THESIS

THE EFFECT OF AN INTENSIVE, OUTDOOR CAMP ON BEHAVIORAL REGULATION AND PRAXIS IN CHILDREN

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ABSTRACT

THE EFFECT OF AN INTENSIVE, OUTDOOR CAMP ON BEHAVIORAL REGULATION AND PRAXIS IN CHILDREN

Background: Behavioral regulation and praxis skills are both crucial to childhood participation and performance in occupation. Behavioral regulation is the ability to employ executive functions in order to regulate, monitor, and adapt behavior to interact within the environment. Praxis is the ability to recognize object and environment affordance, develop an idea for action, plan the action, and then perform it. It is reflected by successful interactions with people and things in the environment. Purpose: This study examined the impact of a 5-day outdoor camp with integrated occupational therapy supports on behavioral regulation and praxis in 36 children with sensory processing, praxis, and behavioral challenges. Methods: Pre-test/post-test retrospective cohort design. Data were drawn from two parent-report questionnaires completed 3 months pre and 3 months post camp: the Behavior Rating Inventory of Executive Function-2 (BRIEF-2) and the Sensory Processing Measure (SPM). Findings: Linear mixed modelling revealed an association between behavioral regulation and praxis throughout the 6-month timespan. Paired samples *t*-tests showed significant change in praxis, and positive non-significant change in behavioral regulation. Implications: Practitioners should consider contexts and factors contributing to children's praxis and behavioral regulation skills, as well as the interface between the two characteristics. The use of outdoor camps should be considered in occupational therapy intervention for enhancing children's praxis, as well as participation and performance in occupations.

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CHAPTER 1: INTRODUCTION

Outdoor summer camps are a typical childhood experience that multiple investigators have shown to benefit child self-esteem, physical activity, positive behavioral changes, self-regulation, social skills and participation, academic and future workplace readiness, play, cognitive and physical skills, and (Frainšic et al., 2016; Halsall et al., 2016; Henert et al., 2021; McCurdy et al., 2010; Thurber et al., 2007; Uhls et al., 2014; Wilson & Sibthorp, 2018). Unfortunately, a majority of outdoor camps target typically developing children. While camps inclusive to children with disabilities exist, these tend to be diagnosis-specific (e.g., only for children with diabetes) (Browne et al., 2019). Consequently, camps catering to the needs and inclusion of children with broader behavioral and sensory challenges are limited (Clark & Nwokah, 2011). This is unfortunate as researchers have shown that outdoor camps can be beneficial to children of a variety of abilities, and although few have adequately explored the impact of outdoor camps on children with behavioral and/or sensory challenges (Browne et al., 2019; Clark & Nwokah, 2011; Frainšic et al., 2016; Hantson et al., 2012; Henderson, 2018; Henert et al., 2021; McCarthy, 2015; Sendak et al., 2018; Wozencroft et al., 2019)

Behavioral regulation is crucial to performance and participation in human occupations (Aro et al., 2012; Duncan et al., 2017; Sektnan et al., 2010a). While inconsistently conceptualized in literature, behavioral regulation can be defined as the ability to regulate and monitor behavior effectively through use of executive functions (Gioia et al., 2015). Executive functions are a collection of higher cognitive processes that support goal-directed behavior, cognitive development, learning, problem-solving, and emotional and behavioral regulation (i.e., working memory, shifting, inhibition, emotional control, initiation, planning and organizing,

self-monitoring, organizing of materials) (Gioia et al., 2000). Of this array of cognitive functions, researchers generally concur that inhibitory control is the prominent executive function influencing behavioral regulation (Becker et al., 2014; Gioia et al., 2015; Mcclelland et al., 2010; Petersen et al., 2016). The expression of inhibitory control, or the ability to resist acting on impulses in order to complete goal-directed tasks, matures gradually across development (Gioia et al., 2015; Petersen et al., 2016). Executive function skills, such as inhibition, support behavioral regulation by enhancing control of goal-directed, emotionally related, and socially contextualized behaviors that impact engagement in occupations such as school, play, social participation, and other activities of daily living (Aro et al., 2012; Eisenberg et al., 2000; McClelland et al., 2014).

Behavioral challenges reflect a broad group of concerns related to difficulties with behavioral regulation. Behavioral regulation challenges may be observed as socially inappropriate behaviors that could potentially cause harm to others or oneself, and/or alter community, social, and educational experiences throughout the lifespan (Emerson et al., 2001; Hong & Matson, 2021). Challenges with behavioral regulation in children can create barriers in activities of daily life related to occupations such as school and social participation, self-care, play, and leisure (Romero-Ayuso et al., 2018).

