Ulset et al., 2017), Finland (Kyttä, 2004), and Norway (Fjortft, 2001). Only one research study was conducted in the United States (Schuttle et al., 2017) and connected ART to young children's attention outcomes but it does not represent expectations about outdoor areas in childcare. Therefore, the results presented in the studies aforementioned need to be understood relative to the cultural values and expectations context in which the research took place. Scandinavian countries specifically have engrained in their culture and self-identity as a nature loving people (Sandell & Sörlin, 2008). This is supported by the philosophy of *friluftsliv*, a term is utilized in Norway and Sweden to indicate the reconnection with nature and the old Scandinavian outdoor tradition (Gelter, 2000). These values resonate in these countries early childhood education aims, standards, and practices. For instance, according to the Norwegian Framework Plan for the Kindergartens (NMER, 2017), which applies to all ECE institutions and guides teachers pedagogical work with children in Norway, outdoor time and activities are a major focus and Norwegian children spend more than 70% of their total time in ECE outdoors in the summer, and more than 30% of the total time in the winter (Moser & Martisen, 2010).

In the United States, outdoor settings in childcare became increasingly important in the early 1900s as philosophers such as John Dewey (1852-1952) recognized the significance of movement and physical activity for young children. Moreover, influenced by Froebel (1782-1852) ideas, North American kindergartens began to include climbing equipment, seesaws, and swings to their playgrounds, and to give importance to a richer natural environment. Nevertheless, as kindergartens became part of the public school system, the significance of play and playing outdoors diminished as activities considered more academic gained more relevancy (Frost et al., 2001). Along with this, in the 1980's, the trend of standardized testing became prevalent in the US overemphasizing intellectual development in math, science, and literacy at young ages (Elkind, 1982; Bassok et al., 2016; Haslip & Gullo, 2018). These sociopolitical changes resulted in less time outdoors for young children attending childcare programs.

In this sense, Bronfenbrenner's bioecological model offers a framework to conceptualize the role of the cultural and social context in a specific time point, and to understand how such values and expectations may resonate in daily interactions between teacher-child in outdoor areas, the amount of time young children spend outdoors, and even the design and organization of such environments. This study will not examine how differences in cultural values related to outdoor life and activities across nations might change teacher-child interactions in outdoor settings in childcare. Nevertheless, it is important to acknowledge such variations as a great share of research on outdoor environments have been conducted in Scandinavian countries. Therefore, the study results and application must be interpreted accordingly with its context and time. In this regard, the bioecological theory serves well in the present investigation because it places context and time in its framework, and it may support understanding the role of specific values and standards related to childcare outdoor environments in the United States in these settings designs, the presence of natural materials, or the amount of time children spend outdoors.

The present study draws upon both affordance and attention restoration theories paired with Bronfenbrenner's bioecological theory. The studies listed in this section illustrate the contributions of affordance theory and ART to conceptualize in which ways outdoor areas in childcare programs may support young children in developing cognitive and social skills. ART enables understanding the role of natural elements or a more nature-like outdoor space in reestablishing young children's attention abilities. On the other hand, affordance theory drives attention to the importance of outdoor designs in providing opportunities to improve young children's physical activity, playing, and learning.

As it pertains to the discussion of quality measurement, affordance theory and attention restoration theory appear to relate more to the structural aspect of quality. According to the main premise of Gibson's (1977) affordance theory—that we perceive and pay attention to objects and environmental affordances, rather than their qualities—affordance exists in the intersection—and interaction—between the subject and the environment. Thus, an object in the outdoor area will be considered "swing-able" if it is possible to swing. Even though this premise relates to a process of bidirectional interactions between individuals and environments, research has been looking at affordance availability as the extent to which materials and characteristics of the

environment leading to specific behaviors (e.g., different types of play or levels of physical activity). In this sense, the use of affordance theory might shed light on the structural aspect of outdoor quality.

In the same vein, Kaplan's (1995) attention restoration theory might relate to the structural aspect of quality, rather than process. This theory posits that natural environments have the potential to restore ones' attention by reducing mental fatigue. Direct attention is understood as a limited resource that can be depleted after long and/or intensive use, and Kaplan's theory proposes that natural environments have the potential to facilitate recovery from attention depletion. One of its premises is that natures' fascinating qualities replenish direct attention. Typical instances of nature's fascinations are "clouds, sunsets, snow patterns, the motion of the leaves in the breeze" (Kaplan, 1993, p. 139). Therefore, this theory drives focus to physical features of the environments, especially natural ones, and the presence of natural elements, which characterizes a structural aspect of quality.

Process quality entails interactions between teacher and children, as well as children and their peers. It encompasses the extent to which teachers promote, for instance, children's learning and positive peer interactions by scaffolding their thinking, giving emotional support, and having warm relationships with them. Measures addressing process quality pay attention to teachers' use of language, use of materials to explain and expand concepts, closeness and proximity to children when engaging on interactions with them. Nonetheless, Bronfenbrenner's (2006) bioecological theory posits large importance on the characteristics of microsystems in supporting effective proximal processes—that is, progressively more complex forms of enduring interactions between an individual and the persons, objects, and symbols present in its most immediate environment occurring consistently over prolonged periods of time. Microsystems include not only physical features of the environment, but also pattern of activities that invite or inhibit engagement in proximal processes. In this sense, structural aspects of quality, that is physical characteristics of the environment (e.g., design, set up, organization, materials available), and levels of stability (e.g., program schedule) interact with the process aspect of quality because it is what sets the ground for potential optimal interactions to occur. Therefore,

the current study puts together these three theoretical frameworks in the effort to understand how outdoor quality might be linked to young children's cognitive and social development.

QUALITY OF OUTDOOR ENVIRONMENTS IN CHILDCARE AND REGULATIONS IN THE U.S.

The design of outdoor spaces in childcare settings is contingent upon a set of cultural values and expectations in a specific point in time. These are present in the standards regulating the quality of such environments. The debate about quality in ECE has a long legacy in the United States.

The Coleman et al. (1966) study was one of the first investigations which pointed out a strong relationship between children's backgrounds (i.e., family structure, environment, income, and social status) and their achievement in school. Nevertheless, the research also showed that specific school features could influence children's outcomes, including characteristics of the physical environment, group sizes, and teachers' education. Since then, school quality has been an important issue among scholars in the fields of education and child development. As early childhood education became part of the public school system and increasingly relevant to young children's development and further academic success, researchers and states governments have been paying attention to the quality of childcare environments.

The measurement of quality in ECE settings has been traditionally conceptualized in two main aspects. The first is structural quality, related to teacher-child ratios, group composition, and staff qualification. The second is process quality, related to interactive activities or experiences, which encompass teacher-child interactions and language stimulation by teachers. When both aspects are combined, they are usually called a measure of "global quality" (Philips & Howes, 1987; Vandell & Wolfe, 2000). The ECERS-R (Early Childhood Environment Rating Scale Revised – Harms et al., 2005), for instance, is a measure of global quality. This instrument considers both structural (e.g., availability of materials, health and safety standards) and process (e.g., supportive interactions, warmth, appropriate stimulation with language and activities) aspects of quality within childcare settings.

The ECERS (Harms et al., 1980) first version was not elaborated to serve as a standardized tool of quality measurement. Instead, it was initially developed to help Early Childhood Education (ECE) programs prepare for the National Association of the Education of Young Children (NAEYC) Program Accreditation (Frank Porter Graham Child Development Institute, 2003). Therefore, the definition of quality adopted by the ECERS scale, including the revised version, is consistent with the NAEYC program accreditation standards, which addresses professional knowledge teachers need to promote high quality classrooms (Setodji et al., 2018).

Along with this, many states' Quality Rating and Improvement Systems (QRIS) in the U.S. have adopted the ECERS-R to assess early childhood programs' overall levels of quality but this focuses primarily on the indoor settings. Within the U.S., 38 of 50 states have a statewide Quality Rating and Improvement System (QRIS Compendium, n.d.). The purpose of these systems is to regulate quality in licensed programs. Thirty-four of them use the ECERS-R (Harms et al., 2005) to assess preschool programs quality. Programs' overall level of quality is often determined by the ECERS-R scores and other standards required by each QRIS. For example, some systems require that all teachers meet some level of education. According to each QRIS policy, levels of quality may result in accountability for programs, such as the amount of funding they will receive from the state, or their star rating. Each state QRIS determines how frequently licensed programs should be evaluated. In North Carolina, for instance, official assessments occur every three years whereas in other states, such as Florida, South Carolina, and Tennessee, ECE programs quality evaluation occurs every year (QRIS Compendium, 2017).

One of the main areas of study focuses on the relationship between quality as measured by the ECERS-R and children's outcomes. Mashburn et al. (2008) indicated that the overall score yield with the ECERS-R is only associated with children's development of expressive language skills, but not other aspects of development (e.g., emotional development). In contrast, Hestenes et al. (2014) found that higher scores on ECERS-R were linked with higher levels of learning self-efficacy. In Setodji et al. (2018), ECERS-R total scores above 3.4 did not correlate with additional improvements to children's social, cognitive, or language outcomes. The authors argued about the existence of a ceiling effect of quality measured with the ECERS-R on

children's developmental outcomes, casting doubt in higher scores as meaning of higher levels of quality and its impact on children's outcomes.

Some scholars argue that the lack of associations between children's outcomes and quality measured with the ECERS-R is explained because this scale collapses multiple aspects of preschool environment into a unidimensional measure. This would account for less precision when measuring processes responsible for development (Mashburn et al., 2008; Cassidy et al., 2005). Still, the ECERS-R is a widely used scale to measure quality of early childhood settings in the United States and in many states QRIS the ECERS-R scoring counts towards programs' star ratings, which may result in accountability for programs (e.g., determining the amount of state funding a program receives).

The ECERS-R is a measure of childcare quality aligned with Bronfenbrenner's bioecological theory because it considers both physical characteristics of childcare classrooms (e.g., activity centers, presence of books, manipulative toys), characteristics of the programs in which those classrooms are part of (e.g., curriculum, schedule), along with teacher-child and child-child interactions (e.g., teachers' use of language with children, learning scaffolding). Therefore, this instrument considers elements of the proximal processes, of the classroom as a microsystem, and other systems influencing on the classroom. As posited by this theory, the conjugation of all these elements in one single scale may be important because their mutual action affect "the form, power, content, and direction" (Bronfenbrenner & Morris, 2006, p. 996) of those same proximal processes, considered the engines of development in the Process-Person-Context-Time (PPCT) model.

Still, instruments to measure childcare quality, such as the ECERS-R, are primarily in the evaluation of indoor environments. In the ECERS-R, outdoor quality is minimally considered. Among its 43 items, only three relate to nature or to the outdoor learning environment (i.e., space for gross motor play, gross motor equipment, and supervision of gross motor activities). In the current study, however, these items will not be analyzed separately. According to Cooper (2015), a program with "excellent" rating on the ECERS-R could have a low-quality outdoor area. It is important to note that because outdoor environment quality is minimally addressed by the

ECERS-R, results utilizing this instrument total score might overshadow specific areas, such as the outdoor setting. To date, few tools have been developed to measure quality of outdoor areas in childcare settings.

DeBord et al. (2005) developed the Preschool Outdoor Environment Measurement Scale (POEMS) to assess the quality of outdoor environments for preschoolers. This measure includes not only the physical environment of the outdoor setting (e.g., variety of materials and equipment available to the children) but also interactions among children, between teachers and children and between children and the environment. Additionally, the scale evaluates the potential of the outdoor area to support learning in different developmental domains, such as language, math, science, music, and art.

This scale consists of five domains of which three of them (i.e., Physical Environment, Play and Learning Settings, and Program) address aspects of structural quality. These domains assess the presence of elements of the physical environment, such as the building construction, the outdoor accessibility and design, availability of different types of materials for play and equipment, as well as program schedule (e.g., periodicity of outdoor time). The other two of domains (i.e., Interactions and Teacher/Caregiver Role) entail aspects of process quality by addressing teacher-child, child-child, and child-environment interactions, teachers' support for children's learning, and teachers as role models for environmental care. Therefore, POEMS might be considered a scale of global outdoor quality because it entails both structural and process aspects of quality. Nevertheless, to date, no study performed a factorial analysis to confirm whether POEMS is more focused on structural, process, or global aspects of outdoor quality.

Since its publication, this scale has been utilized in many US states, such as North Carolina (Li et al., 2016; Cosco et al., 2014), Tennessee (Landy, 2018) and Virginia (Goodling, 2016), as well as in other countries like Spain (Miranda et al., 2017). As opposed to the ECERS-R, POEMS has been utilized only for research purposes, not for licensing regulations or star rating.

The lack of instruments to measure outdoor quality in childcare settings might explain limited investigation about the overall quality of these environments and its influences on children's

developmental outcomes (Shim et al., 2001). Existing research has focused on how specific characteristics of outdoor areas, such as the presence of natural elements (Nedovic & Morrissey 2013) or connecting pathways (Dowdell et al., 2011), influence on children's play behaviors, social interactions with peers, and vocabulary.

