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Measuring Outcomes of Occupational Therapy Facilitated in Natural Settings with Young Children

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**Measuring Outcomes of Occupational Therapy Facilitated in
Natural Settings with Young Children**

By

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A culminating capstone project, submitted to the faculty of Dominican University of California
in partial fulfillment of the requirements for the degree of
Master of Science in Occupational Therapy

Dominican University of California

San Rafael, CA

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Abstract

To date, there is limited evidence to support the effectiveness of Occupational Therapy (OT) services delivered outside in nature. This study explored the benefits of OT intervention in Natural Settings (NS) for children by examining development in the areas of self-regulation, social skills, sensory processing, confidence, and motor skills. A quantitative, quasi-experimental pre-test/post-test design was used in this study. Researchers partnered with a local outpatient OT clinic that offers an 8-week outdoor program. Seven children and their parents were recruited and participated in the study. A modified version of the COPM and two BOT-2 subtests, along with a novel log climb measure were used to track changes among participants. Group results are presented, as well as two case vignettes that capture individual progress of two participants. Results showed that performance and satisfaction ratings, as well as scores from the balance and catching subtests from the BOT-2 generally improved from pre-test to post-test after the eight weeks. Additionally, the speed, efficiency, and quality of movement data gathered from the novel log climb generally improved by the end of the 8-week period. Overall, though there are several limitations to the study, the data showed improvement in key areas across parent reports and motor skill measures.

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Introduction

Over the past century, social play outdoors has declined sharply in lieu of an increase in solitary, sedentary activities with captivating technology (Driscoll et al., 2008; Gray, 2011; Kemple et al., 2016; O'Brien & Kuhaneck, 2020; Sandseter et al., 2021; Wilkinson et al., 2019). With the increase of playtime occurring indoors with devices, children are exposed less to nature. McCurdy et al. (2010) argues that this has led to a decrease in physical activity and less time for kids to participate in play, specifically unstructured free play. Thus, there has been a movement to get children to spend less time on devices and more time outside. Connecting children with nature has become a movement in education and therapeutic settings (Harper, 2017; Park Figueroa, 2020; Summers et al., 2019). This movement has been particularly evident in programs like Forest Schools with a focus on education and Timbernook with a focus on exploration (Bradley & Male, 2017; Hanscom, 2016; Petrigna et al., 2022). Forest Schools aim to facilitate children's schooling through the promotion of intrinsic motivation and positive functional outcomes (Petrigna et al., 2022). The TimberNook model was developed by an occupational therapist (OT). Their website states, in this model, "outdoor play is treated as a form of preventive health care for children. The more they engage in child-directed learning and take reasonable risks outdoors, the more they are equipped to be successful in home and school environments" (TimberNook sensational experiences, 2022). OTs have designed and delivered services in outdoor environments, but it is not the norm. An article recently published in an AOTA OT Practice Issue explicitly links the OT Practice Framework to this type of service delivery (Wilkinson et al., 2021). To date, there is limited research evidence to support the effectiveness of Occupational Therapy (OT) services delivered in NS. More research is needed to bolster evidence-based practice on the benefits of OT interventions facilitated in nature. The

purpose of this study is to examine if OT intervention, facilitated in the unique environment of Natural Settings (NS), facilitates children's development of self-regulation, social skills, motor skills, confidence, and sensory processing.

Literature Review

Occupational Therapy with Children

Occupational therapy is defined as, “the therapeutic use of everyday life occupations with persons, groups or populations to enhance or enable participation” (AOTA, 2020 p.1). OTs working with children, especially children with disabilities, commonly address the occupation of play and use it as meaningful intervention. OTs analyze the interplay among performance skills and client factors during play. Performance skills are observable, goal-directed actions and consist of motor skills, process skills, and social interaction skills (OPTF, 2020 p.13). Client Factors include values, beliefs, and spirituality which encompasses a child’s perceptions and motivations. Client Factors also included Body Functions and Body Structures, which is a child’s physiology and anatomy (AOTA, 2020). OTs engage children in therapeutic activities that address weaknesses in performance skills and client factors that interfere with participation in meaningful occupations such as play.

The goals of OT in pediatric practice are guided primarily by a family-centered approach in which the child and family’s priorities are at the forefront. While the priorities of each family are unique, common themes emerge. Cohn et al., (2014) studied the key concerns of parents seeking out OT services for their child. The results noted that 72% of parents were concerned with self-regulation, 41% were concerned with social participation, 40% were concerned with skill development, and 39% were concerned with confidence (Cohn et al., 2014). These findings suggest parents priorities are well aligned with OT services and expertise.

OT Outside and Natural Settings

Pediatric Occupational Therapists are skilled at adapting environments and tasks to best support a child's function and growth (Law et al., 1996, Sterman et al., 2016). According to

Sterman et al., it is best to emphasize environmental changes or adjustments during OT interventions done with children who have disabilities instead of focusing on changing aspects of the disability itself, which is likely not possible (2016). Practicing OT in NS is an environmental change that is well suited for utilization in pediatric populations.

Laura Park Figueroa, an O.T., created the definition of Natural Settings (NS) used in this study; “outdoor environments that retain their uncultivated features and have been relatively untouched by human development” (2020, p. 2). Examples of NS include creeks, ponds, forests, grasslands, beaches, and other places where buildings or structures are not visible or part of one's immediate consciousness (Park Figueroa, 2020). These types of settings allow children the freedom to run, shout, laugh, and play without interference of societal expectations, which leads to increased occupational performance and participation in childhood occupations (Li et al., 2019; Park Figueroa, 2020). These untouched settings inspire curiosity, challenges, and sensory exploration immersed among elements like rocks, dirt, water, trees, flowers, and insects which results in positive learning experiences (West, 2018; Wilkinson et al., 2019).

Benefits of Play Outside and in Natural Settings

The benefits of playing outdoors, not necessarily in NS, have been well researched. Studies have found that outdoor play supports many skills within the developmental umbrella categories of motor, cognition, social, and physical health (McCurdy et al., 2010; White et al., 2019). In the outdoors, there are dynamic opportunities for developing gross and fine motor coordination, problem-solving, risk-taking, creativity, a stronger immune system, and socialization with peers (Bento & Dias, 2017; Bradley & Male, 2017; Li, et al. 2019; McCurdy et al., 2010; Park Figueroa, 2020; Schaaf et al., 2015; White et al., 2019). Research on utilization of outdoor spaces by children indicate unique opportunities for risk-taking, discovery, strengthening

sense of self, psychological restoration, and cognitive development, while inducing positive emotional states, such as wonder (Dadvand et al., 2015; Sterman et al., 2016).

The benefits of playing in NS, in particular, has also been researched and linked to a variety of positive developmental outcomes. Play within NS, such as climbing rocks or trees, has been linked to promoting motor development more effectively than traditional playgrounds that encourage more directed and close-ended play (Fjortoft, 2004; Hanscom & Schoen, 2014; Nel et al., 2017). One can imagine that climbing a tree with bumpy bark from uneven branch to uneven branch, around a cylindrical trunk is a more challenging and dynamic task compared to climbing a slide's metal ladder with consistently spaced, smooth bars. Play in NS has also been shown to benefit children's mental health and cognition; according to Hanscom and Schoen, "play outdoors—especially reconnecting with nature and the natural resources—supports children's cognitive functioning and bolsters their resilience to stress and adversity" (2014, p. 2). This is further supported by West, who asserts that nature helps foster connection with others, self-efficacy, and discovery of self (2018).