Beyond development, behavioral regulation is also influenced by context and challenges arising from different developmental trajectories. Behavioral regulation challenges may arise as an outgrowth of contextual factors (conditions of living environments, socioeconomic status, parent education levels, and parenting styles) or performance factors related to concerns around such things as sustained attention, planning, or organizing. Karasinski (2015) found relationships between behavioral concerns and performance factors related to Attention Deficit Hyperactivity

Disorder (ADHD), such as challenges with inhibition and externalization of behaviors (self-monitoring). Challenges with behavioral regulation skills have also been identified in other children with neurodiversity, such as autism, developmental disorders, and learning difficulties (Blijd-Hoogewys et. al, 2014). Clinically, the cognitive foundations of behavioral regulation skills and challenges have primarily been studied in laboratory settings (Cameron Ponitz et al., 2008; Mcclelland et al., 2010). Thus, there is a need to study the outward manifestation of behavioral regulation skills in the context of participating in the childhood occupations encountered in real-life situations, in order to further understand this construct. Further, while examining child behavior, the way in which a child takes in the world around them cannot be overlooked, as it is documented that children with challenges processing sensory information frequently demonstrate executive function challenges (John & Mervis, 2010).

Differences with the processing of sensation and the development of motor praxis can lead to disruption with participation and engagement in a manner similar to what has been reported for challenges with behavioral regulation. When a child presents with challenges in processing and/or integrating sensory stimuli, their ability to plan and organize behavior may be negatively impacted (Bundy & Lane, 2020). This phenomenon is explained by the theory of sensory integration, which links observable behaviors with underlying neurological functions (Reynolds et al., 2017). Sensory integration has been defined Click or tap here to enter text.as "the neurological process that organizes sensation from one's own body and from the environment and makes it possible to use the body effectively within the environment" (Ayres, 1972, p.11). Praxis is a core component of sensory integration and is a child's ability to conceptualize, plan, and perform motor actions in order to interact adaptively with the physical environment (Ayres, 1985; Ayres & Cermak, 2011). Praxis is dependent on the integration of

sensation from vestibular, proprioceptive, tactile, and visual systems, which contribute to postural control and balance, knowledge of position in and movement through space, and the ability to perceive affordances in the environment (Ayres & Cermak, 2011).

The term dyspraxia is used to reflect difficulties with ideation, planning, and/or execution of motor tasks (Ayres, 1985; Ayres & Cermak, 2011; Bundy & Lane, 2020; Lane et al., 2019). Dyspraxia may impact participation in all childhood occupations requiring a component of motor planning such as play, social participation, education, instrumental activities of daily living (IADLs), and activities of daily living (ADLs) (Bodison, 2015; Kinnealey et al., 2012; O'Brien & Kuhaneck, 2019). Researchers have examined aspects of dyspraxia in children with autism, developmental coordination disorder, ADHD, Down syndrome, and other motor coordination deficits, but research into dyspraxia in the absence of specific medical diagnoses is limited (Fidler et al., 2005; Lane et al., 2019; Miller et al., 2014; Remigereau et al., 2018; Romero-Ayuso et al., 2020). Interventions with the potential to impact a broad range of praxis and behavioral regulation skills in children should be further explored.

The available literature highlights the importance of behavioral regulation, sensory integration, and praxis in relation to participation and performance in childhood occupations. Researchers have also identified potential benefits of children participating in outdoor camps. Missing from the literature is an understanding of the benefits of outdoor camps that are inclusive to groups of children with a range of sensory, praxis, and behavioral challenges on behavioral regulation. In addition, limited research is available that connects behavioral regulation with praxis yet challenges with both can negatively impact engagement in childhood occupations. We examined how participation in a 1-week, intensive (occupational therapy

supports and interventions), outdoor camp (Camp Jabiru) impacted behavioral regulation and praxis for children with behavioral and sensory challenges.