REGULATIONS REGARDING OUTDOOR ENVIRONMENTS AND EXPERIENCES

Outdoor environment standards for childcare centers consists of minimum mandatory and non-mandatory requirements (Cooper, 2015). Mandatory regulations are deliberated at each state level, whereas non-mandatory regulations are indicated at each Quality Rating and Improvement Systems (QRIS) level and Early Learning and Development Guidelines (ELG). QRISs' non-mandatory regulations incentivize improvements to ECE, and ELGs' specify desired learning and development outcomes.

According with the Child Care Center Handbook (North Carolina Division of Child Development, 2009), in North Carolina it is mandatory that early childhood programs have an outdoor area with a minimum space of 75 square feet per child and that all children, including infants and toddlers, must be taken outdoors daily even if the program operates less than 4 hours per day. The amount of time is not specified in the document. Recommended enhancements to licensing provided by NC's QRIS (Division of Child Development and Early Education, 2020) suggest that children are taken at least 30 minutes per day to play outside if the program operates only half a day, and 60 minutes for those open all day, considering weather permitting conditions (e.g., having water outside when it is too hot, or putting sunscreen on children when it is too sunny). The Preschool Outdoor Environment Measurement Scale (POEMS) is also recommended as a tool to assist licensed programs in evaluating the quality of outdoor environment for children between three and five years old, but this is not a mandatory requirement for licensure or a part of the QRIS.

Along with this, the North Carolina Foundations for Early Learning and Development (North Carolina Foundations Task Force, 2013), suggests that teachers should show enjoyment for being outdoors and encourage them to explore the outdoor environment (p.74), take children to listen to different sounds outdoors and pointing them out by saying 'Listen to the birds' (p. 100), play

music outdoors where children can make large movements (p. 129), provide opportunities to observe naturally occurring patterns (p. 143), and include science materials in the outdoor environments (p. 147). These recommendations are linked with early childhood learning goals related to language and communication, motor development, and scientific knowledge. Only two address specifically outdoor activities; these include engaging in physical play outdoors (p. 71) and observing and describing characteristics of living things and the physical world (p. 144).

Cooper (2015) pointed out that only a few states in the U.S. use QRIS standards to encourage the enhancement of childcare outdoor learning areas provision and use. The author indicated that only 7 states QRISs have regulations related to programs' outdoor environments (i.e., TX, NC, IN, NY, MI, OK, and WI). Michigan's QRIS has the highest requirement for outdoor time, being 30 minutes for every 3 hours children spend in the program. In contrast, Texas' QRIS was the only one which detailed quality standards for outdoor learning environments as it related to equipment/materials and areas of interest within the outdoor environment (e.g., music, quiet area). According to his review, the remaining states relied on Environmental Rating Scales (ERS) or left the quality of childcare outdoor settings completely unaddressed.

OUTDOOR ENVIRONMENTS AND CHILDREN'S OUTCOMES

In outdoor environments, young children are more prone to engage in open-ended, unstructured, social play and aerobic exercise (Robertson, 2020; Bjørgen, 2016). As mentioned previously, recent investigations have drawn attention to relationships between increased outdoor physical activity levels and children's higher levels of executive functioning, such as the ability to self-regulate (Becker et al. 2014), as well as the presence of natural elements in outdoor settings and children's peer play interactions, depth and duration of sociodramatic play (Burgess & Ernst, 2020; Robertson et al., 2020). Positive child outcomes are also linked with school readiness in preschoolers (Becker et al. 2018; Burgess & Ernst, 2020) and academic attainment in primary school (Khan et al. 2020). Burgess and Ernst (2020) analyzed the influence of nature preschools on peer play interactions and learning behavior. This investigation utilized a non-equivalent comparison group design in which 4 natural preschools served as the treatment group and 2 non-nature preschools served as the comparison group. Nature preschools were defined as childcare programs in which children spend most of the day in outdoors nature play (e.g., four to five

hours of daily nature play). Indoor spaces were minimally utilized (e.g., one to two hours) and outdoor play occurred regardless of weather conditions. Children's play and learning behaviors were assessed respectively with the Penn Interactive Peer Play Scale (Mcwayne et al., 2007)—a teacher and parent rating scale—and the Preschool Learning Behaviors Scale (McDermott et al., 1996) reported by the teachers. Results showed that children in nature preschool scored significantly higher on competence motivation (i.e., interest in learning-related activities) and play interactions (i.e., comforting and helping other children, encouraging and welcoming other in play), as well as significantly lower rates on play disruption (i.e., antisocial behaviors that interfere with ongoing peer play) and disconnection (i.e., withdrawn and nonparticipation in peer play).

The current study investigates how young children's experiences in outdoor learning environments may support their cognitive and social skills, specifically their executive function, conceptual perspective taking abilities, internalizing and externalizing behaviors, and social skills, such as cooperation among peers, demonstrating empathy, sharing classroom materials, and following rules. The following subsections will explain how and why these skills might be show associations with time and quality of children's outdoor experiences, while indicating recent research findings on these topics.

Cognitive Development

In the first five years of life there is a significant development of the brain critical for cognitive development (Khan & Hillman, 2014). Between 3 and 5 years of age, children experience rapid growth in several cognitive domains, including language (Shonkoff & Phillips, 2000) and other higher order cognitive skills known as executive functions (Garon et al., 2008). Executive functioning involves abilities of planning, working memory, changing strategy (i.e., shifting), and response inhibition (Zelazo, 2015). Executive functions are classified in hot and cool tasks (Waller et al., 2017). As opposed to hot tasks, cool tasks do not involve an affective component, such as waiting until someone has finished talking before speaking. Cool tasks are, for example, recalling numbers in reverse order or changing strategy when a rule does not apply anymore. Hot tasks are, therefore, those which entail an affective component, and usually require inhibitory control, such as not peeking when a present is being wrapped.

Studies have shown that executive functions are associated with play and physical activity in early childhood (Verswijveren et al., 2020; McClelland et al., 2019). Even though during outdoor time physical activities are almost always mingled into children's play, these two aspects offer different contributions to their development (Waller et al. 2017). Motor development is associated with cognitive development because the cerebellum, a region within the brain responsible for motor control and balance, is also involved in the coordination of thoughts, attention, and working memory (Diamond, 2000). Thus, children's neural and cognitive development are linked with physical activity.

Diamond and Lee (2011) argued that executive functions are improved by activities indirectly targeting these skills, such as aerobics, martial arts, yoga, and mindfulness. Best (2010) proposed three ways in which physical activity is linked with executive function: "(1) the cognitive demands inherent in the structure of goal-directed and engaging exercise, (2) the cognitive engagement required to execute complex motor movements, and (3) the physiological changes in the brain induced by aerobic exercise" (p. 339). These relationships can also be considered in the context of play.

Other studies have signaled the integration between visual-motor skills and executive function. MacDonald et al. (2016) took measures of visual-motor integration skills, object manipulation, executive function skills and social behaviors of 92 children between 3 and 5 years-old in the fall and spring semesters of the preschool year. The authors pointed out that young children might spend more than half of their overall time in childcare in fine motor activities, such as drawing, tracing, cutting, and manipulating small objects. Activities such building with blocks or copying shapes require not only visual and motor integration, but also focused attention, working memory, and use of inhibitory control (i.e., avoid surrounding temptations). In addition, they argued that gross motor skills, especially object manipulation, provide a foundation for socialization and interactions with peers during active play and outdoor activities. Object manipulation skills are used, for instance, in reciprocal play types of games, such as catch or soccer. Because of that, this study utilized object manipulation as a control variable in assessing the association between visual motor integration skills and executive function. The findings

indicated that better visual-motor integration skills measured in the fall predicted higher scores in executive functioning in the spring semester. Furthermore, children who demonstrated better object manipulation skills in the fall also showed significantly better social behaviors in the spring, such as more self-control and cooperation. However, measures of social behavior in this study were based on teachers' ratings.

On the other hand, play might involve abilities related to inhibitory control, such as during pretend play, that are described as hot executive functions because they entail an affective component (Waller et al., 2017). Cemore and Herwig (2005), for example, utilized a delay gratification task to test the relationship between play and self-regulation in preschoolers. The authors found a significant correlation between make-believe play and delayed gratification, but only when children played at home, and not at the preschool center. Most interestingly, this study revealed that, among other variables such as age, sex, family structure, ethnicity, childcare center, and mother education, make-believe play was still the only significant variable in explaining delayed gratification. In the same vein, Diamond and Lee (2011) pointed that play-based curriculum led to more improvements in executive functions scores when compared to a standard curriculum.

Studies specifically addressing young children's outdoor experiences have shown mixed associations between outdoor play time and early development of executive functioning. Zamzow and Ernst (2020) evaluated the influence of young children's executive function skills attending nature preschools in comparison with those attending non-nature preschools over the course of one full academic year. The difference between nature and non-nature preschool was defined by the proportion of the school day children spent outdoors and the location of outdoor play time, that is, in nature as opposed to a maintained outdoor setting. Results from pretest and posttest measurements of preschoolers' executive functioning showed non-significant differences between those attending nature and non-nature centers. The authors indicated that children in both types of schools demonstrated executive functioning growth beyond what would be expected for their age. They explained such result by pointing out that in both preschools children spent on average four to five hours daily in unstructured play. The main difference was the location in which children engaged in unstructured play, that is, in outdoor natural settings or

indoor settings. Based on previous research linking unstructured play and executive functioning development, the authors concluded that, rather than the type of preschool children's attended (i.e., nature or non-nature), what seemed to drive their growth in executive function skills was the amount of time spent in unstructured play.

Carr et al. (2017) investigated what components of executive function preschoolers use while engaging in free play in playscapes intentionally designed to provide children opportunities to use goal-directed behaviors. Particularly, they wanted to understand how the affordances of a playscape strengthened executive functioning in children between 3- and 5-years-old. The study observed and video-taped sixty-five children from two childcare programs, one an urban university laboratory preschool, and the other a non-profit program serving low-income suburban and rural population. Data were collected over an 18-month period. The findings indicated that playscapes affordances such as built environmental elements and natural loose parts (i.e., logs, tree cookies, and risk-taking challenges) provided children opportunities for problem-solving situations where they exercised inhibitory control, initiation, flexibility, working memory, planning, organization, and monitoring.

Kharitonova and Munakata (2011) did an experiment with 3-year-old children measuring flexibility in terms of switching between rules in a card-sorting task, and abstraction in terms of selecting the one picture that did not belong with the others. The findings of this study indicated a strong link between flexible and abstract thought. Children who switched from one card-sorting rule to another also better performed in the odd-one-out task. The relationship between flexibility and abstraction is relevant to understand how outdoor learning environments contribute to young children's developmental outcomes because they spend most of their time in outdoors areas in sociodramatic and social play (Shim et al., 2001; Frost et al., 2012).

The set of studies reviewed in this section show how motor development and different types of play are associated with cognitive development, and specifically young children's executive functioning development. These associations are important in the context of outdoor play because children spend most of their time in these spaces running, climbing, lifting, manipulating objects, while engaging in many types of play. Some studies point specifically to the relationship

between cognitive development and children's outdoor experiences in childcare. Nevertheless, not only are there still few studies dedicated to analyze how specific characteristics of the outdoor environment in childcare contribute to young children's cognitive development—by fostering motor activities and supporting social play, for instance—but also the literature is limited when it comes to drawing explanations to these relationships based on theoretical frameworks, and to investigating contexts in which outdoor learning environments are not taken as important as other variables linked to children's development (e.g., indoor classroom). The study of Zamzow and Ernst (2020), for example, examined nature preschools in Minnesota, representing a context in which outdoor environments—certainly where natural elements were prevalent—are considered as important as other aspects of young children's education. The present study aims to contribute to this literature by utilizing data from a randomized sample in the state of North Carolina, and analyzing it based on a set of theoretical frameworks as a way to shed light on different aspects of this important context in relation to children's executive functioning.

Social Development

During outdoor play, young children have the opportunity to develop their social skills by engaging in more complex types of play and playing with different peers. Preschool-age children are learning to assign language to their needs and feelings, as well as to understand others' feelings and perspectives (Copple & Bredekamp, 2009). Research has shown positive associations between children's experiences in outdoor environments and their social development.

Hartle (1994) observed 27 kindergarten children playing outdoors for four days a week over six weeks looking for indicators of social competence during uninterrupted play. Enduring forms of play are important for children to develop communication skills, the ability to understand others' emotions and consider others' needs, both real and imagined. Children from this study attended a laboratory school affiliated with a southeastern university and were from mixed aged groups, race, and socioeconomic status. The findings indicated children who had six specific social skills were more likely to understand others' words and meanings, and to better "read" social situations. The six social skills included negotiation of a hierarchy of authority, evaluating and

monitoring the behaviors of others, acknowledging others' intentions, shifting standards, and negotiating common meanings (Hartle, 1994). Additionally, Hartle pointed out that outdoor play time may encourage exercising these social skills as children, for example, must make or find opportunities to form groups. She concluded that the ability to recognize and understand others' emotions and needs were enhanced during outdoor play.