Play Characteristics

Play is widely recognized as integral to a child's development, helping strengthen motor, sensory, emotional, and cognitive skills (Creekpaum, 2019; Gray, 2011). Risky play, unstructured play, and child-directed play are widely recognized beneficial play characteristics. Each characteristic is multifaceted, commonly used in practice by OTs, and well suited to occurring in NS.

Risky Play

Risky play is defined as, "a thrilling and exciting form of physical play that involves uncertainty and a risk of physical injury" (Sandseter et al., 2021, p. 305). This type of play may

be broken up into eight subtypes; play with great heights, play with high speed, play with dangerous tools, play near dangerous elements, rough and tumble play, play where one may get lost, play with impact, and vicarious play (Sandseter et al., 2021). All of these have benefits of engagement such as a decrease in anxiety when learning to overcome challenges and increases in self-confidence, gross and fine motor coordination, problem-solving, creativity, and socialization with peers (Bento & Dias, 2017; Bradley & Male, 2017; Li, et al., 2019; Park Figueroa, 2020; Schaaf et al., 2015). Researchers have found that risky play increases children's physical activity, creativity, social interaction, and resilience (Bundy et al., 2009; Wyver et al., 2010). Many adults, both teachers and parents, have significant hesitations about allowing children to engage in risky play, which most commonly takes place outside (McFarland & Laird, 2020; Yokum, 2018). Notably, children with disabilities are usually even more restricted in accessing risky play opportunities compared to their typically developing peers (Beetham et al., 2019; Grady-Dominguez, 2020).

Unstructured Play

Unstructured play is defined as, “when [a child follows] their instincts, ideas, and interests without an imposed outcome” (Canadian Public Health Association (CPHA), 2019). This type of play is shown to improve mental and emotional well-being such as self-concept, self-esteem, resilience, risk management skills, and cognition (CPHA, 2019, p. 5; Parrot & Cohen, 2020). According to a systematic review conducted by Lee et al. (2020), children who participated in unstructured play showed increased endurance and enjoyment in physical activity, reduced anxiety, and an improvement in self-control within groups. During unstructured play, children gain skills in playing with peers since conflict resolution, sharing, turn-taking, being a leader, negotiating rules, and collaborating naturally arises (Parrot & Cohen, 2020). Crosby et al.

(2012) emphasized the positive developmental outcomes in motor skills, visual perceptual skills, and self-confidence when children explore materials while partaking in activities that have no emphasis on outcomes.

Child-Directed Play

Child-directed play includes intentional adult scaffolding and limited management, which leaves space for a child to initiate and select an activity. This increases interest and motivation to engage while also building a child's self-esteem, interest in the environment, and intent to play (O'Brien & Kuhaneck, 2020). A study done by O'Brien and Kuhaneck (2020), found that adult direction during play leads to less independent exploration and more task-oriented activity.

Play in OT and NS

These play characteristics are both utilized by OTs in pediatric intervention and are well suited to occurring in NS. It is well known that play has been part of pediatric OT since the beginning of the profession and that it continues to be a very prominent and commonly used therapeutic tool (Mulligan, 2014; O'Brien & Kuhaneck, 2020). In the Occupational Therapy Practice Framework (OTPF), the guiding document of the OT profession, play is defined as, "activities that are intrinsically motivated, internally controlled, and freely chosen and that may include suspension of reality, exploration, humor, risk taking, contests, and celebration" (AOTA, 2020, p. 34). While risk taking is explicitly named, unstructured and child-directed are described in different words including, *intrinsically motivated*, *internally controlled*, and *freely chosen*. While the majority of research on risky play has been done in outdoor playground settings contrasted against indoor spaces, there are even more opportunities to engage in risky play in NS as the environment is inherently novel with unique challenges to practice problem solving and are not extensively regulated for safety precautions (Frost & Sutterby, 2017; Little, 2022).

Additionally, Summers et al. (2019) found that children prefer to play in NS that are full of trees, flowers, plants, dirt, water, mud, dirt, sand, insects and animals. This is further supported by Hanscom (2016) who states that ‘loose parts’ or things that can be easily moved inspire natural creativity among children, and create opportunities for imaginative and child directed play. Unstructured and child directed play is well suited to NS as such an environment has ample manipulatable materials and endless opportunities for unstructured interactions with peers (Drown & Christensen, 2014). Occupational therapists can address children’s challenges by leveraging the benefits of risky, unstructured, child-directed play during interventions taking place in NS (Park Figueroa, 2020).

Current Evidence for OT outdoors

Although research is sparse, a few studies of OT delivered in an outdoor setting suggest benefits to a child’s development beyond what a clinical setting can offer. In 2013, Sahoo and Sanapati conducted a study with children diagnosed with Attention Deficit Hyperactivity Disorder. The children showed improvement in functional outcomes when their sensory needs were met through outdoor play and SI therapy, compared to SI therapy alone. The authors concluded that being outdoors, although not in a NS, created opportunities for tactile, proprioceptive, and vestibular input which supported children in their own organization and regulation, and therefore, functional behavior (Sahoo & Senapati, 2014). Further, Jeffery (2018) examined the impact of adventure-based OT interventions on individuals with mental health disorders outdoors. The author concluded that the outdoor environment, which supports risk taking and problem solving, can have a profound impact on individuals' engagement and participation in everyday life. Though this study of youth and not young children, it is an example of OTs utilizing outdoor environments in their interventions. In an online survey of

practicing OTs regarding the topic of facilitating interventions outside, Wilkinson et al. (2019) found that, “the majority of pediatric OT’s in the sample perceived outdoor play as having a wide array of benefits for children but they felt limited by barriers to outdoor play such as weather, time restrictions, space restrictions, and a habit of remaining indoors” (p. 1). They also found that OTs with more years of experience were slightly more likely to use natural spaces for intervention. The top reasons stated included the ability to address sensory and motor goals, as well as work within a naturalistic environment (Wilkinson et al., 2019). While the use of NS in the practice of OT is a topic of conversation, it is certainly not the norm and continues to be underutilized due to logistic challenges, routine, and expectations.

Laura Park Figueroa, MS, OTR/L runs nature-based OT programs in Berkeley and Oakland, California and has developed a framework to use when facilitating in NS with young children (Outdoor kids: Occupational therapy). Park Figueroa illustrated the effectiveness of the framework she developed called ConTiGO (Connection, Transformation, In the Great Outdoors) by presenting a case study of a boy with Autism Spectrum Disorder. He showed increased flexibility, changes in motor coordination, and attention to others after participation in their nature-based occupational therapy. The ConTiGo framework is facilitated with groups of children who each have unique developmental challenges and personalized goals based on assessment and collaboration with their family. ConTiGo emphasizes building trusting friendships with peers in a group setting, using children's interests to direct activities that use natural materials, and places nature as a “co-facilitator” by presenting dynamic and ever-changing challenges (Park Figueroa, 2020). While some evidence supports the benefits of OT interventions facilitated outdoors, little specifically examines NS. The existing evidence is based on small sample sizes and inconsistent outcome measures. However, the evidence suggests that

OT intervention in NS supports progress in functional outcomes, positively affecting everyday life. The research suggests that NS, unlike clinical settings, provides a range of opportunities to engage the senses, challenge motor skills and coordination, and foster regulation, attention, and flexibility.