CHAPTER 2: LITERATURE REVIEW

In this study I will investigate the impact of an outdoor camp on behavioral regulation and praxis skills in children with sensory and behavioral challenges, as well as the relationship between those behavioral regulation and praxis skills. Behavioral regulation manifests from the application of executive functions, including the function of inhibitory control (Cameron Ponitz et al., 2008; Day et al., 2015; McClelland et al., 2010; McClelland et al., 2014). Behavioral regulation is a predictor of performance and participation in childhood occupations such as education, social participation, and play, and has the potential to continue impacting occupations into adolescence (American Occupational Therapy Association, 2020; Aro et al., 2012; Becker et al., 2014; Cameron Ponitz et al., 2008; Day et al., 2015; Duncan et al., 2017; Edossa et al., 2018; Eisenberg et al., 2000; Sektnan et al., 2010; Vernon-Feagans et al., 2016). Another predictor of childhood occupation outcomes is a child's praxis abilities; praxis is a child's ability to create an idea of, plan, and perform motor actions in order to interact adaptively with the physical environment (Ayres & Cermak, 2011). The following summary of the literature addresses each of these elements.

Search terms used in the conduct of this literature review are presented in Table 1. I used the following databases: CINHAL, APAPsycNet, PubMed, OT Seeker. Additionally, I examined pertinent books on child behavior, sensory integration, and praxis/dyspraxia. Finally, I reviewed articles citing prior literature I found, and examined the references included within literature. In this chapter I will highlight the literature that supports this project. The following areas of relevance are reviewed: outdoor camp, praxis, dyspraxia, dyspraxia and behavior organization,

behavioral regulation, behavioral regulation development and challenges, assessing behavioral regulation in children.

Table 1.

Literature Review Search Terms

Participant Population	Intervention	Participant Outcome
ADHD	Camp	Behavioral regulation
Autis*	Outdoor camp	Behavior*
Autism	Nature*	Executive function*
ASD	Outdoor*	Inhibit*
Child*	Sensory Integration	Inhibition
Dyspraxia		Inhibitory control
		Praxis
		Self-regulation
		Sensory integration

Outdoor Camp

Research regarding the impact of camp on youth development dates back almost 100 years. Dimock and Hendry's *Camping and Character* (1929) may have been one of the first studies to document the impact of outdoor camps on youth. These investigators found that a 7-week outdoor camp positively impacted behavior, social participation, self-confidence, and exploration of boy campers. These boy campers were divided into six different age groups, ranging from childhood to adolescence. Outdoor summer camps have continued to be a typical childhood experience that research has shown to benefit child development and occupations such

as: self-esteem, physical activity, positive behavioral changes, self-regulation, social skills and participation, academic and future workplace readiness, play, cognitive and physical skills, and independence (Frainšic et al., 2016; Halsall et al., 2016; Henert et al., 2021; Thurber et al., 2007; Uhls et al., 2014; Wilson & Sibthorp, 2018). For instance, Wozencroft and colleagues (2019) used a qualitative approach to identify the value of an outdoor therapeutic camp for youth (ages 18-21) with more than one disability. Participants in this study had a range of diagnoses (autism, cerebral palsy, Down syndrome, intellectual disabilities) and their responses to interview questions pertaining to camp identified the therapeutic camp as a way to enhance social participation and build self-esteem. Goodwin and Staples (2005) used a phenomenological approach to explore the meaning of YMCA camps among campers (ages 14-19) with disabilities (primarily cerebral palsy) and found that campers felt a sense of community, a sense of independence, and a chance for exploration. Flynn et al. 2019 evaluated seven years of social skills data for children (ages 3-22) with social, emotional, developmental, and learning disabilities that participated in a residential summer camp. Children attended camp for 3-week sessions each summer and were organized into groups of 4 to 5 campers based on developmental age. Researchers found significant improvements in social skills such as: communication, self-control, self-help, positive attitudes, and relationship building (Flynn et al., 2019). Sendak et al. (2018) conducted a systematic review on the impact of camps on youth (ages 16 and under) with chronic illnesses (diabetes, cancer, asthma, visual impairments, and cystic fibrosis). Their findings revealed that, in over 90% of the 425 studies included in this review, participants had significant increases in sustaining positive social relationships and developing characteristics of leadership such as self-confidence. Furthermore, a 2-week therapeutic outdoor camp for children (ages 6-12) with ADHD resulted in significant improvements in behavior, peer relationships,

self-esteem, and overall functioning (Hantson et al., 2012). These collective findings demonstrated that engagement in camp has the potential to support children and/or occupational engagement regardless of child ability. On the other hand, these studies may report outcomes that are beneficial to child development and participation, none report praxis or behavioral regulation skills as outcomes. Additionally, these studies are limited in their diversity of neurotypes and diagnoses, as participants often fit in one diagnostic group or are neurotypical and/or typically developing.