More recent research has also found that specific elements of outdoor play areas such as connecting pathways, bushes, loose materials, and opportunities for seclusion supported young children's sociodramatic play for longer periods of time (Robertson, et al., 2020; Nedovic & Morrissey, 2013). Play is a crucial element to children's social development. Numerous studies and theories (Erikson, 1963; Piaget, 1962; Vygotsky, 1978) show that play is an opportunity for children to take others' perspectives into account, which might differ from their own.

One of the aspects of social development is when a child learns to understand other's perspectives. Flavell et al. (1968) defined perspective taking as the process in which an individual cognizes specific attributes of another person, such as needs, intentions, opinions, beliefs, or emotional states. Two types of perspective taking have been distinguished (Marvin et al., 1976). *Perceptual* perspective taking refers to inferences regarding another person's visual, auditory, or other perceptual experience. *Conceptual* perspective taking refers to inferences about other's internal experiences, such as thoughts, desires, attitudes, emotions, or plans.

Founders of child development study, such as Jean Piaget, thought that children could only develop such competencies by the age of seven, the beginning of the concrete stage (Piaget & Inhelder, 1956). Nevertheless, investigations in the 1970s showed that young children were able to engage in non-egocentric perceptual perspective taking by the age of 3 (Flavell, 1974), and non-egocentric conceptual perspective taking by the age of 5 (Mossier et al., 1976). Marvin et al. (1976) also pointed out that children at the age of 4 were able to distinguish among multiple conceptual points of view in a non-egocentric fashion. The results of these studies need to be taken with caution because most of the samples are comprised of children with middle-class backgrounds, and, as many have indicated before (Bourdieu, 1986; Lareau, 2011), middle-class parents' child-rearing practices might elicit certain social abilities at earlier ages.

There are many empirical studies investigating the role of play on children's social development. Nevertheless, similar analyses pertaining to children's outdoor play experiences are limited. One of the few studies addressing this inquiry was done by Li et al. (2016), who investigated relationships between outdoor pretend play and children's social skills. The study observed 28 children attending high quality childcare centers in a southeast suburban area during outdoor free time for a period of two weeks. Children's social skills were assessed by the Social Skill Rating System (age 3–5; teacher report; Gresham & Elliott, 1990), and the frequency of pretend play during outdoor time. The findings indicated that different types of pretend play (i.e., concrete, abstract, and social) were associated with different aspects of social skills (i.e., self-control, assertive, and cooperation). Abstract pretend play, for instance, showed positive correlations with cooperation, whereas total pretend play amount was positively correlated with assertiveness. Regression analyses including age and gender as control variables also showed a positive relationship between social pretend play and cooperation, and self-control. Boys engaged slightly more than girls in concrete play, and girls were observed to spend more time in abstract pretend play than boys. The authors concluded that high quality outdoor environments afford many opportunities for unstructured social interactions and engagement in pretend play by offering costumes, loose part equipment (e.g., balls, wagons, buckets), or natural elements (e.g., small sticks, leaves, and mulch).

Investigations specifically addressing the quality of outdoor environments and children's social outcomes are also limited. Hestenes et al. (2015) explored how different measures of classroom quality predicted preschoolers' socioemotional outcomes, utilizing indoor (i.e., ECERS-R, ECERS-E, and CLASS) assessment tools. Children's social skills, internalizing and externalizing behaviors were measured with a more recent version of the Social Skill Rating System (Gresham & Elliott, 1990), the Social Skills Improvement System (SSIS; Gresham & Elliott, 2008). Data was collected in 97 preschool classrooms and 422 children between ages of 3 and 5 were observed. The ECERS-R did not show as a significant predictor of children's social skills, internalizing or externalizing behaviors. This finding might be explained by the fact that the ECERS-R is a measure of global quality.

As compared to the cognitive development domain, empirical literature about contributions of outdoor environments to young children's social development seems to be even more restricted. The few investigations reviewed in this section present ways in which outdoor areas in childcare enhance young children's social development by supporting many types of play (e.g., social, sociodramatic, and concrete play), while being of high quality. This study aims to contribute to this literature by analyzing data on young children's social skills and outdoor environmental quality grounded on a set of theoretical frameworks to allow a more comprehensive interpretation of findings.

THE PRESENT STUDY

The literature review showed the importance of outdoor learning environments in childcare settings to young children's cognitive and social development. As stated previously, outdoor time enables children to exercise abilities related to language, math, science, social interaction, and movement (Kemple et al., 2016; Rivkvin, 2000; Harrison, 2008; Cosco et al., 2014). In addition, specific features of programs' outdoor spaces may enhance types of activities, such as sociodramatic play, or vigorous aerobic physical exercise, that facilitate development in these areas. For instance, the presence of more natural elements (Nedovic & Morrissey, 2013), secluded spaces (Robertson et al., 2020), loose materials (Fjørtoft, 2001; Dowdell et al., 2011; Li et al., 2016), and connecting pathways (Striniste & Moore, 1989; Kyttä, 2003; Koziol, 2011; Carr et al., 2017) proved to influence the amount of time children spent in uninterrupted social play, the number and complexity of words children used during play, and children's focused attention. However, most of these studies remain atheoretical.

One of the contributions of the current investigation is to offer an analysis of how outdoor learning environments may contribute to young children's cognitive and social skills grounded in theoretical frameworks. Bronfenbrenner's bioecological theory provides a framework to conceptualize the role of cultural and social context in a specific point in time, and to understand how such values and expectations may resonate in daily interactions between teachers and children in outdoor areas, the amount of time young children spend outdoors, and even the design and organization of such environments. The theory of affordances drives attention to the importance of outdoor designs as it pertains to children's perspectives of the environment, and in

providing opportunities to improve playing and learning. In addition, this theory supports understanding the ways in which the design of outdoor spaces may afford children more and longer interactions among themselves. This is important to the present investigation as it analyzes associations between outdoor environments and children's social outcomes. Lastly, ART enables understanding the role of natural elements or a more nature-like outdoor space in reestablishing young children's attention abilities, which might also positively contribute to other cognitive outcomes. The questions raised in this investigation are congruent with the assumptions offered by these theories.

Additionally, there are a lack of studies addressing how the quality of outdoor learning environments may contribute to young children's developmental outcomes. While there are many studies examining indoor or global quality, there are very few that consider the relationship between indoor and outdoor quality, or the additional impact that outdoor settings may have above and beyond the quality of the indoor setting. Few studies have pointed to the importance of including the measurements of outdoor quality in understanding how to promote enhancements in early childhood education programs (Muela et al., 2019). Therefore, the present study aims to fill these gaps by answering the following questions and testing the respective hypotheses:

Q1. Within childcare centers, what is the association between the quality of outdoor learning environments and a global measure of quality (i.e., ECERS-R total score)?

H1. There will be a positive association between the quality of outdoor learning environments (as measured by the POEMS) and a global measure of quality (i.e., ECERS-R).

Q2. Does the quality of the outdoor learning environment predict children's cognitive and social outcomes above and beyond a global measure of quality (i.e., ECERS-R)?

H2. Children's cognitive and social outcomes as measured by the FIST, CPT, and SSIS will be predicted by outdoor quality above and beyond a global measure of quality (i.e., ECERS-R total score).

Q3. Are outdoor learning environments with more natural elements associated with children's cognitive and social outcomes?

H3. Outdoor learning environments with more natural elements will be positively associated with higher cognitive and social outcomes for children.

CHAPTER IV: METHODS

PROCEDURES

The data to be analyzed in the current investigation was part of a larger study aimed at comparing the relationships among a variety of quality measures, and to verify the relationships between these tools and children's cognitive, social, and emotional outcomes. Data collection at each program center took place over two days, within a two-week period in 2009. On the first day, one assessor observed the classrooms on the first-day visit using the Early Childhood Environment Rating Scale-Revised (Harms et al., 2005). Teachers also received the Social Skills Inventory System (SSIS; Gresham & Elliot, 2008). This questionnaire measured participating children's social skills.

On the second day, a different assessor observed outdoor time and completed the Preschool Outdoor Environment Measurement Scale (DeBord et al., 2005). In the afternoon of the second day, the assessor conducted child interviews to measure flexible thinking utilizing the Flexible Item Selection Task (FIST; Jacques & Zelazo, 2001), and conceptual perspective taking utilizing the Conceptual Perspective Taking Task (CPT; Taylor, 1988). These interviews were conducted only with the randomly selected children (from those children who had parental consent).

All data was collected by highly trained assessors. The present study will utilize data collected pertaining to preschoolers' flexible thinking, abstraction, conceptual perspective taking abilities, social skills, problem behaviors, and indoor and outdoor environmental quality. Children's cognitive outcomes refer to their performance on flexible thinking and abstraction measured by the FIST (Jacques & Zelazo, 2001), whereas their social outcomes refer to their scoring on the CPT (Taylor, 1988) and SSIS's (Gresham & Elliot, 2008) Social Skills and Problem Behaviors subscales. For more information about the larger investigation, refer to Hestenes et al. (2015).

SAMPLE

The present study utilizes the sample of the larger study above mentioned. This larger investigation randomly selected childcare centers across the state of North Carolina according to their star-rating of 1-5 possible stars. In the Division of Child Development and Early Education

there were 4779 programs listed, including urban, rural, Head Start, non-profit, and private centers. To be considered eligible, programs needed to serve children ages 0–12 or 2–12 and have at least 35 total children enrolled. Based on these requirements, 3030 programs, 181 one-star (5.9%), 168 two-star (5.5%), 814 three-star (26.8%), 1131 four-star (37.3%), and 736 five-star programs (24.3%) were considered eligible. All these programs were participating in the North Carolina Quality Rating and Improvement System (NC QRIS) and, because of that, they were star rated programs. Postcards were sent to all possible eligible programs and program directors were called inviting their programs to participate in the project. Compensation was offered to programs and teachers who agreed to participate in the study. If the director agreed, one toddler, one preschool, and one school age classroom were randomly selected from the program's classrooms. Teachers completed a consent form which was collected on the first day of observation.

To recruit child participants from classrooms selected, consent forms and a short questionnaire (asking, for example, the number of hours the child was in care each week, child age when non-familial care began, and length of time with current teacher) were sent to parents. On the observation day, five children whose parents returned both the consent form and the short questionnaire were randomly selected in each classroom. Children with identified disabilities, reported by the teachers, were not included in the random selection because it was not an aim of this larger study to addresses issues related to cognitive and social development of children with special needs.

One hundred and seventeen of these programs agreed (36.2%) to participate in the study, but 16 canceled their scheduled observation. Hence, the total sample was 101 childcare programs, including 246 teachers, 94 toddler, 97 preschool, and 55 school-age classrooms.

The present study is a secondary data analysis of 92 preschool classrooms from the sample above described. Five classrooms were not included in this study because they did not have data for POEMS. Along with this, not all classrooms had child data for all 5 children randomly selected either because children were absent or because they refused to engage in the tasks (i.e., FIST and CPT). Therefore, out of the 92 classrooms, 57 have 5 children, 15 have 4 children, 13 have 3

children, 1 has 2 children, and 3 classrooms only have data from 1 child. Two classrooms have 6 children with data. Due to children's data being unbalance between classrooms, this investigation utilizes a multilevel model analysis which is a statistical procedure that accounts for unbalanced data. The total number of children in this study sample was 405.

The 92 preschool classrooms were part of programs with the following star ratings: 14 1-star (15%), 12 2-star (13%), 23 3-star (25%), 21 4-star (23%), and 22 5-star (24%). Higher star ratings mean programs with higher level of quality according to the NC QRIS. ECERS-R scores are one of the criteria to achieve higher levels of quality. Research has indicated an association between higher ECERS-R scores and programs' higher levels of quality (Cassidy et al., 2005; Mims et al., 2008). Therefore, 27% of the sample consisted of classrooms from programs of low quality (1-2), 23% of moderate quality (3-4), and 24% of high quality (5). The sample of 405 preschool children was comprised 52% of girls and 48% of boys. Twenty-six percent of the children were identified by their teachers as from African Descent, 53% from European Descent, and 7% as other, and 5% from Hispanic Descent. The age of the children ranged from 24 to 69 months (M = 48.3, SD = 8.3). Twenty-six percent of the teachers had a NC early childhood credential, 18% had some college, and 23% percent had a 2-year associate degree. Only 10% had a 4-year degree in a field related to early childhood education, and 5% had a 4-year degree in child development or early childhood education (N = 88).