Summary

Occupational Therapists specialize in supporting children in a variety of areas including gross or fine motor delays, social-emotional deficits, sensory processing issues, social skills, and/or cognitive delays (Case-Smith et al., 2015; Cohn et al., 2014; Cohn et al., 2000; Ismael et al., 2018; O'Brien & Kuhaneck, 2020; Piwinski et al., 2021; Schaaf et al., 2015). These challenge areas can be specifically targeted through play that is risk-friendly, unstructured, and child-directed in NS (Bradley & Male, 2017; Canadian Public Health Association, 2019; Dadvand et al., 2015; Harper, 2017; Lee et al., 2020; Parrott & Cohen, 2020; Sandseter et al., 2021). OT provided in NS supports children by immersing them in dynamic challenges with motivating interactions to address their performance skills. By coupling occupational interventions facilitated by a trained therapist with thoughtful environmental choices, a child's challenges may be skillfully addressed (Sterman et al., 2016).

The literature documenting the outcomes of outdoor OT is limited, however, a solid body of evidence shows the positive influence of NS and the rich play that occurs in such environments. These benefits include positive effects on sensory processing, motor skills, and cognitive skills like executive functioning. OT in NS is likely to provide those same positive benefits. In conclusion, to address this missing link between OT interventions and NS this study will build on existing literature about pediatric OT facilitated outdoors, and examine the

development of self-regulation, social skills, motor skills, confidence, and sensory processing following OT intervention within NS.

Statement of Purpose

The purpose of this study is to examine if OT intervention, provided in the unique environment of Natural Settings (NS), facilitates children's development of self-regulation, social skills, motor skills, confidence, and sensory processing. NS inherently immerse all senses, provides opportunities for physical risk, and is the ideal backdrop for risky, unstructured, child-directed play. The use of outdoor interventions by pediatric OTs is increasing due to its growing popularity over the years in western societies for children to spend more time outdoors and most recently COVID-19 necessitating social time spent outdoors for safety. However, there is limited evidence documenting the benefits of OT services in NS. Therefore, the purpose of this research is to add to the literature and explore the benefits of OT intervention done in NS for children improving development in the areas of self-regulation, social skills, motor skills, confidence, and sensory processing.

Hypothesis

OT intervention facilitated in NS will positively affect a child's self-regulation, social skills, motor skills, confidence, and sensory processing.

Theoretical Framework

Health and well-being are influenced by the ability to engage in valued, daily occupations, which provides a medium to promote development and belonging. For this study, researchers used the Person, Environment, and Occupation framework (PEO), which views occupational performance as a product of the transactional and dynamic relationships between the client's factors, the environment they are in, and the occupation that they are participating in (Bruce et al., 2016). By examining each area, the OT analyzes what changes may improve

occupational performance and plan an effective intervention. When using the PEO framework, the environment is considered a very strong change agent.

Although OTs work with people across the lifespan, one of the key practice areas is with children and youth (AOTA, 2021). In this practice area, OTs collaborate with the child and the primary caregivers as a team. The ‘person’ or people in this study in regard to the framework will be children who show one or more deficits in the following areas of self-regulation, social skills, motor skills, confidence, and sensory processing. As children do not engage in many of the occupations that adults do, the OTPF describes play as one of the main occupations engaged in during this stage of life (AOTA, 2020). Play, specifically risky, child-directed, and unstructured play, will be the intervention of focus in this study as it is a key occupation for a child. It is how they learn more about the world around them and about themselves by promoting engagement in activities that elicit physical coordination, social skills, emotional maturity, self-confidence, and exploration of new environments (AOTA, 2021).

Law et al. (1996) explains that any task that a person wishes to accomplish will be significantly influenced by the context of their environment in which the task is to be performed. This environment can either constrain performance or make it easier. OT with children is typically provided one-on-one in an outpatient, indoor clinic where the environment is built and manipulated to facilitate play through targeted challenges using plastic, foam, and wooden equipment and games. While these spaces are modular and can be set up in a variety of ways, NS inherently provide more variability and challenge with significantly more square footage, loose parts, and seasonal changes. Sticks, rocks, and leaves are examples of potential play tools, all of which change with the seasons. Dirt turning into mud, sand getting washed down a creek bed, leaves falling from trees, and the high likelihood of encountering living things are all examples

of how NS are an extremely dynamic environment. In this study, the environment or intervention will not be an indoor clinic, but a natural outdoor environment in a group setting of children of similar age and range of dysfunction.

Ethical and Legal Considerations

Prior to contacting participants, this research study was approved by the Institutional Review Board for the Protection of Human Subjects (IRBPHS) at the Dominican University of California. The researchers referenced and abided by The American Occupational Therapy Association Code of Ethics for the duration of this study (AOTA 2020 occupational therapy code of ethics, 2020). Friendship Explorations (FE) is the name of the outdoor NS program that operates within the occupational therapy pediatric clinic named Ready Set GO Therapy. Ready Set GO Therapy gave consent to the researchers to contact participants and collaborate with FE.

Participants and their guardians were informed of all procedures and possible risks and/or discomforts that could be experienced. Participants were informed of their rights to withdraw from the study at any time (self-determination). Participants were informed that not participating or withdrawing from the study at any time would not affect their experience with FE (justice). Researchers interpreted and reported data truthfully and to the best of their ability (veracity).

Confidentiality was maintained. Participants' names were not included in any reports or publications resulting from the study. All information was kept in a secure google drive and all participants were assigned a code in a separate spreadsheet so personal identifying information was not included in data collection or analysis. All original documents were destroyed one year after the study concluded. The researchers acted professionally and upheld respect and fairness in all interactions with participants and benefactors.

Methods

Design

A quantitative, quasi-experimental pre-test/post-test design was used in this study. The independent variable in this study was the time of the OT services in NS and the dependent variables were the scores of the participants' self-regulation, social skills, motor skills, confidence, and sensory processing gathered before and after participation. The specific scores come from a Modified Canadian Occupational Measure (COPM), two subtests of the Bruininks Oseretsky Test of Motor Proficiency 2 (BOT-2), and a novel log climb measure created by researchers.

Participants

Children from the families who participated were between the ages of 4-12 years old and enrolled in FE, an 8-week after-school program that provides outdoor OT services in NS. The inclusion criteria was that a child was participating in FE and that both child and parent agreed to informed consent and participation in the study. All children enrolled in FE were eligible to participate and there were no further exclusion criteria. Ready Set GO Therapy provided a brief description of the research to families when they signed up for the FE program. Potential participants could opt to be contacted by the research team. Researchers followed up with them to provide further information via phone call and a follow-up email which included a handout and consent form.

Informed consent or assent was obtained from both the child and their primary caregiver. Caregivers agreed to allow themselves and their child to participate in the study prior to gathering any data. They gave their consent to participate in each measure at the start and end of FE, and for their child to do so as well. They consented to videography of their child, were

informed of how study records would be kept confidential, and the possible risks and benefits of participation. Parent forms were distributed by email and included parental consent form. Researchers received signed consent forms via email and stored them in a secure google drive. Additionally, assent from the children was obtained on the first day of the camp by a researcher verbally introducing themselves, explaining what they would be asked to do (throw a ball, balance on one leg, and climb a log), stating that they (the child) could ask questions, leave the study at any time, and choose to participate or not. Both children and families were informed that they were free to leave the study at any time throughout its duration without any penalties. Each child gave a verbal or a physical (head nod) response. These were stored in a faculty password protected google drive. This research study was approved by the Dominican University of California Institutional Review Board #10990.