While previous research on outdoor camps and children has focused on transferable skills of daily living and lifelong learning, Henderson (2018) argued that researchers should strive to ask how camps can impact a broad range of occupations for children with varying abilities. This should include children with a range of disabilities and sensory, praxis, and behavioral challenges. While most outdoor camp participants are neurotypical children, there are camps inclusive to children with disabilities or even specific to children with disabilities, but camps specifically catering to the needs of children with broader behavioral, sensory and/or praxis challenges are limited (Browne et al., 2019; Clark & Nwokah, 2011; Flynn et al., 2019; Goodwin & Staples, 2005). Camp Jabiru is an example of one of the few outdoor camps catering to the needs of children with broad range of sensory, praxis, and behavioral differences. Jabiru is loosely based off of another outdoor camp known as, Camp Avanti (Kinnealey et al., 1999). Camp Jabiru employs a model that integrates sensory integration and relationship-based frameworks in meeting the needs of campers. There is a further need to understand how outdoor camps that are inclusive to children with a range of sensory and behavioral differences can impact child characteristics, skills, and development.

Praxis

In order to understand a child's behavior, we must also try to understand how the child takes in the world around them through sensation (Delahooke, 2019). Dr. A. Jean Ayres, an occupational therapist with a background in neuroscience and psychology, conducted decades of research to understand integration of sensation from the body and environment, developing the theory and practice of Ayres Sensory Integration (ASI®) (Bundy & Lane, 2020). Praxis is a core component of ASI® (Lane et al., 2019) and a focus in this study. Praxis is a child's ability to conceptualize, plan, and perform motor actions in order to interact adaptively with the physical environment (Ayres, 1985; Ayres & Cermak, 2011). Praxis is dependent on integration of three core sensory systems: vestibular, proprioception and, tactile; the visual system is also seen as important to praxis (Ayres & Cermak, 2011). Integration of sensation from these systems supports postural control and balance, knowledge of position in and movement through space, and the ability to perceive affordances in the environment.

Praxis is composed of three components: ideation, planning, and execution (Lane et al., 2019). Ideation is the cognitive process of developing an idea for an action and the means to achieve that idea (Ayres, 1985). Ideation is conceptualized as an outgrowth of the interactions of the person with the object(s) or the environment, and an understanding of the affordances of both (May-Benson, 2001). Motor planning is the process in-between ideation and execution through which an individual consciously structures a plan of action before executing (implementing the plan) the motor action (Ayres & Cermak, 2011). Praxis is critical to all day-to-day tasks, but is most clearly seen with novel tasks (Parham et al., 2007). A child's ability to climb on the monkey bars at a playground is an example of a novel task involving praxis. First, the child looks at the monkey bars and attempts to develop an idea of what to do based on the structure and their

own skills. In this stage of ideation, the child may be taking into consideration the number of other children nearby, the available space, and the structure itself. The child may also consider the actions of other children on the monkey bars that may help model movement. After constructing an idea for action, the child then plans at the start and throughout execution of the task, making subtle but needed adjustments as the action unfolds, determining how much to reach, which hand to place where and which foot to place where. Praxis is dynamic and is indirectly observed through the final component of execution.

Dyspraxia

Dyspraxia is conceptualized as being developmental in nature, and as linked to challenges with the integration of sensation, the construction of an idea for motor interaction within the environment, and/or the planning of this interaction.(Ayres, 1985; Ayres & Cermak, 2011; Bundy & Lane, 2020; Lane et al., 2019). In terms of ideation, children with dyspraxia may have to engage cognitively to understand what actions are needed to perform a task, even if they have performed it previously (Christmas & van de Weyer, 2019). When thinking back to the example of a child on the monkey bars, the child needs to be able to process internal sensations and understand their own body's potential. Further, the child also needs to understand their environment and the affordances within it to be "practic". The monkey bars within the environment offer a surface and path for climbing, but they could also be slippery or far apart. This part of ideation may be challenging for children with dyspraxia as they may have to think through the action they are attempting to perform at the expense of the task at hand, impacting both motor planning and execution (Christmas & van de Weyer, 2019). Dyspraxia occurs due to challenges in processing sensory information such as vestibular, proprioceptive, auditory and visual, and tactile sensations (Achenbach & Ruffle, 2000; Christmas & van de Weyer, 2019;

Miller et al., 2014). These sensory systems inform motor systems, meaning when processing sensation is challenged appropriate physical responses (ability to coordinate motor actions) may also be impacted (Bodison, 2015; Christmas & van de Weyer, 2019; Miller et al., 2014).