MEASURES

Early Childhood Environment Rating Scale-Revised (ECERS-R; Harms et al., 2005)

The ECERS-R is a scale designed to measure global quality in childcare classrooms with children between 2½ through 5 years of age. It considers both structural (e.g., availability of materials, health and safety standards) and process (e.g., supportive interactions, warmth, appropriate stimulation with language and activities) aspects of quality. The ECERS-R includes 43 items organized in 7 subscales: Space and Furnishings (8 items), Personal Care Routines (6 items), Language/Reasoning (4 items), Activities (10 items), Interactions (5 items), Program Structure (4 items), and Parents and Staff (6 items). NC QRIS's ECERS-R assessments no longer use the Parents and Staff subscale. Items are scored from 1 (inadequate), 3 (minimal), 5 (good) to

7 (excellent). ECERS-R total score ranges from 1 to 7 and it is calculated by averaging the 6 subscales. Each subscale score also ranges from 1 to 7. In this study, only ECERS-R total score is utilized in the analysis. This tool requires a 3 to 4 hours observation and an interview with the lead teacher at the end of the observation, which is utilized to complete items scores that could not be observed, and then to collect information on teachers, group size, and teacher-child ratios. Intra-class correlations are reported as a measure of internal consistency for the ECERS-R. Subscales interrater internal consistencies vary from .71 (Parents and Staff) to .88 (Activities), and the total scale interrater internal consistency is .92 (Harms et al., 2005).

Preschool Outdoor Environment Measurement Scale (POEMS, DeBord et al., 2005)

The Preschool Outdoor Environment Measurement Scale (POEMS, DeBord et al., 2005) consists of a checklist of 56 items organized in five domains related to the outdoor environment: Physical Environment, Interaction, Play and Learning Settings, Program, and Teacher/ Caregiver Role. This scale requires a direct observation of the outdoor environment for approximately 30 minutes and an interview with the teacher, which lasts approximately 15 minutes. In this interview, teachers are asked about the extent to which they value outdoor play and how they communicate it to parents, if they facilitate participation of families in outdoor activities, if they allow children to do environmental care tasks (e.g., watering plants) with them, if they seek professional development using the outdoors, and which procedures they use to handle emergencies outdoors.

Each item is scored "no" for not present/not observed and "yes" for present/observed. Some items require checking a minimum number of boxes to give credit. The total score is comprised of all the items scored as a 'yes' across all the domains. POEMS total score ranges from 0 to 56. Higher scores represent higher outdoor quality. Additionally, POEMS has been shown to be a reliable and valid instrument. The internal consistency for the scale was tested in 41 childcare programs in North Carolina and Cronbach's alpha was strong (.87). This pilot reliability and validity study also showed that in high quality outdoor settings children tended to display more constructive play (e.g., exploring, building, hypothesizing), and in low quality outdoor environments children displayed more negative behaviors, as well as functional and repetitive play (DeBord et al., 2005).

A natural elements subscale was created utilizing six items retrieved from POEMS (DeBord et al., 2005), one from the Physical Environment domain, two from the Interactions domain, and three from the Play and Learning Settings domain. These items included 27 subitems (check boxes) pertaining to the presence of natural loose parts (e.g., shells, river stones, pine cones), variety of play and learning settings with natural elements (e.g. sand play area, flower or vegetable garden, animal habitat), and the overall impression of the outdoors as a natural area (e.g., variety of trees, shrubs, and non-poisonous flowering plants). Cronbach's alpha for this subscale was .71.

Flexible Item Selection Task (FIST; Jacques & Zelazo, 2001)

The cognitive outcomes in this study were flexible thinking and abstraction as measured by the Flexible Item Selection Task (FIST; Jacques & Zelazo, 2001), a test commonly utilized to assess these abilities in young children. Flexible thinking and abstraction are two skills related to executive function. Executive functions include planning, working memory, shifting, and response inhibition (Zelazo, 2015). Flexible thinking (i.e., shifting from one rule to another, or from one goal to another) is linked with abstraction as working memory as new rules and goals demand representation and encoding new information (Kharitonova & Munakata, 2011). Moreover, cognitive flexibility is also required in other type of skills, such as social communication (Ruby & Decety, 2003).

This test measures cognitive flexibility by providing children a shift cue without giving information about the new rule. Children were asked to pair four pictures where two of them were identical with each other, but not identical on any other dimension (i.e., color, size, shape, or number) with the other two. Two cards were identical in terms of color, size, shape, and number, or dimensions, while the other two cards were identical on all four dimensions but differed from the first set of cards. For example, children were shown a card with one medium orange pair of socks, three medium orange pairs of socks, and three small orange pairs of socks, and the test item (i.e., three medium orange pairs of socks) was placed in the center position. Children are asked to identify two things that go together in one way (abstraction) and, afterward, two things that go together, but in a different way (flexible thinking). They used the cues on each dimension to decide how to match the pictures.

All children were administered 6 trials and 6 tests for each flexible thinking and abstraction abilities. In the current study, FIST overall scores consider only the 6 tests scores for each cognitive ability. Scores were also calculated for abstraction and flexibility separately. FIST Abstraction scores vary from 0 to 6 and refer only to test questions addressing abstraction skills. FIST Flexibility scores vary from 0 to 6 and refer specifically to test questions addressing flexible thinking skills. FIST overall raw score can range between 0 and 12. Each question response was rated 0 for "incorrect" and 1 for "correct". Therefore, the average score for this scale ranges between 0 and 1. In this study analyses were performed utilized average score. Cronbach's alpha for FIST overall scores was .84, .85 for FIST Abstraction, and .74 for FIST Flexibility. This indicates the measures have good to acceptable internal consistencies.

Conceptual Perspective Taking (CPT; Taylor, 1988)

The Conceptual Perspective Taking (Taylor, 1988) assesses children's ability to differentiate between what is seen and what is known. This ability is thought to progress through two stages, or levels. According to Taylor (1988), children at Level 1 equate seeing with knowing. They believe that if someone else sees what they see, then that other party also knows what they, the child, knows. At Level 2, children understand that two people can see something and not necessarily have equivalent knowledge of that particular thing.

In the data utilized in the current study, children were submitted to one set of 5 trials (i.e., questions about a bear figure) and 7 tests (i.e., 5 questions about a turtle figure and 2 questions about a cat/dog figure). Before administering each task, the assessor made sure the children could both produce and recognize, from his or her point of view. The trial consisted in presenting children an animal card (e.g., a bear) and asking them what animal that was, to point to the animals' head and feet, and putting the animal right side up and upside down. Following this trial, the first task showed a turtle card and asked the child if, from her perspective, the turtle was standing on his feet or lying on his back. After that, the child was asked if, from the assessor's perspective, the turtle was standing on his feet or lying on his back. The second task showed a card with a cat on one side and a dog on the other. The card was placed flat on a table one at a

time alternating whether they were right side up to the child or assessor. The child was then asked what animal he/she sees and what animal the assessor sees.

Items were coded 1 for correct and 0 for incorrect. The questions concerning if the child could accurately express how the experimenter views the cards were added together to create the total sum score. There total possible score considering only the tests, not the trials, is 7. Higher scores represent better perspective taking skills.

Social Skills Improvement System (SSIS; Gresham & Elliott, 2008)

The Social Skills Improvement System (SSIS; Gresham & Elliott, 2008) is a teacher report measure about children's social and emotional development. This measure is comprised of three scales and 83 items in total. The Social Skills scale has 46 items organized into seven subscales: communication, cooperation, assertion, responsibility, empathy, engagement, and self-control. The Problem Behavior scale has 30 items utilized to measure externalizing and internalizing behavior. The Academic Competence scale has 5 items. In the current study, only the Social Skills and the Problem Behavior scales are utilized.

This tool requires that teachers rate how often a child exhibits a specific behavior on a scale from 0 (never) to 3 (almost always). Examples of items measuring social skills include behaviors of cooperation among peers, demonstrating empathy, sharing classroom materials, and following rules. Items measuring externalizing behaviors include aggression and anger, whereas internalizing behaviors include anxiety and nervousness.

Scores for the Social Skills and Problem Behavior scales are created by summing up subscales scores. Each subscale score is calculated based on the average of its items scores, which range from 0 to 3. Therefore, subscales scores range from 0 to 3. Therefore, the Social Skills scale total score ranges from 0 to 21, and the Problem Behavior scale total score rages from 0 to 6. Higher scores on the Social Skills scale means children show higher levels of social skills, and high scores on the Problem Behavior scale means children demonstrate higher levels of problem behaviors. Internal consistencies were .96 for Social Skills and .92 for Problem Behaviors.

CHAPTER V: RESULTS

PRELIMINARY ANALYSES

All data analyses were conducted using the Statistical Package for the Social Sciences (SPSS) software v. 27 (Armon, NY, IBM Corp). The independent variables analyzed in this study were indoor (i.e., ECERS-R total score) and outdoor (i.e., POEMS total score) quality, as well as the number of natural elements outdoors (i.e., Natural Elements subscale). The dependent variables were children's cognitive (i.e., FIST overall score, FIST Abstraction, and FIST Flexibility) and social outcomes (i.e., CPT and SSIS Social Skills and Problems Behaviors subscales scores). Data on children's age, sex, and the amount of time they spent in childcare per week were utilized as control variables. All variables were checked for normality, ranges, skewness, kurtosis, and outlier observations. Data were normally distributed.

Descriptive and frequency analyses were run to examine demographic characteristics, program variables, and child variables. Table 1 shows descriptive statistics of quality measures analyzed in this study. Among the 92 preschools included, ECERS-R total scores ranged from 2.88 to 6.07 with a mean of 4.6 (*SD* = 0.77). POEMS total scores ranged from 15 to 48 with a mean of 31.27 (*SD* = 7.03). Scorings on the Natural Elements Subscale ranged from 1 to 18 with a mean of 6.16 (SD = 3.3). The time spent outdoors during POEMS data collection observation ranged from 12 to 60 minutes with a mean of 32 minutes (*SD* = 8.1).

Table 1. Descriptives Statistics of Quality Measures

Quality measure	N	Possible Range	Min.	Max.	Mean	*SD*
ECERS-R	92	1-7	2.88	6.07	4.6	0.77
POEMS total score	92	0-56	15	48	31.27	7.03
Natural Elements Subscale	92	0-26	1	18	6.16	3.3

Table 2 displays the descriptive results for the child measures. Children's mean scores on both the Flexible Item Selection Task (FIST; Jacques & Zelazo, 2001) and Conceptual Perspective Taking (CPT; Taylor, 1988) range from 0 to 1. Children means in these tests were respectively .408 (*SD* = .283) and .685 (*SD* = .202). Half of the FIST (i.e., six questions) measured abstraction and the other half assessed flexibility. Children had higher means (*M* = .639) on

questions specifically addressing abstraction (*SD* = .381) when compared to questions related to flexible thinking (*M* = .187, *SD* = .270). In the Social Skills subscale, children's scores ranged from .29 to 2.89 with a mean of 1.84 (*SD* = .476). In the Problem Behaviors subscale, scores ranged from 0 to 1.93 with mean of .692 (*SD* = .401). Lower scores on the Problem Behaviors subscale indicate fewer problem behaviors as rated by the child's teacher.

Table 2. Descriptives Statistics of Child Measures

Measure	N	Possible Range	Min.	Max.	Mean	*SD*
FIST overall score	250	0-1	0	1	.408	.283
FIST Abstraction	246	0-1	0	1	.639	.381
FIST Flexibility	240	0-1	0	1	.187	.270
CPT	337	0-1	0	1	.685	.202
Social Skills	388	0-3	.29	2.89	1.84	.476
Problem Behaviors	388	0-3	0	1.93	.692	.401

QUALITY MEASURES AND CHILD OUTCOMES CORRELATIONS

To answer the first research question —whether quality of outdoor learning environments, as measured with the POEMS total score, was associated with a global measure of childcare quality measured with ECERS-R total score—a Pearson correlation analysis was performed. Along with that, a series of zero-order correlations were run to verify relationships between quality measures, child outcomes, child-level covariates (i.e., age, sex, time in childcare), time outdoors, and teachers' education.

As showed in Table 3, there was a positive significant correlation between POEMS total scores and ECERS-R total scores (r = .426; p <.01). This result implies that programs with higher levels of classroom global quality also tended to have higher outdoor quality environments. The ECERS-R was not significantly correlated with any of child's measurements. ECERS-R total scores only showed a positive significant correlation with POEMS total scores and a positive significant association with time outdoors on the POEMS data collection day (r = .295; p <.05). POEMS total scores were positively associated with the FIST overall scores (r = .169; p <.05), FIST Abstraction (r = .295; p <.05), FIST Flexibility (r = .295; p <.05), and the CPT (r = .113; p <.05), and negatively correlated with Problem Behaviors (r = -.112; p <.05). The ratings of Social Skills were not associated with the POEMS total score. The Natural Elements subscale

showed a negative significant association with Problem Behaviors (r = -.104; p <.05) but not with other child outcomes.