Measurement/Instrumentation

Data was gathered using a variety of measurements to assess the effectiveness of OT interventions done in NS, both pre and post-intervention. Demographic information was self-reported by primary caregivers and collected digitally and in paper form. A modified version of the COPM was administered with a primary caregiver of each child. Children were assessed on their balance and upper limb coordination using two items from the BOT-2. Researchers created a novel log climb measure that assessed each child's speed, efficiency, and quality of movement when climbing in a NS.

Demographics

Both a FE registration form and the age appropriate, school-age or preschool version, Sensory Processing Measure (SPM) Home Form were used to gather demographic information from consenting participants. Parents filled out an online questionnaire to register their child for

FE, a program within Ready Set GO Therapy. The full questionnaire is located in Appendix B. This information was submitted by caregivers to Ready Set GO Therapy staff in their secure online system during enrollment. After a consent form was obtained from a parent to participate, Ready Set GO staff released the data from caregivers to the researchers. The SPM Home Form was administered to caregivers either digitally or in paper form prior to the start of the 8-week intervention. This measure utilizes rating scales that assess difficulty in social participation and praxis in addition to sensory processing. It is a standardized assessment for children ages 4-12, that has demonstrated good to excellent test-retest reliability, adequate interrater reliability, adequate to high internal consistency, and moderate convergent validity with the Sensory Profile (Rehabilitation measures database, 2021). It resulted in scores that measure the sensory processing skills of a child. The SPM typically takes about 20 minutes to complete and was collected by the researchers (Parham et al., 2007).

Modified Canadian Occupational Performance Measures (COPM)

A modified COPM was used to gather data from parents about their child's target outcome measures, see the areas that were selected to be used in the form in Appendix A. The COPM is an evidence-based assessment and measures changes in patient-reported outcomes over time. It provides a scale of scores that rates performance and satisfaction from 1 to 10, yielding both quantitative and qualitative data (Rehabilitation measures database, 2021). It uses a family-centered approach to identify problem areas that can impact a child's ADLs among other occupations through a semi-structured interview. The parents rated their child's performance and their satisfaction in each of these targeted areas: self-regulation, social participation, skill development, confidence, and sensory processing. Researchers conducted a semi-structured

interview with each caregiver during a time of their choosing and took 30-45 minutes to complete (Law et al., 2019).

Bruininks Oseretsky Test of Motor Proficiency 2 (BOT-2)

Child participants were assessed on motor skills, using three items from the BOT-2. Two items from the Balance subtest included Standing on One Leg on a Line (Eyes Open and Eyes Closed) on their preferred foot and one item from the Upper Limb Coordination Subtest, Catching a Tossed Ball (Both Hands). The full-length BOT-2 is commonly used by pediatricians, physical education teachers, therapists, and teachers in adaptive learning. There are four specific areas evaluated when using the full-length BOT-2 including fine manual control, manual coordination, physical coordination, and balance; each has multiple subtests within each area (Jirovec et al., 2019). The full-length BOT-2 and its subtests have excellent test/retest reliability and excellent internal consistency (Rehabilitation measures database, 2021).

Items were administered as closely as possible to the standardized directions, however, in a NS. Balance items were timed for the number of seconds they maintained balance. The children were instructed to stand on a flat surface on their preferred leg and balance for as long as they could, with a ceiling score of 10 seconds, while their eyes were open. Then they were asked to repeat the task with their eyes closed with a ceiling score of 10 seconds. Scores were the best time of two trails with a maximum of 10 seconds. For the catching item, children were scored on the number of successful catches out of five attempts. Raw scores were recorded rather than scaled scores for all three items.

Novel Log Climb Measure

Children were scored on speed, efficiency, and quality of movement when invited to climb a log in a NS. This is a novel measure the researchers created for the purpose of this study

in order to capture a motor challenge that is typical of NS play. Children were prompted with a challenge to climb up an inclined log, ring a bell that was placed at the top, and climb back down as fast as they could. A researcher stood nearby for safety and verbal encouragement only, they did not physically help the children at any point.

The log selected was in Mill Valley California along the Oakwood Valley Trail, which is located within the Golden Gate National Recreation Area, a large, protected park space that is a NS. This area has ample rocks, trees, dirt, a creek, and no human made elements besides the initial trailhead that begins at a place where the road widens and visitors park. The log selected was a fallen eucalyptus tree that was an average of 52 inches in diameter. There was lots of variation in the surface of the tree, the bark had fallen off, and though it was generally a smooth surface, it had many rough landmarks where the tree had split or had branches broken off. The entire log rested at a solid incline of approximately 25 degrees, +/- 5 degrees at any point, on its uneven surface. The total length of one direction of the climb was 15.5 feet. Researchers divided the span of the log into three zones. Zone 1 was closest to the ground and included a horizontal piece of wood many children stepped up onto first, this zone was approximately 3.5 feet. Zone 2 was in the middle and measured 5.5 feet. Zone 3 was highest off the ground and at the end a bell was suspended from a branch that the children could ring when they made it to the top. This last zone was approximately 6.5 feet in length. A picture of the log climb site with zones designated can be found in Appendix C.

Video analysis of the climb was completed by all researchers together, scoring each child concurrently. The full Log Climb Observation Scoring Sheet can be found in Appendix D. Disagreements were resolved by reviewing video footage multiple times, in slow motion, and by consensus. Most scoring was done by zone. Both ascending and descending were scored,

although only ascending scores were ultimately used in the results. Each child got a maximum of three trials during each testing session. Researchers recorded in each zone: time spent, number of touchpoints for every body part that came in contact with the log (including hands, forearms, feet, knees, bottom, and trunk), push or pull pattern, body orientation regarding neck positioning, body posture (supine, prone, standing, sitting, quadruped, or reverse quadruped), movement pattern (homologous, homolateral, contralateral, or disorganized), self talk (positive, negative, none), external talk (positive, negative), and general observation notes. Additionally, type of shoe worn, truck rotation was noted (yes or no) at the transition point between ascending and descending in zone 3 only, and any confounding factors for the duration of the climb noted (such as weather, injuries, distractions, cueing etc.).

After all the data was gathered, researchers selected the measures of speed, efficiency, and quality of movement. Speed was defined as the duration of ascent and reported in seconds. Efficiency was defined as hand and foot touch points during ascent and reported as a total number. Quality of movement was defined as either disorganized or organized (which included homologous, homolateral, and contralateral movement patterns). The following movement patterns were observed and are generally considered a progression of difficulty (Cohen, 2018). In a homologous movement pattern both arms extend simultaneously, followed by both legs flexed to push and then pull forward. In the homolateral movement pattern the arm and leg on the same side of the body simultaneously move forward. In the contralateral movement pattern, the opposite arm and leg simultaneously move forward, which is considered the most complex pattern out of the three (Cohen, 2018).