Regarding the child covariates, age was significantly correlated with scores on the FIST (r = .347; p <.01), FIST Abstraction (r = .249; p <.05), FIST Flexibility (r = .321; p <.01), and the CPT (r = .325; p <.01), but not on Social Skills (r = .170) or Problem Behaviors (r = .009). In contrast, children's sex was not correlated with the FIST and CPT, but it was significantly associated with Social Skills (r = -.262; p <.01) and Problem Behaviors (r = .222; p <.01). Time spent in childcare per week did not show any association with children's outcomes.

Table 3. Correlations Between Quality Measures, Child Outcomes, and Covariates

Variables	1	2	3	4	5	6	7	8	9	10	11	12	13	14
1. ECERS-R	-													
2. POEMS	.426**	-												
3. Natural Elements Subscale	.173	.437**	-											
4. FIST overall score	-.097	.169**	.011	-										
5. FIST Abstraction	-.070	.152*	.001	.898**	-									
6. FIST Flexibility	-.109	.141*	-.015	.787**	.426**	-								
7. CPT	.022	.113*	-.032	.294**	.282**	.182**	-							
8. Social Skills	.036	.021	.066	.245**	.272**	.111	.237**	-						
9. Problem behavior	-.029	-.112*	-.104*	-.087	-.073	-.071	-.110*	-.568**	-					
10. Age	-.024	.126*	.114*	.347**	.249**	.321**	.325**	.170	.009	-				
11. Sex	.038	-.005	-.065	-.003	-.042	.052	-.061	-.262**	.222**	.064	-			
12. Time in childcare per week	-.079	-.108*	-.080	-.087	-.089	-.027	.037	-.032	.083	-.074	-.053	-		
13. Time outdoor (on the observation day)	.295**	.104	.116	.004	.004	.003	-.136*	-.049	-.043	-.113*	-.036	-.123*	-	
14. Teacher education	.162	-.080	.060	-.047	-.023	-.059	.029	.075	-.061	.132*	-.036	-.123*	-.083	-

*$p < .05$. **$p < .01$.

MULTILEVEL MODELS

In order to test research questions 2 and 3— respectively whether POEMS total scores predicted children's cognitive (i.e., FIST overall score, FIST Abstraction, and FIST Flexibility) and social outcomes (i.e., CPT, Social Skills, and Problem Behaviors); and if programs' outdoor environments with more natural elements were associated with children's cognitive and social outcomes—a multilevel analysis was performed. A multilevel model approach is adequate in the current investigation because it considers dependencies accounted by nested data, such as children within classrooms (Heck et al., 2014). Child-level predictors are treated in Level 1 and classroom level predictors are treated as Level 2. To examine variance in child outcomes, contextual characteristics of age, sex, and time spent in childcare per week were considered at the child-level. Environmental quality (i.e., as measured by the ECERS-R and POEMS total scores) and the extent to which childcare outdoor environments have less or more natural elements (i.e., Natural Elements subscale) were included as classroom-level variables.

UNCONDITIONAL MODEL

Following Field's (2009) approach to multilevel analysis, an unconditional model was first tested utilizing restricted maximum likelihood estimation to examine how much variance in the dependent variables (i.e., FIST, CPT, Social Skills, and Problem Behaviors scores) could be explained by within and between classroom differences. This model, also referred as a null or no predictors model, is a typical first step in multilevel modeling used to determine whether there is evidence of clustering in the data with respect to the dependent variable, which might lead to biases in the parameter estimates and standard errors (Heck et al., 2014). Therefore, it indicates the extent to which dependent variables variation lies within Level 2 units (i.e., between group) through an intraclass correlation. The equation tested in this model reads as follows:

$$y_{ij} = \gamma_{00} + \mu_{0j} + \varepsilon_{ij}$$

$$Social\ Skills_{ij} = \gamma_{00} + \mu_{0j} + \varepsilon_{ij}$$

Where y_{ij} stands for the outcome variable (e.g., Social Skills) for a child "i" in classroom "j", γ_{00} stands for the classroom level intercepts, μ_{0j} stands for the Level 2 residual (which is the difference between a classroom's intercept and the grand mean of the intercepts), and ε_{ij} represents the Level 1 residual (which is the difference between each child "i" in classroom "j" individual scores and its classroom predicted scores).

Results indicated that classroom variance accounted for differences in children's scores in the FIST overall scores (ICC = .30), FIST Abstraction (ICC = .37), FIST Flexibility (ICC = .15), CPT (ICC = .15), Social Skills (ICC = .18), and Problem Behaviors (ICC = .24). These intraclass correlation values indicate that a considerable portion of the variance in child outcomes is attributed to between-classroom differences, providing evidence that justifies the use of a multilevel modeling approach.

CONDITIONAL MODELS

Addition of Covariates

A random intercept model using restricted maximum likelihood estimation was run with the child-level covariates (i.e., age, sex, and time spent in childcare per week) specified as fixed-effects. Child age and time spent in childcare were centered around the grand mean—providing these variables a baseline starting from 0 but maintaining the original standard deviation—as suggested by Anderson (2012) and Enders and Tofighi (2007). This improves the interpretability of intercepts and variances of the multilevel models. In this model, there are two equations at work, a between-groups intercept equation—tested solely in the null model—and a within-group (i.e., individual-level) equation. The equation for this mixed-effects (i.e., a random intercept and fixed effects at Level 1) model reads as follows:

$$\gamma_{ij} = \gamma_{00} + \gamma_{10}Age_{ij} + \gamma_{20}Sex_{ij} + \gamma_{30}TimeChildcare_{ij} + \mu_{0j} + \varepsilon_{ij}$$

$$Social\ Skills_{ij} = \gamma_{00} + \gamma_{10}Age_{ij} + \gamma_{20}Sex_{ij} + \gamma_{30}TimeChildcare_{ij} + \mu_{0j} + \varepsilon_{ij}$$

In this model, y_{ij} stands for the outcome variable (e.g., Social Skills) for a child "i" in classroom "j", γ_{00} stands for the classroom level intercepts, $\gamma_{10}Age_{ij}$ stands for the intercept of age, $\gamma_{20}Sex_{ij}$ of sex, and $\gamma_{30}TimeChildcare_{ij}$ of time spent in childcare per week. Lastly, μ_{0j} stands for the Level 2 residual and ε_{ij} represents the Level 1 residual.

Addition of Predictors

To the random intercept and fixed Level 1 predictors, classroom level predictors were added as fixed effects. These include ECERS-R and POEMS total scores. To answer the third question asked in this investigation—whether outdoors environments with more natural elements predicted higher scores on children's cognitive and social outcomes—a Model 3 considering only the Natural Elements subscale as the classroom level predictor was computed separately. Therefore, Models 2 and 3 comprised of a random intercept with fixed effects at Level 1 and Level 2 predictors. The equations for Models 2 and 3 read respectively as follows:

$$\gamma_{ij} = \gamma_{00} + \gamma_{01}ECERS + \gamma_{02}POEMS + \gamma_{10}Age_{ij} + \gamma_{20}Sex_{ij} + \gamma_{30}TimeChildcare_{ij} + \mu_{0j} + \varepsilon_{ij}$$

$$\gamma_{ij} = \gamma_{00} + \gamma_{01}NaturalElements + \gamma_{10}Age_{ij} + \gamma_{20}Sex_{ij} + \gamma_{30}TimeChildcare_{ij} + \mu_{0j} \quad + \varepsilon_{ij}$$

Where $\gamma_{01}ECERS$ stands for the intercept of ECERS-R total scores, $\gamma_{02}POEMS$ stands for the intercept of POEMS scores, and $\gamma_{01}NaturalElements$ represents the intercept of the Natural Elements subscale scores.

RESULTS OF THE CONDITIONAL MODELS

FIST Overall Score

Main effects of the conditional Models 1, 2 and 3 are reported for children's overall scores on the FIST in Table 4. As indicated by the unconditional model intraclass correlation, 30% of differences in children's FIST overall scores occurs between classrooms, which was indicated as a significant portion of the variance (*Est* = .024; S.E. = .006; p <.001). Model 1 included child-level covariates of age, sex, and time spent in childcare per week. Only age was a significant

predictor of FIST overall scores (*B* = .010; S.E. = .002; *p* <.001). The positive estimate suggests older children tend to have higher scores on this test. Additionally, the random intercept representing variations across classrooms (i.e., between group) reduced its significance (*Est* = .009; S.E. = .005; *p* = .056) when compared to the null model. The intraclass correlation for Model 1 indicated that now only 14.3% of variance on children's FIST overall scores lied between classrooms.

Model 2 included ECERS-R and POEMS total scores as classroom level predictors. Children's age remained a strong significant predictor of FIST overall scores (*B* = .010; S.E. = .002; *p* = .000), followed by POEMS total scores (*B* = .003; S.E. = .002; *p* = .047) and ECERS-R total scores (*B* = -.050; S.E. = .030; *p* = .076). At Model 3, including solely the Natural Elements subscale as a classroom level predictor, children's age is the only predictor of FIST overall scores. The intraclass correlation for Model 2 showed that 14% of the variance on children's FIST overall scores still occurred between classrooms. This indicates that, even though POEMS and ECERS-R total scores showed as significant predictors of FIST overall scores at *p*-levels of <.05 and <.1, respectively, 14% of the variance in children's individual FIST scores still exists between classrooms.

Table 4. Multilevel Regression Estimates for Main Effects of Level 1 Covariates and Level 2 Predictors on FIST Overall Scores

	Null model			Model 1			Model 2			Model 3		
Fixed Effects				*B*	S.E.	*p*	*B*	S.E.	*p*	*B*	S.E.	*p*
Level 1												
Age				.010	.002	<.001***	.010	.002	.000***	.010	.002	.000***
Sex				-.350	.033	.293	-.033	.033	.316	-.035	.002	.286
Time in childcare				-.002	.002	.297	-.002	.002	.328	-.002	.002	.294
Level 2												
ECERS-R							-.050	.030	.076^{+}	-	-	-
POEMS							.003	.002	.047*	-	-	-
Natural Elements subscale										-.001	.006	.806
Random Effects	Est.	S.E.	*p*	Est.	S.E.	*p*	Est.	S.E.	*p*	Est.	S.E.	*p*
Intercept	.024	.006	<.001***	.009	.005	.056^{+}	.009	.004	.059^{+}	.009	.005	.053^{+}

$^{+}$ p < 0.1 *p < 0.05. **p < 0.01 ***p < 0.001

FIST Abstraction

Main effects of the conditional Models 1, 2 and 3 are reported for children's scores on the FIST Abstraction in Table 5. According to the unconditional model intraclass correlation, 37% of variance in children's FIST Abstraction scores lied between classrooms. Model 1 included child-level covariates of age, sex, and time spent in childcare per week. Only age showed as a significant predictor of FIST Abstraction scores (B = .010; S.E. = .003; p = .003). Even though according to the intraclass correlation for Model 1 the remaining variance lying between classrooms dropped to 26.5%, the random intercept remained significant (*Est* = .035; S.E. = .012; p = .004), suggesting that still a significant portion of variance occurs between classrooms.

Models 2 and 3 included classroom level variables. Age remained the strongest predictor in both, but POEMS total scores showed as a significant predictor of children's FIST Abstraction scores considering p <.1 (B = .009; S.E. = .004; p = .069). ECERS-R total scores and the Natural Elements subscale were not predictive of children's FIST Abstraction scores. Intraclass correlations for Models 2 and 3 showed respectively that 25.9% and 26.6% of the variance in this outcome still occurred between classrooms. This indicates that even though classroom level predictors were included in the model, there is still a significant portion of the variance explained by classroom clustering (*Est* = .034; S.E. = .011; p = .004).

Table 5. Multilevel Regression Estimates for Main Effects of Level 1 Covariates and Level 2 Predictors on FIST Abstraction Scores

	Null model			Model 1			Model 2			Model 3		
Fixed Effects				*B*	S.E.	*p*	*B*	S.E.	*p*	*B*	S.E.	*p*
Level 1												
Age				.010	.003	.003**	.009	.003	.005**	.010	.003	.003**
Sex				-.068	.044	.125	-.065	.044	.147	-.071	.044	.113
Time in childcare				-.003	.003	.237	-.003	.004	.265	-.003	.003	.232
Level 2												
ECERS-R							-.073	.045	.109	-	-	-
POEMS							.009	.004	.069^{+}	-	-	-
Natural Elements subscale										-.005	.009	.539
Random Effects	Est.	S.E.	*p*	Est.	S.E.	*p*	Est.	S.E.	*p*	Est.	S.E.	*p*
Intercept	.053	.013	<.001***	.035	.012	.004**	.034	.011	.004**	.035	.012	.004**

$^{+}$ p < 0.1 *p < 0.05. **p < 0.01 ***p < 0.001

FIST Flexibility

Main effects of the conditional Models 1, 2 and 3 are reported for children's scores on the FIST Flexibility in Table 6. Intraclass correlation calculated in the null model indicated that 15% of differences in children's FIST Flexibility scores lied between classrooms. In Model 1, child-level covariates of age, sex, and time spent in childcare per week were added. Only age was a significant predictor of FIST Flexibility scores (B = .009; S.E. = .002; p <.001). The ICC calculated for this model revealed that now only 2.9% of variance in children's FIST Flexibility scores were explained by classroom clustering. The random intercept in Model 1 also lost significance (*Est* = .001; S.E. = .003; p = .640).

The inclusion of classroom level variables in Models 2 and 3 showed that neither of the quality measures were significant predictors of FIST Flexibility scores, or the Natural Elements subscale. The intraclass correlation in both models showed that a small portion—respectively 2.9% and 3.4%—of the variance was explained by classroom clustering and both random intercepts lost significance.

Table 6. Multilevel Regression Estimates for Main Effects of Level 1 Covariates and Level 2 Predictors on FIST Flexibility Scores

	Null model			Model 1			Model 2			Model 3		
Fixed Effects				*B*	S.E.	*p*	*B*	S.E.	*p*	*B*	S.E.	*p*
Level 1												
Age				.009	.002	<.001***	.009	.002	.000***	.009	.002	.000***
Sex				-.001	.033	.967	-.001	.033	.970	-.0005	.033	.987
Time in childcare				-.0002	.002	.896	-.0002	.002	.901	-.000	.002	.896
Level 2												
ECERS-R							-.037	.026	.165	-	-	-
POEMS							.003	.002	.198	-	-	-
Natural Elements subscale										.0007	.005	.889
Random Effects	Est.	S.E.	*p*	Est.	S.E.	*p*	Est.	S.E.	*p*	Est.	S.E.	*p*
Intercept	.010	.004	.027*	.001	.003	.640	.001	.003	.642	.002	.003	.535

$^{+}$ p < 0.1 *p < 0.05. **p < 0.01 ***p < 0.001

Conceptual Perspective Taking

Main effects of the conditional Models 1, 2, and 3 are reported for children's scores on the CPT task in Table 7. According to the null model intraclass correlation, 15% of the difference in children's CPT scores lied between classrooms. Model 1 included child-level covariates of age, sex, and time spent in childcare per week. Age (B = .008; S.E. = .001; p <.001) and sex (B = -0.51; S.E. = .020; p = .013) were significant predictors of children's conceptual perspective taking scores. The negative estimate for sex indicates that girls (coded as 0) tended to score higher on the CPT task as compared to boys (coded as 1). The intraclass correlation for Model 1 indicated that, by adding child-level covariates, the variance on CPT scores occurring between classrooms dropped to 6%. The random intercept in Model 1 also lost significance (*Est* = .002; S.E. = .002; p = .275).

In Model 2, ECERS-R and POEMS total scores were included as classroom level predictors. Children's age (B = .008; S.E. = .001; p = .000) and sex (B = -0.50; S.E. = .020; p = .015) continued to be the only two significant predictors of children's scores on the CPT task. None of the quality measures significantly predicted scores on this test, or the Natural Elements subscale, as shown in Model 3. The intraclass correlation for Model 2 indicated that only 8.1% of the difference between children's CPT scores lied between classrooms. As compared with Model 1, the inclusion of Level 2 predictors did not manage to account for variation in the between classroom intercepts. The random intercepts in both models remained non-significant indicating that the portion of variance lying between classrooms is not significant anymore as compared to the null model.

Table 7. Multilevel Regression Estimates for Main Effects of Level 1 Covariates and Level 2 Predictors on CPT Scores

	Null model			Model 1			Model 2			Model 3		
Fixed Effects				*B*	S.E.	*p*	*B*	S.E.	*p*	*B*	S.E.	*p*
Level 1												
Age				.008	.001	<.001***	.008	.001	.000***	.008	.001	.000***
Sex				-.051	.020	.013*	-.050	.020	.015*	-.053	.020	.010*
Time in childcare				-.0001	.001	.900	-.000	.001	.980	-.0003	.001	.816
Level 2												
ECERS-R							-.008	.017	.603	-	-	-
POEMS							.002	.001	.289	-	-	-
Natural Elements subscale										-.004	.003	.248
Random Effects	Est.	S.E.	*p*	Est.	S.E.	*p*	Est.	S.E.	*p*	Est.	S.E.	*p*
Intercept	.006	.002	.017*	.002	.002	.275	.002	.002	.194	.002	.002	.300

$^{+}$ p < 0.1 *p < 0.05. **p < 0.01 ***p < 0.001

Social Skills

Main effects of the conditional Models 1, 2, and 3 for children's scores on Social Skills are displayed in Table 8. The null model indicated that 18% of differences between children's scores on Social Skills were accounted for between-classroom variation. Model 1 included child-level covariates of age, sex, and time spent in the childcare per week. Age (B = 0.13; S.E. = .003; p <.001) and sex (B = -.249; S.E. = .045; p <.001) were equally significant predictors of children's Social Skill scores. The negative estimate for sex indicates that girls (coded as 0) tended to have significantly higher scores on Social Skills than boys (coded as 1). Nevertheless, the random intercept accounting for between classrooms variance remained significant (*Est* = 0.43; S.E. = .013; p = .001). The intraclass correlation for Model 1 indicated that 20.6% of the variance in Social Skills scores occurred between classrooms. As compared to the null model, the ICC increased more than 2%. This suggests that, even though age and sex showed as significant predictors of children's Social Skills scores, they did not manage to account for some variance between classrooms.

In Model 2, ECERS-R and POEMS total scores were included as classroom level predictors. Age (B = 0.13; S.E. = .003; p = .000) and sex (B = -.251; S.E. = .045; p = .000) continued to be significant predictors of Social Skills scores, whereas none of the quality measures significantly predicted children's scores on this outcome. As in Model 1, the random intercept remained significant (*Est* = 0.44; S.E. = .013; p = .001) and the intraclass correlation increased to 21.3%. This means that a significant portion of variance in children's Social Skills scores still lies between classrooms. Model 3 showed that the Natural Elements subscale also does not predict children's outcomes on the conceptual perspective taking task.

Table 8. Multilevel Regression Estimates for Main Effects of Level 1 Covariates and Level 2 Predictors on Social Skills Scores

	Null model			**Model 1**			**Model 2**			**Model 3**		
Fixed Effects				*B*	S.E.	*p*	*B*	S.E.	*p*	*B*	S.E.	*p*
Level 1												
Age				.013	.003	<.001***	.013	.003	.000***	.013	.003	.000***
Sex				-.249	.045	<.001***	-.251	.045	.000***	-.248	.045	.000***
Time in childcare				-.002	.002	.331	-.002	.002	.336	-.002	.002	.332
Level 2												
ECERS-R							.035	.046	.439	-	-	-
POEMS							-.002	.005	.656	-	-	-
Natural Elements subscale										.0003	.009	.974
Random Effects	Est.	S.E.	*p*	Est.	S.E.	*p*	Est.	S.E.	*p*	Est.	S.E.	*p*
Intercept	.042	.013	.001**	.043	.013	.001**	.044	.013	.001**	.044	.013	.001**

$^{+}$ p < 0.1 *p < 0.05. **p < 0.01 ***p < 0.001

Problem Behaviors

Main effects of Models 1, 2, and 3 for children's Problem Behaviors scores are reported in Table 9. As indicated by the unconditional model intraclass correlation, 24% of differences in Problem Behaviors outcomes lied between classrooms. Model 1 included child-level covariates of age, sex, and time spent in the childcare per week. In comparison to the other child outcomes, sex (*B* = .158; S.E. = .038; *p* <.001), but not age (*B* = -.0001; S.E. = .002; *p* = .970), was the strongest significant predictor of scores on Problem Behavior. The positive estimate indicates that boys (coded as 1) tended to have higher scores on Problem Behaviors when compared to girls (coded as 0). Moreover, for this child outcome, time in childcare per week showed a significant predictor at *p*-level <.1 (*B* = .004; S.E. = .002; *p* = .067). Even so, the random intercept continued to be significant (*Est* = .037; S.E. = .010; *p* <.001) and the interclass correlation remained at 24%. This suggests that sex and time in childcare were significant Level 1 predictors of children's Problem Behaviors scores but did not account for some of the variation lying between classrooms.

In Models 2 and 3, classroom level predictors were entered. None of them significantly predicted scores on Problem Behaviors. Sex remained the strongest predictor explaining variation on this outcome (*B* = .157; S.E. = .038; *p* = .000), followed by time in childcare per week (*B* = .004; S.E. = .002; *p* = .082). The random intercept in Model 2 continued to be significant (*Est* = .038; S.E. = .010; *p* = .000) even though the ICC dropped to 18.6%. These two pieces of evidence indicate that there is still a significant proportion of variation in Problem Behaviors scores that lies between groups and it is not being captured by Level 2 predictors—ECERS-R, POEMS, and the Natural Elements subscale.

Table 9. Multilevel Regression Estimates for Main Effects of Level 1 Covariates and Level 2 Predictors on Problem Behaviors Scores

	Null model			Model 1			Model 2			Model 3		
Fixed Effects				*B*	S.E.	*p*	*B*	S.E.	*p*	*B*	S.E.	*p*
Level 1												
Age				-.0001	.002	.970	.000	.002	.934	.000	.002	.926
Sex				.158	.038	<.001***	.157	.038	.000***	.155	.038	.000***
Time in childcare				.004	.002	.067^{+}	.004	.002	.082^{+}	.004	.002	.075^{+}
Level 2												
ECERS-R							.003	.040	.923	-	-	-
POEMS							-.004	.004	.316	-	-	-
Natural Elements subscale										-.008	.008	.331
Random Effects	Est.	S.E.	*p*	Est.	S.E.	*p*	Est.	S.E.	*p*	Est.	S.E.	*p*
Intercept	.038	.010	<.001***	.037	.010	<.001***	.038	.010	.000***	.037	.010	.000***

$^{+}$ p < 0.1 *p < 0.05. **p < 0.01 ***p < 0.001

These results supported confirming part of the research questions raised in this study. The first asked whether classroom level global quality, as measured by ECERS-R total scores, was correlated with outdoor quality, measured with POEMS total scores. This question was confirmed as ECERS-R total scores showed a positive significant correlation with POEMS total scores. The second and third questions addressed if childcare outdoor quality and those in which more natural elements were present predicted above and beyond classroom level global quality children's cognitive and social outcomes. The results partially confirmed these questions as POEMS total scores only significantly predicted children's FIST overall and FIST Abstraction scores. The following section provides a summary of the results and ideas about how these findings make sense within the three theoretical frameworks and past empirical research.

CHAPTER VI: DISCUSSION

SUMMARY OF RESULTS

The overall aim of this study was to understand the extent to which the quality of childcare outdoor learning environments may contribute to young children's cognitive and social skills above and beyond classroom level global quality. Children's scores on the FIST assessment of executive functioning served as a measure of cognitive outcome, while preschoolers' social skills were measured in terms of conceptual perspective taking by the CPT task, and the SSIS Social Skills and Problem Behaviors subscales. In this section, results are reviewed and further discussed in relation to the theoretical frameworks and recent literature reviewed.

The first research question was addressed with a Pearson correlation analysis showing a positive significant association between ECERS-R and POEMS scores. Zero-order correlations exploring relationships among classroom quality, child outcomes, and covariates revealed that ECERS-R total scores were not correlated with any of child outcomes analyzed. Beyond the association with POEMS total scores, ECERS-R total scores were correlated with time spent outdoors during the POEMS data collection day. Interestingly, POEMS total scores showed positive significant correlations with the FIST overall scores, FIST Abstraction, FIST Flexibility, and the CPT, and a negative association with Problem Behavior. In addition, the Natural Elements subscale showed a negative correlation with Problem Behaviors. Children's age showed positive significant associations with children's scores on the FIST overall scores, FIST Abstraction, FIST Flexibility, and CPT. In contrast, sex showed a negative significant correlation with Social Skills, and a positive significant association with Problem Behaviors scores. This indicates girls (coded as 0) were rated higher than boys (coded as 1) in the Social Skills subscale, whereas boys were rated higher in the Problem Behaviors subscale when compared to girls.

The results from all unconditional models, a first step when conducting a multilevel analysis, revealed that a significant proportion of all child variables analyzed lied between classrooms, warranting further multilevel models. Intraclass correlation indicated that the proportion of variance lying between classrooms varied between 15% (FIST Flexibility and CPT scores) to

37% (FIST Abstraction scores). The inclusion of child-level covariates in Model 1 showed that age was a significant predictor of children's FIST overall scores, FIST Abstraction, FIST Flexibility, CPT, and Social Skills scores but not Problem Behaviors. Sex was a significant predictor of children's CPT scores and the strongest predictor of Problem Behaviors scores. Time spent in childcare was a significant predictor of children's Problem Behaviors scores at p <.1. Moreover, the inclusion of child covariates as predictors in Model 1 reduced the significance of the random intercept—which accounts for the proportion of variance occurring between-groups—in the FIST overall scores, FIST Abstraction, FIST Flexibility, and CPT models. In Models 1 for Social Skills and Problem Behaviors, the inclusion of child-level variables did not reduce the significance of the random intercept.