Procedures

After agreeing to participate and signing an informed consent, each participant pair (child and parent) did the following to participate in the study. The parent filled out a SPM Home Form before the 8-week FE session, which they could choose to fill out online or in paper version. The questionnaire took approximately 20 minutes to complete. The parent completed a 30-45 minute Modified COPM interview about their child's self-regulation, social participation, skill development, confidence, and sensory processing. This interview occurred one time before the start of FE and again after the program ended and occurred over zoom or in-person with a researcher. Each child was instructed to complete a short motor assessment during the first and last group sessions. This included an assessment of balance, catching, and climbing a log, which took approximately 15 minutes.

FE offered participants two sessions a week that were each two hours long. Participants could attend to choose one or both days. The program focused on building social skills within NS while exploring nature and natural materials, including hiking, climbing trees and rocks, and playing outdoor games. The location of the delivery of services was chosen collaboratively each week by the OT running the program and the children participating. All locations were near Mill Valley and were NS and ranged from redwood or eucalyptus forests to grassy and rocky hilltops. These provided various dynamic NS to be immersed in and included things like trees, downed logs, riverbeds, grasses, dirt, and rocks. Study procedures were carefully designed to align with what FE, as a program, typically offers. Participants' experience in the FE program was not affected positively or negatively whether or not they chose to participate in the study. Prior to this research, and during, the OTs facilitated FE group sessions by implementing risky, unstructured, and child-directed play during intervention. The OTs running the group were

particularly adept at monitoring and maintaining the safety of participants within the environment, as they had experience leading groups in the past.

Data Management and Analysis

The demographic and raw assessment data was collected and organized in a spreadsheet format that was stored on a secure google drive. Researchers created a unique four-letter code for each participant to organize data and maintain privacy. Video of the children's performance was recorded on the researcher's password protected phone or iPad, immediately uploaded to a secure google drive, and deleted from the phone or iPad. All records and videos were stored on the secure google drive. Pre-test and post-test data was compared using paired t-tests. All collected data was analyzed for assumptions that lead to the use of parametric statistics. The data was analyzed using the IBM SPSS v.26.

Results

Data was collected from nine families that participated in 8-weeks of FE through Ready Set GO Therapy. One of the participants dropped out of the study and did not complete all the measures. One other child did not complete all of the post-test measures; only the COPM. Complete data is reported for seven children.

Demographics

The children's ages ranged from 4-12 years old with a mean age of 7.38 and a standard deviation of 3.02. All children were residents of the San Francisco Bay Area and were members of families that were able to pay out of pocket for the cost of the program. The children were assigned to a group of six peers based on age. Each child participated in either one or two sessions a week throughout the 8-week program. One group included five older participants, ages 7-12 years old. The other group included two younger participants, ages 4-5 years old. All participants' primary language spoken at home was English. Six participants were male, and one participant was female. Five of the seven children had participated in FE before the implementation of the study. All the participants were reported to have received OT services in a clinical and/or school setting prior to attending FE. Five out of seven participants were concurrently receiving OT services while attending FE, presumably in an indoor outpatient setting or in a school-based setting. Four of the participants were reported to have received additional therapeutic services such as Speech Therapy, Applied Behavioral Therapy, and Physical Therapy. Upon enrollment in FE, five out of seven participant parents completed the SPM about their child. Out of the five participants who completed the SPM, four showed "some problems" and one participant showed "definite dysfunction" overall in Total Sensory Systems indicating overall, some level of sensory dysfunction in the participants. The result of "some

problems” was seen in three out of five participants in social participation, four out of five in vision, one out of five in hearing, four out of five in touch, four out of five in body awareness, and four out of five in planning and ideas. The result of “definite dysfunction” was seen in one out of five in body awareness and two out of five in balance and motion. The SPM measure indicates that study participants had varying levels of sensory dysfunction in a range of areas.

Outcome Measures

Modified Canadian Occupational Performance Measures (COPM)

Pre and post interviews were completed with seven parents of children who participated in the FE program. Parents identified specific concerns and goals in each of these five areas: self regulation, social participation, skill development, confidence, and sensory processing. Key themes for parents' concerns and goals for each area are presented in Table 1. Parents rated both the child's performance and satisfaction on a 10-point scale and selected a top priority concern in each occupational performance area. Pre- and post-test ratings for performance and satisfaction for each area were assessed for both clinical and statistical significance. According to Baptiste et al., (2004) “a change score of two or more is considered clinically significant” (p. 211). Statistical significance was assessed with a series of paired *t*-tests.

Mean performance rating scores showed no statistical or clinical difference between the pre-test and post-test ratings for any of the areas, see Table 2. The mean improvement in the skill development area did approach statistical significance ($p=.06$) from pre-test to post-test after eight weeks. Generally, individual performance ratings stayed the same or improved. Three parents reported lower scores post-test, the other four reported an increase. The highest individual point changes were seen in sensory processing (tactile increased seven points), confidence (self-esteem increased seven points), self regulation (flexibility increased six points),

and social participation (friendships and group interaction increased five points). Overall, individual improvements on performance skills were as follows; six out of seven improved in self-regulation, skill development and confidence, four out of seven improved in social participation and sensory processing.

The mean satisfaction rating scores showed statistically significant improvement ($p < .05$) in skill development. Clinical improvement was seen for the areas of skill development and sensory processing. Generally, individual satisfaction ratings stayed the same or improved. Five parents reported lower scores post-test on one or more areas. Like performance scores, the overall satisfaction scores typically increased with each child. The highest individual point changes were seen in self-regulation (flexibility increased seven points), social participation (group interaction increased seven points), sensory processing (tactile increased seven points, proprioception and vestibular increased six points), skill development (gross motor increased six points), and confidence (self-esteem increased six points). Overall, individual improvements on satisfaction ratings were as follows; five out of seven improved in self-regulation, skill development, and sensory processing, while four out of seven improved in confidence, and three out of seven improved in social participation.

Table 1 Key Themes for Child Specific COPM Goals.

COPM Area	Child Concerns/Goals
Self Regulation	Flexibility: ability to adapt to change (4) Initiation of Tasks: homework, play, games (2) Planning & Organizing: games, tasks (1)
Social Participation	Group Interaction: participation in groups (3) Interaction with Family: conversations/participation (2) Friendships: maintaining, making new friends (2)
Skill Development	Self-Care Skills: dressing, feeding, hygiene, bathing (4) Gross Motor Skills: large body movements (2) Visual Motor Skills: hand-eye coordination (1)
Confidence	Self-Esteem: belief in self to complete tasks (5) Participation: in school, play, activities (2)
Sensory Processing	Vestibular: movement & balance (3) Proprioception: awareness of body movement and orientation (2) Tactile: response to touch (2)

Table 2 Pre- and Post-test COPM Performance Ratings

COPM Performance	Pre-test		Post-test		<i>t</i>	<i>df</i>	<i>p</i>
	M	SD	M	SD			
Self Regulation	5.50	1.93	6.13	2.3	.523	7	.62
Social Participation	6.38	2.83	6.88	1.2	.435	7	.68
Skill Development	6.00	1.2	7.38	1.6	2.200	7	.06
Confidence	5.00	2.07	6.25	2.05	1.279	7	.24
Sensory Processing	5.00	1.85	6.63	2.13	1.476	7	.18

Table 3 Pre- and Post-test COPM Satisfaction Ratings

COPM Performance	Pre-test		Post-test		<i>t</i>	<i>df</i>	<i>p</i>
	M	SD	M	SD			
Self Regulation	5.75	1.75	6.00	3.67	-0.162	7	.88
Social Participation	6.00	3.67	7.13	1.46	-1.35	7	.22
Skill Development	5.38	1.69	8.00 ^C	1.77	-2.73	7	.03*
Confidence	4.50	1.92	6.38	2.13	-1.89	7	.10
Sensory Processing	4.75	2.12	6.75 ^C	2.55	-1.37	7	.21

Note: * indicates statistically significant change in ratings. ^C indicates clinically significant change in ratings.