Results from Model 2 indicated that the inclusion of quality measures to explain differences in child outcomes was only significant for FIST overall scores and FIST Abstraction. POEMS total scores were more significant than ECERS-R total scores in predicting children's scores on FIST overall, and it was the only quality measure significantly predicting FIST Abstraction scores considering p <.1. Results from Model 3 indicated that the Natural Elements subscale did not predict any of the child outcomes analyzed. In Models 3 for FIST overall scores, FIST Abstraction, and FIST Flexibility scores, age remained the only significant predictor. In Model 3 for Social Skills scores, age and sex were equally significant predictors, and for Problem Behaviors, sex was the strongest predictor followed by time spent in childcare per week at p <.1.

Overall, the results found in the multilevel analysis are consistent with zero-order correlations observed among quality measures, child outcomes, and covariates, in which (1) age was associated with children's scores on the FIST overall, FIST Abstraction, FIST Flexibility, and CPT; (2) sex was correlated with Social Skills and Problem Behaviors scores; (3) POEMS showed significant correlations with FIST overall scores, FIST Abstraction, FIST Flexibility, CPT, and Problem Behaviors; and (4) ECERS-R total scores did not show any correlation with child outcomes analyzed in this study.

The first question addressed in this investigation explored the association between quality of outdoor learning environments, as measured by the POEMS total score, and classroom global quality, measured by ECERS-R total score. This Pearson correlation analysis confirmed hypothesis 1 by indicating a positive moderate significant correlation existed between the ECERS-R and POEMS total scores. This implies that programs with higher levels of classroom global quality also tend to have higher outdoor quality environments. The moderate level of the correlation indicates an association but not high levels of redundancy between the two measures of quality. In other words, a moderate correlation indicates that POEMS measures unique aspects of outdoor environments in childcare that differ from aspects of indoor environments as measured by the ECERS-R. This is an important finding because it shows outdoor environments are unique and, therefore, merit study as a separate construct of quality.

In the same vein, the worthiness of studying with greater detail childcare outdoor environments is also supported by the multilevel model results. The second research question of this study aimed to test if outdoor quality, as measured by POEMS total scores, predicted children's cognitive and social outcomes above and beyond classrooms' global levels of quality, measured with ECERS-R total scores. Multilevel analyses including age, sex, and time spent in childcare per week as child-level predictors, and POEMS total scores and ECERS-R total scores as classroom-level predictors, demonstrated that outdoor quality predicted children's FIST overall and FIST Abstraction scores above and beyond classrooms global levels of quality. This indicates outdoor quality has unique significant contributions to young children's executive functioning overall and abstraction specifically.

The reason why outdoor quality predicted children's cognitive outcomes may lie in the affordances of such environments. Mounting evidence has shown that higher levels of physical activity—especially those requiring vigorous aerobic exercises—is associated with positive cognitive outcomes for young children (Khan et al., 2020; Ludwig & Rauch, 2018; Becker et al., 2014). Studies have found that connecting pathways, fixed functional equipment (e.g., climbing towers, swings), and a playscape with diverse relief afford episodes of high physical activity

(Sando & Sandseter, 2020; Bjørgen, 2016). Along with that, these environments might afford more pretend and unstructured social play, as well as problem-solving situations in which young children can grow and exercise their executive function abilities of flexible thinking and abstraction (Zamzow & Ernst, 2020; Carr et al., 2017; Li et al., 2016). Investigations have shown that opportunities for different types of play (e.g., sociodramatic, parallel, solitary play) is associated with social skills outcomes (Li et al., 2016; Burriss & Burriss, 2011). This literature reveals how specific features of the outdoor environment can promote and enhance children's experiences of play and physical activity, which in turn may contribute to their developmental growth.

Another possible reason can be drawn based on Kaplan's (1995) Attention Restoration Theory (ART). This theory poses that natural environments have the potential to restore ones' attention by reducing mental fatigue. As demonstrated in previous studies, higher quality childcare settings tend to have more natural elements, such as sticks, leaves, trees, and gardens (Li et al., 2016) or to be more nature-like environments (Zamzow & Ernst, 2020). The presence of natural elements might change the type, complexity, and timing of children's play. For instance, Dowdell et al. (2011) indicated that children attending a program in which the outdoor environment had more natural elements engaged in more imaginative play—and play endured for longer periods of time—as compared to those playing in an outdoor area with less natural elements. Putting together these pieces of evidence coupled with ART theory, it is reasonable to speculate that one of the possible reasons explaining why outdoor environments of higher quality (i.e., as measured with POEMS total scores) predicted above and beyond classrooms global levels of quality (i.e., as measured with ECERS-R) children's FIST overall and FIST Abstraction scores relied on the provision of natural elements. As it relates specifically to the nature of this outcome and based on ART theory, it is possible to speculate that young children need greater levels of attention and focus to perform activities involving cognitive flexibility and abstraction. Outdoor environments of greater quality would provide more opportunities for children to restore their attention by offering them natural elements to play outdoors, which would enable them to be more focused and to perform better in tasks requiring flexible thinking and abstraction.

An important caveat in this discussion is that POEMS measures potential affordances, rather than actualized ones. As explained by Gibson (1979), potential affordances are those which exist in the environment even though individuals may have not yet perceived them. They have the potential to be realized as individuals interact, move, and manipulate the environment. This realization was termed within this theoretical framework as actualized affordances. POEMS has a greater number of items assessing the presence of specific objects, equipment, and design of outdoor environments in early childhood settings, which relates to the potential affordances children may find. This outdoor quality scale has fewer items measuring interactions between children and the outdoor environment (e.g., evidence of children manipulating natural loose parts, or climbing on an anchored piece of equipment), which would address affordances children actualize. In this sense, speculations about why outdoor quality predicted young children's executive functioning and abstraction outcomes can only be made in terms of potential affordances available. These might have led them to types of play and physical activity shown in the literature to enhance cognitive outcomes.

Even though multilevel models predicting children's cognitive flexibility, conceptual perspective taking, social skills, and problems behaviors outcomes did not indicate POEMS as a significant predictor, initial zero-correlations pointed to relevant clues. POEMS total scores, but not ECERS-R total scores, were positively associated with FIST overall scores, FIST Abstraction, FIST Flexibility, and the CPT, and negatively correlated with Problem Behaviors. This indicates that children participating in outdoor environments of higher quality score significantly higher on the FIST measure of executive functioning, the CPT measure of social perspective taking, and show significantly fewer problem behaviors. This is consistent with prior literature indicating that higher quality outdoor spaces offer children opportunities for unstructured play, which enables them to gain perspective-taking abilities (Burriss & Burriss, 2011) and grow executive functioning skills of working memory, flexible thinking, and inhibitory control (Zamzow & Ernst, 2020). Although small, these correlations may be a hint that in a larger study, which would provide greater statistical power, outdoor quality might show higher associations with children's outcomes and could possibly be observed as predictors in multilevel models.

The presence of natural elements might be a particular way in which childcare outdoor areas can differ from indoor environments, and uniquely contribute to children's developmental outcomes. The third research question aimed to test whether the presence of more natural elements in childcare outdoor environments predicted children's cognitive outcomes. Multilevel models utilizing the Natural Elements subscale as the only classroom-level predictor did not show evidence that outdoor areas with more natural elements predicted children's cognitive and social outcomes analyzed. Nevertheless, a negative association between the Natural Elements subscale and Problem Behaviors scores was found. This suggests that children attending programs in which the outdoor environment had more natural elements scored lower on the Problem Behaviors measure. There is a lack of research addressing the extent to which childcare outdoor levels of natural elements is related to differences in preschoolers' problem behaviors. Only one study reviewed indicated a positive relationship between a higher number of natural elements in childcare outdoor areas and children showing themselves to be more focused on play and calmer (Nedovic & Morrissey, 2013). This result may also be further explained by Kaplan's (1995) theory. Although ART specifically addresses the restoration of attention skills, this association might suggest that there is more to be uncovered about the influences of natural elements that goes beyond restoring one's attention. Ulset et al. (2017), for example, indicated that outdoor time in preschool protected against inattention and hyperactivity symptoms, which is a facet of problem behaviors (Gresham & Elliot, 2008). Ultimately, there is a need for more research addressing how and why different levels of natural elements in childcare outdoor environments may relate to positive or negative child outcomes.

Moreover, this finding might point to the need for constructing more refined measures addressing not only the number of natural elements, but also the types of observed interactions children have—and are allowed to—with them as a way to capture how and why natural elements may contribute to young children's developmental outcomes. As Gibson's (1979) Affordance theory suggests, it is important to understand if potential affordances are being actualized by children as a way to verify how natural elements may contribute to children's outcomes by promoting specific types of play and physical activity or changing the duration and complexity of such activities. Research has shown, for instance, that open-ended natural

materials (e.g., leaves, gardens, pinecones, trees) support more complex and longer sociodramatic play (Morrisey et al., 2017).

As it relates to non-significant estimates found between ECERS-R and child outcomes, previous studies have also verified a similar pattern (Hestenes et al., 2015; Brunsek et al., 2017). Others have also shown small effect sizes of this quality measure and child outcomes on cognitive development, language and social skills, and problem behaviors (Mayer & Beckh, 2016). Non-significant associations between ECERS-R and child outcomes are also in line with previous investigations that have not found associations between the ECERS-R and increases in child cognitive and social outcomes (Setodji et al., 2018), or indicated weak effects between this quality measure and children's language and positive behaviors outcomes (Brunsek et al., 2017).

The comparison of POEMS and ECERS-R in relation to children's cognitive and social outcomes evidenced groundbreaking findings to the study of outdoor environments quality as no other study found in the literature has compared the extent to which these two measures of quality predict young children's outcomes. First, in the models in which childcare environmental quality was a significant predictor of children's outcomes (i.e., FIST overall and FIST Abstraction scores), POEMS was more significant than ECERS-R. Along with that, POEMS was significantly correlated with all child outcomes measured in this study, except for social skills. This might indicate that in a larger study—hence, with greater statistical power—estimates in multilevel analysis may be significant. Moreover, the negative significant association found between the Natural Elements subscale and young children's Problem Behaviors scores not only points to the need to further investigate the contribution of outdoor environments for young children offering more natural elements to children's outcomes—either enhancing desirable developmental outcomes or buffering undesirable ones—but also to understand the reasons for this association. As discussed above, research and theories have not yet offered enough evidence and a framework to conceptualize and comprehend the means by which natural elements contribute to child outcomes. Therefore, it would be beneficial to have an outdoor quality measure that not only collects more information regarding the presence of natural elements, but also interactions children have with teachers, peers, and natural objects themselves. This would

support better understanding of the means by which the presence of natural elements might influence on children's activities outdoors and, thereby, their development.

CHILD PREDICTORS AND PROXIMAL PROCESSES OUTDOORS

Results from multilevel models and correlations pointed out that measures of outdoor environment quality in early childhood settings might be promising in understanding children's cognitive and social skills. However, the significance of the random intercepts in the multilevel models, even with the inclusion of child characteristics, might indicate the need for an outdoor quality measure that captures more of the interactions between children, teachers, and the outdoor environment itself. In this regard, Bronfenbrenner's bioecological theory supports understanding why this may be valuable.

The significance of the intercepts points to the extent to which differences in the outcomes of interest lie between classrooms. Intercepts in Models 1, which included only child-level variables (i.e., age, sex, and time spent in childcare per week), had a considerably drop in their significances for the CPT and FIST Flexibility scores. According to the intraclass correlations for these models, the variance on CPT scores occurring between classrooms dropped to 6%, while on FIST Flexibility scores reduced to 2.9%. Heck et al. (2014) suggested a 5% cutoff of evidence of substantial clustering. This indicates that the inclusion of Level 1 predictors managed to account for almost all the variation in CPT and FIST Flexibility scores between classrooms with respect to the random intercepts—in these cases, only age and sex were significant. Models 2 and 3 for the CPT and FIST Flexibility outcomes add support to these explanations as the random intercepts remained non-significant even with the inclusion of quality measures and the Natural Elements subscale, and child-level variables remained the only significant predictors. Therefore, it might suggest that as it relates specifically to cognitive operations of flexible thinking, as well as the social ability of conceptual perspective taking, children's individual characteristics of age and sex are better predictors of variation in these outcomes than environmental characteristics.