BOT-2 Subtests: Balance & Catching

Mean scores on the balance and catching items generally improved from pre-test to post-test after eight weeks. Only catching scores significantly improved. Overall, five out of seven children improved in balance with eyes open and eyes closed, and six out of seven children improved in their catching ability.

Table 4 Pre- and Post-test BOT-2 Scores

Modified BOT-2	Pre-test		Post-test		<i>t</i>	<i>df</i>	<i>p</i>
	M	SD	M	SD			
Balance Eyes Open	1.86	3.77	5.15	4.84	-2.14	6	.077
Balance Eyes Closed	0.86	2.27	3.0	4.8	-1.51	6	.182
Catching	1.71	2.22	2.86	2.27	-2.5	6	.047*

*Note: * indicates statistically significant change in ratings. Best Scores of two trials for balance and catching*

Log Climb Measure

The children's ability to free climb a natural incline log was assessed for speed, efficiency, and quality of movement. Analysis of the data was limited by the fact that not all children were able to climb through all zones during each of the pre-test and post-test trials.

Speed was assessed by the time (seconds) it took a child to ascend through each of three zones. Overall, speed of climbing was highly variable for the individual and was dependent on the zone achieved. Therefore, overall mean comparisons were not a useful metric of this task. Most children improved or had the same time spent in zone 1. Time in zone 2 and 3 was inconsistent. Two of the children who completed zone 3 on both the first and second trials completed the task quickly and were considered to have reached the ceiling on the first trial. Children who did not complete zone 2 or 3 on the first trial tended to take much longer in those zones than children who completed zone 3 on the first trial. Improvement in time was seen in at least one zone for four of seven children.

Efficiency of climbing was assessed by the number of hand and feet touch points during ascent for each zone compared between trial 1 and trial 2. Like speed, efficiency or number touch points were highly variable between individuals and climbing zones. Of the participants six out of seven reduced the number of touch points in zone 1, three out of four reduced touch points in zone 2, and two out of four reduced touchpoints in zone three. Improvement was seen in efficiency in at least one zone by all seven children.

Quality of movement was categorized as organized (including homologous, homolateral, and contralateral) or disorganized. Improvement in quality of movement (from disorganized to organized) was seen in five out of seven children.

Individual Case Illustrations

The results of this pilot study are promising, but do not illustrate individual improvements made by the participants. To highlight the progress made in the assessed areas over the course of a longer period, two case vignettes of participants that completed a consecutive 16 weeks of FE are presented. As previously stated, to ensure privacy of individual participant data, unique four-letter codes were created for each child.

Participant: NAYA

NAYA, was the only female participant and 5 years old. She showed improvements in all measures, which included the Modified COPM, two BOT-2 subtests, and Log Climb Measure. She attended the younger group of participants within FE, with ages ranging from 4-5 years old. NAYA attended sessions two days a week and was a returning participant at FE. She received additional OT services, spoke English at home, and had two younger siblings. According to her parent, her strengths are that she has a big heart, loves and cares about a lot of people, and wants to do the right thing.

Additionally, they reported the following occupational performance problems on the Modified COPM; flexibility, group interactions, gross motor skills, self-esteem, and proprioception. They rated NAYA's performance and their satisfaction level during week 1, week 8, and week 16 of FE. The tables below illustrate parent-reported data about NAYA's performance and parent satisfaction in the five performance areas and the interpretation of change scores. According to the COPM, a change score greater than or equal to two is considered clinically significant (Baptiste et al., 2004). The change between week 1 and week 16 in the total performance was a score of 3.6 and the change in the total satisfaction was a score of

5, meaning her improvement in the areas measured by the modified COPM were clinically significant.

Table 5 Change in COPM Performance Ratings for NAYA

COPM Performance	P1	P2	P3	Total Change (P3 -P1)
Self Regulation: Flexibility	3	7	8	5
Social Participation: Group Interactions	2	6	7	5
Skill Development: Gross Motor Skills	4	7	7	3
Confidence: Self-Esteem	5	4	7	2
Sensory Processing: Proprioception	3	7	6	3
Average Score	3.4	4.8	7	3.6

Table 6 Change in COPM Satisfaction Ratings for NAYA

COPM Performance	S1	S2	S3	Total Change (S3 -S1)
Self Regulation: Flexibility	3	9	10	7
Social Participation: Group Interactions	3	6	10	7
Skill Development: Gross Motor Skills	4	10	10	6
Confidence: Self-Esteem	5	3	7	2
Sensory Processing: Proprioception	3	9	6	3
Average Score	3.6	7.4	8.6	5

Scores on the BOT-2 items showed improvement in the one leg standing balance (eyes closed) and catching a tennis ball. The change in scores was calculated as the difference between trial 3 and trial 1. Table 7 illustrates the improvement made from trial 1, trial 2, and trial 3.

Table 7 Change in BOT-2 Scores for NAYA

BOT-2 Subtests	T1	T2	T3	Change in Scores (T3-T1)
Catching	0/5	0/5	3/5	3
Balance Eyes Open	0 sec	0 sec	1 sec	1
Balance Eyes Closed	0 sec	5 sec	1 sec	1

In the log climb measure created by the researchers as a novel NS motor assessment, NAYA was assessed on speed, efficiency, and quality of movement. NAYA's performance in this measure improved after continued FE attendance. In her first trial when measuring speed, NAYA spent 42 seconds in zone 1 and 2. In her second trial at week 8, she ascended through zone 1 and 2 again, and decreased time spent climbing to 10 seconds. In her first two trials she was not able to ascend through all three zones, but the amount of time it took for her to ascend up to zone 2 decreased. In the last trial at week 16, NAYA ascended through zone 1, zone 2, and zone 3 with a total time of 56 seconds. The second area that was assessed was efficiency, which was calculated by adding the total number of touchpoints NAYA had in each zone. In the first trial, NAYA ascended up to zone 2 with a total of 87 touchpoints, (12 in zone 1 and 75 in zone 2). In her second trial, NAYA ascended to zone 2 with 19 total touchpoints, (12 in zone 1 and 7 in zone 2). By the second trial, NAYA was able to decrease the number of total touch points needed to get to zone 2. For her final trial, she was able to ascend through all three zones with a total of 73 touchpoints (5 in zone 1, 26 in zone 2, and 42 in zone 3). NAYA's higher scores in

time and touchpoints for her first trial are potentially due to her unwavering determination to ascend to the top of the log when faced with a new challenge. The last area assessed for the log climb measure was the quality of movement. In her first trial, researchers observed that NAYA displayed no distinguishable organized coordinated movement pattern. She used inefficient grasp patterns to climb. In the second trial, researchers rated her movement pattern as disorganized. NAYA's final trial showed improvement as researchers rated her movement pattern as being homologous. Further, she was more efficient in use of her hands and feet.

Participant: COLE

COLE was an 8-year-old, male participant who showed improvements in all three measures after 16 weeks of FE. He attended FE with the older group of participants whose ages ranged from 7-12 years old. COLE attended sessions two days a week and was a returning FE participant. Parent reported English spoken in the home, two siblings, four years of OT and Speech Therapy services prior to FE, and his love of nature. According to his parents, his strengths were seen in physical activities when he used his gross motor skills and in his independence in daily self-care tasks.

After completion of the COPM, COLE's parent reported interest in the following occupational performance problems; flexibility, friendships, visual-motor skills, self-esteem, tactile. Like NAYA, COLE's parent rated performance and satisfaction in each of the areas listed above at week 1 of FE, week 8, and week 16. To reiterate, according to the COPM, a change score greater than or equal to two is considered clinically significant (Baptiste et al., 2004). The change in total performance was a score of 5.4 and the change in total satisfaction was a score of 5, meaning his improvement in the areas assessed by the modified COPM were clinically significant. The tables below illustrate parent-reported data about COLE's performance and

parent satisfaction in the five occupational performance areas and the interpretation of change scores.

Table 8 Change in COPM Performance Ratings for COLE

COPM Performance	P1	P2	P3	Total Change (P3 -P1)
Self Regulation: Flexibility	3	7	9	6
Social Participation: Friendships	4	8	9	5
Skill Development: Visual Motor Skills	5	7	7	2
Confidence: Self-Esteem	3	9	10	7
Sensory Processing: Tactile	2	8	9	7
Average Score	3.4	7.8	8.8	5.4

Table 9 Change in COPM Satisfaction Ratings for COLE

COPM Performance	S1	S2	S3	Total Change (S3 -S1)
Self Regulation: Flexibility	5	7	9	4
Social Participation: Friendships	4	8	9	5
Skill Development: Visual Motor Skills	5	8	8	3
Confidence: Self-Esteem	4	10	10	6
Sensory Processing: Tactile	2	9	9	7
Average Score	4	8.4	9	5

For the BOT-2, COLE showed some improvement in the assessed subtests; one leg standing balance (eyes closed) and catching. Change scores were calculated as the difference between trial 3 and trial 1. The table below illustrates the improvement made from trial 1, trial 2, and trial 3.

Table 10 Change in BOT-2 Scores for COLE

Modified BOT-2	T1	T2	T3	Change in Scores (T3-T1)
Catching	0/5	3/5	5/5	5
Balance Eyes Open	0 sec	0 sec	2 sec	2
Balance Eyes Closed	0 sec	0 sec	n/a	n/a

COLE's performance in the log climb measure showed improvement in all areas assessed. Starting with speed, COLE was able to reach the top of the log by trial 2, and by trial 3,

he ascended to the top with an overall faster time. On trial 1, COLE ascended to zone 2 within 6 seconds. On trial 2, he improved by ascending to the top of the log in 78 seconds. On his final trial, COLE was able to ascend to the top of the log again in 25 seconds. COLE's efficiency in ascending the log showed improvements as well. In trial 1, he ascended to zone 2 he had 14 total touchpoints (6 in zone 1 and 8 in zone 2). In trial 2 where he reached the top of the log, COLE had 58 total touchpoints (2 in zone 1, 28 in zone 2, and 28 in zone 3). In trial 3, COLE was able to decrease the number of touchpoints needed to get to the top of log to 36 (5 in zone 1, 11 in zone 2, and 20 in zone 3). Like NAYA, COLE's higher scores in trial 1 may be due to the novel nature of the challenge. Lastly, COLE showed improvements in quality of movement. Researchers rated trial 1 and trial 2 as having no distinguishable coordinated movement patterns. However, in trial 3, COLE showed improvement with a homologous movement pattern while ascending to the top of the log.

Discussion

This study explored the benefits of OT intervention in Natural Settings (NS) for children by examining development in the areas of self-regulation, social skills, sensory processing, confidence, and motor skills. Data was collected from a small group of children (n=7) participating in an 8-week outdoor OT program. The results showed preliminary evidence for the benefits of OT facilitated in NS. Overall, the data showed improvement in key areas across parent reports and motor skill measures.

Parent Reports

The areas addressed in the COPM were derived from a previous study (Cohn et al., 2014) who interviewed parents about their goals for their child when seeking OT. Each of the parents in the current study endorsed specific concerns in each area for their child. These areas were believed to be also performance skills that would be addressed in an OT program facilitated in NS. Attending a group OT intervention in NS, like FE, facilitates self-regulation and requires flexibility as challenges arise. There are unique challenges faced in NS and many opportunities to integrate senses and develop motor skills. OTs can utilize NS to provide a just-right-challenge in any area to build a child's confidence. This is similar to findings from previous research that found that children benefit in a range of ways from spending time outdoors. NS allow children the freedom to run, shout, experiment in variable weather conditions, social dynamics, and physical environments, which leads to increased occupational performance and participation in childhood occupations (Li et al., 2019; Park Figueroa, 2020).

Using a modified version of the COPM, the majority of parents reported improvement in average scores addressing self-regulation, social participation, skill development, confidence, and sensory processing. Improvements in ratings of performance were seen in all areas but

ranged for each individual child. Some of the children displayed high or full competence in the initial parent report scores on their COPM. These children were not able to make as much improvement in the post collection data because they were already rated highly. Two children, as further described in vignettes in the results section, made large improvements. The children who started off with much lower ratings were able to make more progress according to scores.

Child Motor Assessments

Overall, group improvements were mixed. The BOT-2 subtests average mean scores of participants improved for both balance and catching. However, large improvements by individuals were not conveyed in the aggregate data due to ceiling effects. One child reached the ceiling score on the first attempt of pre-data collection, giving them no room for improvement within the measure during post-data collection for both balance and catching. Alternatively, other children on their first attempts scored zero seconds or no catches, allowing for more improvement. Most children did show improvements in balance and catching.

The log climb measure was a novel way of looking at children interacting with a naturalistic environment and a more ecologically valid assessment of outdoor play skills fostered in a NS. Children are intrinsically motivated to climb objects and regularly climb logs and trees with no prompting when outdoors with FE. This measure was developed because other standardized measures may not be relevant to capturing the children's ability to play in the outside environment. Extensive data was gathered to create this assessment and it was difficult to determine which areas to compare in order to measure performance improvement. Overall, the data showed that efficiency improved for all the children. Speed, or time it took to climb the log, showed improvement for the children that were able to complete the climb on the first attempt. Additionally, there were documented changes in the quality of movement from disorganized to

an organized and coordinated movement pattern (Cohen, 2018). This aligns with the research that shows NS support more physical and active play and on uneven terrain, which leads to the development of balance and coordination (Little, 2022). FE certainly provided weeks of opportunities to navigate uneven terrain as facilitators regularly encouraged children to climb on and over large natural objects and lead walks through purposefully challenging ground including dry riverbeds and steep off trail exploration.

Overall, researchers examined changes in performance across the whole group but data capturing the group performance was limiting. The significant highlights of performance came from changes seen on an individual level. The data shows that for all motor assessments completed, the older, taller children did overall better to start with and had less room for improvement. The younger, shorter children generally made the most progress in motor skill assessments.