Even though numerous studies and theories (Erikson, 1963; Piaget, 1962; Vygotsky, 1978) show that play is an opportunity for children to take others' perspectives into account, differences in types of perspective taking might also shed light on speculations about this result. *Perceptual* perspective taking refers to inferences regarding another person's visual, auditory, or other perceptual experience, whereas *conceptual* perspective taking refers to inferences about other's internal experiences, such as thoughts, desires, attitudes, emotions, or plans (Marvin et al., 1976). Conceptual perspective taking might be more elaborate and might require more social experience than perceptual perspective taking. Therefore, during early childhood, this outcome might be more reliant on individual characteristics of age and sex as they relate to maturation processes and exposure to experiences in which one can learn conceptual perspective taking skills.

The literature lends support to interpret why age accounts for most of the variance in FIST Flexibility scores by pointing that flexibility is a cognitive operation that depends on other basic executive functioning processes (Jaques & Zelazo, 2001; Bennett & Muller, 2010). Flexibility requires a shifting ability that involves first acknowledging one similarity between features of objects (e.g., moon and orange have both a circle shape), and then another similarity relation (e.g., balloon floating in the air and a buoy floating in the water; see Bulloch & Opfer, 2009) in order to shift and select a pair based on a different rule from the first selection. Therefore, flexibility is a more complex cognitive operation and, because of that, might be more reliant on children's age as it relates to maturational processes and levels of exposure to opportunities of developing this skill. Children in this sample were relatively young and this might also have accounted for age to be a strong significant predictor.

In addition, zero-order correlations between child covariates and outcomes also support results observed in the multilevel models. Previous findings on preschoolers cognitive, social skills, and age (Szarkowicz, 1997; Jaques & Zelazo, 2001; Smidts et al., 2004) show that older children tended to have higher scores on the FIST and the CPT tasks. Nevertheless, in this study age was not associated with Social Skills or Problem Behaviors scores. Instead, sex showed a negative significant association with Social Skills, indicating that girls tended to score higher on this

outcome as compared to boys, and a positive significant correlation with Problem Behaviors, suggesting that boys had higher ratings on this subscale than girls.

Bronfenbrenner's bioecology theory highlights the importance of persons' characteristics in understanding developmental outcomes. The equation proposed by the PPCT model encompasses person characteristics, context, time, and proximal processes. Proximal processes are taken as the catalysts of developmental outcomes and are conceptualized as the types of interaction that occur consistently and get progressively more complex over time. In turn, "the form, power, content, and direction of proximal processes" (Bronfenbrenner & Morris, 2006, p. 798) vary as a joint function of person characteristics, context, and time. All these components mutually and synergistically contribute to change proximal processes and, thereby, influence on specific outcomes. For instance, research has shown children's play in outdoor environments with greater presence of natural elements tended to last longer periods of time, enhanced sociodramatic play and peer play interactions (Burgess & Ernst, 2020; Robertson et al., 2020). This is evidence of how specific contextual characteristics may change the type, complexity, and uninterrupted length of children's play. Play might also vary according to age and sex. For example, Miranda et al. (2017) showed that gender had a moderating effect on play involvement. Although girls tended to have lower frequency of group play as compared to boys, the greater the frequency of this type of play among girls, the higher they would score on the measure of positive play involvement. In this sense, the bioecological theory lends support to understand why there was a considerably drop in the random intercepts' significances for the CPT and FIST Flexibility scores as child-level characteristics were entered in the model, as well as to speculate that age and sex play a more significant role than contextual characteristics in explaining variability for these specific outcomes.

As it relates specifically to multilevel models run for Social Skills and Problem Behaviors outcomes, a greater portion of the variance lying between classrooms remained unexplained even after the inclusion of age and sex, shown as significant predictors. More interestingly, is the case of children's FIST Abstraction scores in which age was the strongest predictor and POEMS were shown to be a significant predictor at $p < .1$ but the random intercept remained steadily

significant, indicating that a considerable portion of the variance in this outcome occurred between classroom and was not being explained. Bell et al. (2019) indicated that when a Level 1 predictor is grand mean centered it will not be correlated with any predictors added at Level 2 or the random intercept. Because age was grand mean centered, this could be a plausible explanation of why the random intercepts remained significant even with the inclusion of significant Level 1 predictors in the models for the FIST Abstraction, Social Skills, and Problem Behaviors.

Another explanation would be that, in the case of these outcomes, there is still a considerable portion of variation to be explained beyond children's individual characteristics. In light of the bioecological theory, one can speculate about proximal processes at work in both indoor and outdoor environments relevant to children's development of abstraction and social skills that are not measured by the ECERS-R and POEMS. Within the Process-Person-Context-Time (PPCT) model, the classroom is a microsystem in which many proximal processes happen between children, teachers, objects and symbols. Measures of the indoor and outdoor environments quality made with the ECERS-R and the POEMS consider aspects of the physical characteristics of the classroom and, to some extent, whether the interactions occurring in the indoor and outdoor classrooms are supportive of children's cognitive and social learning. In this sense, both quality measures utilized in this study are a snapshot of what is occurring in the classroom between teachers, children, and the environment itself. They do not capture interactions that get progressively more complex over time—that is, proximal processes—or the consistency in which these may occur. Given the significance of the random intercepts in models for FIST Abstraction, Social Skills, and Problem Behaviors scores, this theory allows one to speculate that there might be other important interactions to understand variability in these specific outcomes that go beyond children's individual characteristics. By the same token, it is reasonable to make the assumption that both ECERS-R and POEMS do not capture these relevant progressively more complex interactions that might explain variation for these outcomes.

Instead, these measures might more accurately characterize the physical characteristics and routine patterns happening in the indoor and outdoor classrooms as a microsystem. The ECERS-

R, for example, has one subscale entirely dedicate to characteristics of the indoor space (e.g., furniture, space for privacy, arrangement for play), and two subscales addressing routines of children's personal care (e.g., meals, rest, toileting) and structure of the program (e.g., times allotted for free play, group time). On the same vein, POEMS subscales also give more focus on physical characteristics of the outdoor environment, including features of the facility building and design of the outdoor space, presence of learning settings (e.g., sand play area), play materials and equipment related to areas of the program (e.g., books, magnifying glasses, swing, clay). Therefore, these two measures not only put a greater focus on physical characteristics of the indoor and outdoor environments but are also a snapshot of interactions happening in these contexts, rather than capturing patterns of interaction between children, teachers, and the objects in the environments—and whether those get progressively more complex and occur consistently over time.

The same could also be speculated in relation to results found for FIST overall scores. Even though both quality measures were significant predictors of this outcome, as well as age, the random intercept remained significant considering $p < .1$. Therefore, it is reasonable to make the assumption that there still a significant part of variability lying between classrooms to be explained that, in this particular case, is not fully explained by child characteristics and quality measures included. This observation might also add importance to measurements encompassing interactions between children, teachers, and the environment itself that get progressively more complex over time in trying draw relationships to explain variation in young children's flexible thinking.

In sum, the bioecological theory offers a framework to point to the importance of capturing consistent patterns of interaction that get progressively more complex over time in childcare outdoor environments as a means to understand how outdoor quality might influence children's developmental outcomes. As demonstrated in the multilevel models for conceptual perspective taking and flexibility skills, child individual characteristics of age and sex were sufficient to reduce the significance of the random intercept—and, therefore, account for almost all the variance lying between centers. However, the same was not true for the other outcomes

analyzed. Even with the inclusion of quality measures, a significant proportion of variance occurring between classrooms remained unexplained. According to the bioecological theory, this may suggest that there are relevant interactions at work explaining variation in the outcomes of interest. Therefore, this theory lends support to indicate benefits of an outdoor quality measure that encompasses more of the interactions happening between children, teachers, and the environment itself.

LIMITATIONS

As indicated in the results, the ECERS-R and the POEMS did not explain a considerable part of the variation in children's FIST Abstraction, Social Skills, and Problem Behaviors scores lying between classrooms. As discussed, this finding might be due to a greater focus of these measures on the physical characteristics of the indoor and outdoor environments, rather than on the interactions between children and teachers that might be related to the outcomes of interest. Many studies have pointed to the lack of associations between children's outcomes and classroom global quality measured with the ECERS-R, indicating that this might be explained because this scale collapses multiple aspects of preschool environment into a unidimensional measure. This would account for less precision when measuring processes responsible for development (Mashburn et al., 2008; Cassidy et al., 2005). As it relates to the POEMS, less research has been done analyzing childcare outdoor quality and child outcomes (Hestenes et al., 2015). As speculated based on Bronfenbrenner's bioecological theory, there might be proximal processes at play relevant to explain variation in children's outcomes lying between classrooms that are not measured by these scales.

Another limitation is the sample size. According to Heck et al. (2014), the number of clusters establishes the power of multilevel analyses, not the total number of observations across clusters. Even though this sample had 405 children, they were nested within 92 centers only. In this sense, stronger estimates might have been observed if the sample had greater number of programs.

Along with that, this study analyzed secondary data from 2009. Programs' levels of outdoor and indoor quality might have changed over the years and results might not be an accurate portrait of

the current state of childcare programs quality in North Carolina. There is evidence to support the hypothesis that programs levels of outdoor quality have been rising over the past years in North Carolina. Initiatives in this state might have contributed to improve childcare outdoor environment quality. For example, the Natural Learning Institute (NLI) provides not only consultancy to childcare centers in remodeling their outdoor settings, but also offers courses to early childhood teachers addressing the use of outdoor spaces as learning environments to enhance children's experiences. In addition, the NC Division of Child Development and Early Education has showed some efforts to raise programs outdoor quality by implementing time and space regulations towards this end. Overall, in the United States there is an increased focus on outdoor environment quality in childcare settings and its relationship to children's developmental outcomes (Cooper, 2015). Therefore, there is room to hypothesize that childcare centers' outdoor environments in North Carolina have higher levels of quality now as compared to 2009. Given the results of this study showing that outdoor quality predicted children's cognitive skills of flexible thinking and abstraction, it is also possible that studies utilizing current data might reveal even stronger relationships between outdoor quality and children's cognitive skills, and even show associations with other areas of child development.

FUTURE DIRECTIONS

To advance the research on the potential of outdoor learning environments in contributing to young children's development, available measures of childcare outdoor quality need to be more widely tested in relation to child outcomes. This might also support refining existent measures or creating new ones that uncover with greater accuracy interactions between outdoor environments, children's and teachers' relationships, and child development. As argued based on findings and Bronfenbrenner's (2006) bioecological theory, there is reason to believe that important interactions are not being captured by POEMS—as well as by ECERS-R—that might explain variability in children's cognitive and social skills. The lack of this type of data might impact on the extent to which outdoor quality measures associate or predict child outcomes.

Qualitative studies are also rare, and they would be helpful in outdoor quality tool design. The narrative nature of qualitative analysis may offer insights to researchers interested in refining

existing measures of outdoor quality or creating new ones that include items related to interaction between children, teachers, and outdoor environment. The same would also hold true if qualitative studies explore more the role of natural elements, or a more nature-like outdoor environment, in changing children's activities and interactions in these spaces. As indicated, it would be beneficial to have an outdoor quality measure encompassing more information regarding the presence and the interactions with natural elements.

Longitudinal studies would also allow greater understanding of how outdoor learning environments contribute to young children's outcomes. Ulset et al. (2017) was the only longitudinal investigation reviewed in this study. Nevertheless, the extent to which the outdoors influenced children's inattention and hyperactivity symptoms was measured based on the amount of time children played in those settings during childcare and the first grade years. According to Bronfenbrenner's (2006) bioecological theory, changes over time occur for all components of the Process-Person-Context-Time (PPCT) model. Therefore, as children grow, their perception of the environment changes and their perceptions of the affordances of the environment changes as well (Gibson, 1979). Along with that, the outdoor environment itself may also change. Outdoor areas for infants and toddlers may not be the same as compared to those designed for preschoolers or first graders. They might offer different objects, play centers, landscape, and equipment. Therefore, the context in this equation is also ever-changing and this must be acknowledged in the effort toward understanding how children's individual characteristics, childcare center's outdoor environments, and time spent in those settings jointly influence changes in the progressively more complex interactions over time. In this sense, research exploring outdoor quality in early childhood programs would begin to benefit from longitudinal analysis because it would allow researchers to test whether changes in outdoor quality yield significant change in children's development, and by which means this possible relationship occurs.

CONCLUSION

The current study provides groundbreaking findings to the field of quality measurement in early childhood education. It shows that the quality of outdoor environments in childcare settings

contributes to children's abstraction and flexible thinking above and beyond classroom global levels of quality. This is striking because POEMS, in relation to the ECERS-R, is a less complex measure. In line with previous findings, this investigation did not find associations between quality as measured with the ECERS-R—a more complex and widely utilized measure—and any of child outcomes analyzed in this study. The negative significant correlation between the Natural Elements subscale and children's Problem Behaviors provides evidence to justify further analysis on the relationship between the presence of natural elements in childcare outdoor spaces and child outcomes. Finally, future research on the potential of programs' outdoor environments to support children's development might benefit from utilizing longitudinal designs and applying ecological theories of human development that shed light on the interactions occurring between individuals and environment and the mutual effect of these elements in producing change over time.

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