Discussion Summary

The PEO framework emphasizes the environment as a strong change agent that is adaptable. This research suggests that the environment of NS inherently facilitate the transaction between child and the occupation of play. This leads to greater fit and has the potential for transformative change. Naturalistic play environments can be used by OTs instead of, or in conjunction with, indoor clinics. Skilled OT intervention leverages strengths and targets a child's goals. OTs are well suited to skillfully support a child in all the areas researchers measured through the COPM and motor assessments. OT facilitated in NS, which are dynamic and challenging in multifaceted ways, may be greatly impactful on development. The emphasis on using NS as an effective change agent within OT practice has not been explored to its fullest and warrants further research.

Limitations

This pilot study has many limitations with both data collection and interpretation. The main limitation was the small sample size. With only seven participants in this study, there is low statistical power to detect significant changes during the eight weeks and increases probability of type I error. A ceiling effect was encountered on the measures for some children who were older, taller and had more experience in the program. Additionally, lack of complete pre and post data from children and their parents led to even less data. Another limitation is the use of parent reports, as their responses regarding their child may be biased towards wanting improvements, particularly as families paid for FE.

Concerning cost and participants, it is also important to acknowledge that our participant pool was limited to families who sought out OT services in a NS for their child in an after-school program. FE OT services are not covered by insurance, thus the cost of attendance is paid for by families. All participating families lived in the Bay Area and were able to secure transportation to and from NS near Mill Valley regularly during typical working hours. The demographics of the sample can only generalize to a narrow group of relatively affluent families.

Variation in weather was a confounding factor that could have limited the data, especially for the log climb measure. Initial data was collected on a rainy afternoon while the rest of the collection days were relatively dry. Children's willingness to participate, especially the younger group (n=3), varied widely from day to day, with some requiring modifications to testing equipment such as a muddy ball or the facilitator standing beside them. Lastly, some FE attendance was not consistent due to sickness, family emergencies, or conflicting events leading to decreased participation days. Child height greatly impacted a child's ability to complete all

zones in the log climb measure. Shoe type was not controlled for. However, three out of seven children wore the same footwear for both trial 1 and trial 2.

Future Recommendations

Possibilities for future study in this area are numerous. Improvements that could be made were predominantly regarding communication and data gathering. It would be beneficial to develop strategies for getting more complete parent data by having a stronger collaboration with sponsoring organizations. In particular, communication with parents could be supported and followed up on by both parties. While naturalistic observation of log climbing has promise as a measure, exact measurement techniques need to be re-examined and simplified. Researchers would also aim to gather qualitative measures from children, adding their perspective on their own development and growth in the identified areas.

Implications for Occupational Therapy Practice

The findings from this pilot study serve as a starting point for continued research in the field of occupational therapy regarding interventions facilitated in NS. Additionally, NS have been highly regarded by other health care professionals and integrated into some educational settings, demonstrating the importance of the outdoors on human development. Implications for this research is as follows:

- This study has shown preliminary evidence of the benefits of OT facilitated in NS.
- Private pediatric clinics could utilize local NS in their practice.
- NS inherently and dynamically challenge clients. OTs can skillfully use this naturalistic play environment that is rich in sensory, motor, and social challenges to best support a client's function and growth.

- Pairing the dynamic environment of NS with skilled OT intervention is an under researched topic that warrants further exploration.
- OT facilitated in NS is not feasible for all children and their families due to multiple factors, including funding limitations and geographic accessibility.

Conclusion

The environment of NS with group OT intervention can provide rich opportunities for child development in self-regulation, social skills, sensory processing, confidence, and motor skills. The environment is rich with natural challenges for problem solving, social engagement, sensory and motor activity, and self-regulation opportunities. Meeting these challenges can lead to a greater sense of confidence. Playing in NS and using natural objects support the development of cognition and function as well as the ability to handle stress (Hanscom & Schoen, 2014). In the literature it is evident that outdoor settings coupled with OT services have a wide array of positive impacts on a child's development. This study is aligned with previous literature showing the benefits of therapeutic engagement in natural environments. Information gathered from this study further supports the use of OT interventions provided in NS by contributing to the growing field of occupational therapy, providing new opportunities and insights for therapists.

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Appendix A: Modified COPM Areas

Modified COPM Areas of Focus
<p>Self-Regulation</p> <ul style="list-style-type: none"> • Planning & Organizing (games, tasks) • Initiation of Tasks (homework, play, games) • Flexibility (change and ability to adapt)
<p>Social Participation</p> <ul style="list-style-type: none"> • Friendships (maintaining, making new friends) • Group Interactions (participation in groups) • Interaction with Family (conversations/participation)
<p>Skill Development</p> <ul style="list-style-type: none"> • Gross Motor Skills (large body movement) • Visual Motor Skills (hand-eye coordination) • Self-Care Skills (dressing, feeding, hygiene, bathing)
<p>Confidence</p> <ul style="list-style-type: none"> • Willingness (to try new things) • Participation (in school, play, activities) • Self-Esteem (belief in self to complete tasks)
<p>Sensory Integration</p> <ul style="list-style-type: none"> • Tactile (response to touch) • Vestibular (movement & balance) • Proprioception (awareness of body movement and orientation)

Appendix B: Demographic Data Collected via Parent Registration Form

Demographic Data Collected via Friendship Explorations Parent Registration Form

Child's Name
Birth Date
Grade Entering
Gender
Strengths
Previous Outdoor OT (Friendship Explorations or other)
Previous OT
Concurrent OT services outside of FE
Length of OT services
Additional Services (ex: PT, SLP, Feeding, ABA, other)
Language(s) Spoken at Home
Number of Siblings

Appendix C: Picture of Log Climb Site with Zones Designated



Appendix D: Log Climb Observation Scoring Sheet

PROCEDURE: Review video for best trial out of a maximum of 3. Record timestamps for each zone and time spent in each zone for a selected trial. Watch video data at slowed speed. Record number of touch points for Touch Point Qual section. Type out observations in short answer sections. Write an “x” when a category is observed in each zone. Consensus must be reached for each item within the group of assessors.

Assessor Names:

CHILD CODE:		Trial being assessed:			Child's total # of tries:			
Categories		Zone 1 A	Zone 2 A	Zone 3 A	TRNS	Zone 3 D	Zone 2 D	Zone 1 D
Type of Shoe (Barefoot, Socks, Rain Boots, Tennis Shoes, Hiking Shoes)								
Time stamp in each zone								
Time in each zone								
Touch Point Quality	Hand							
	Forearm							
	Foot							
	Knee							
	Bottom							
	Trunk							
Body Pattern	Push Pattern							
	Pull Pattern							
Body	Neck Position Up							

Orientation	Neck Position Neutral or Down							
	Visual Alignment / Orientation to End Goal							
	Trunk rotation (Y or N=pivot)							
Body Posture	Supine							
	Prone							
	Standing							
	Sitting							
	Quadruped							
	Reverse Quadruped							
Movement Pattern	Homologous							
	Homolateral							
	Contralateral							
	Disorganized							
Confidence	Self Positive Talk							
	Self Negative Talk							
	No Self Talk							
	External Positive Talk							
	External Negative Talk							
	Outside Stimulation							

Confounding Factors (Weather, Injuries, distractions, cueing)				
Observation Notes (strategy: trial/error, planning)	Zone 1			
	Zone 2			
	Zone 3			



This version of the Log Climb Observation Scoring Sheet is under a [Creative Commons CC-BY 4.0 license](https://creativecommons.org/licenses/by-nc/4.0/) that allows reusers to distribute, remix, adapt, and build upon the material in any medium or format for noncommercial purposes only, and only so long as attribution is given to the creators.