Prior to the neuroimaging technology related to motor performance and planning that has informed praxis today, Ayres grounded her understanding of dyspraxia using literature relating to apraxia (Lane et al., 2019). The term, dyspraxia, stands in contrast to apraxia, which is the loss of the ability to carry out previously routine motor functions (Swain, 2020). While research specifically on dyspraxia remains limited, this construct has been explored within children experiencing different motor planning challenges: children with autism, developmental coordination disorder, ADHD, Down syndrome and other motor coordination deficits (Fidler et al., 2005; Lane et al., 2019; Miller et al., 2014; Remigereau et al., 2018; Romero-Ayuso et al., 2020). Gibbs et al. (2006) noted that while children with dyspraxia may have difficulty with learning, behavioral regulation and/or attention, and they may present with other diagnoses, these factors should be considered as comorbidities and not "integral parts" of dyspraxia. Being that praxis is necessary for all tasks, dyspraxia has the potential to impact all of children's occupations such as, but not limited to, education, play, and activities of daily living (Ayres & Cermak, 2011; Bodison, 2015; Christmas & van de Weyer, 2019; Kinnealey et al., 2012; Miller et al., 2014).

Dyspraxia and Behavior Organization

Individuals with dyspraxia commonly experience challenges with occupational engagement (Bundy & Lane, 2020). Bundy and Lane (2020) created a complex schematic representation of sensory integrative dysfunction expanding upon Ayres' original theory and schematic representation (cite). In Bundy and Lane's (2020) schematic representation,

hypothesized relationships are illustrated between "sensory systems and behavioral manifestations of sensory integrative dysfunction" (p. 7). Figure 1 is to be read from the center column outward, where sensory modulation or reactivity challenges are presented on the left, and poor sensory integration and praxis indicators are represented on the right. Ayres (1972) suggested that individuals with poor praxis have common outcomes with abstract "behavioral consequences"; this is made explicit in the Bundy and Lane model (2020) . For reference, Bundy and Lane (2020) indicate, in the farthest right column of the schematic representation, impacts that inadequate praxis may have on occupation (poor self-efficacy/self-esteem, clowning, avoidance of engagement in motor activities, poor motor coordination, poor organization, and sensation seeking). These observed behaviors or abstract constructs serve as meaningful way to communicate the potential indicators of poor praxis which are unable to be readily observed (poor postural-ocular control, poor sensory discrimination, and poor body scheme) (Bundy & Lane, 2020). It should be noted that behaviors, such as "clumsiness", by themselves are not indicators that a child has dyspraxia (Bundy & Lane, 2020).

Ayres and Cermak (2011) argued that "the importance of praxis to the organization of behavior cannot be overemphasized" (p. 47). Further, praxis allows us to connect the elements of our "physical world and of our physical and intellectual selves" in order to act with purpose on and within our world (Ayres & Cermak, 2011). Disorganized behavior is commonly correlated with dyspraxia (Ayres & Cermak, 2011). Children with dyspraxia may have differences in behavioral characteristics such as poor self-efficacy and/or self-esteem potentially connected to difficulties with motor coordination activities or perceiving themselves as less than others with "good" motor skills (Bundy & Lane, 2020; Engel-Yeger & Hanna Kasis, 2010). Stephenson and Chesson (2008) found that of 28 children who reported persisting motor difficulties after 6 years

of age, 22 were also identified as having behavioral and emotional concerns. Behavioral manifestations identified during parent interviews included anger, frustration, unhappiness, depression, low self-esteem, embarrassment, and shyness (Stephenson & Chesson, 2008). In addition to internalizing behaviors such as anxiety, depression, and low self-esteem, Cairney, et al. (2010; 2013) found that children with dyspraxia show difficulty externalizing behaviors for example presenting with co-occurring symptoms of ADHD. Children with dyspraxia are generally aware of both their motor abilities and limitations, possibly because the dyspraxia impacts their self-esteem and self-efficacy. As a result, children identified as having dyspraxia often avoid daily physical activities which, in turn, impacts their engagement in meaningful occupations.

Increasing evidence indicates that deficits with executive functioning, behavior organization, and behavior regulation are concomitant with dyspraxia, even if the child has no medical diagnosis (Green& Payne, 2018). Motor challenges alone are not the only factor impacting behavioral organization and regulation in children. Green and Payne (2018) argued that environmental influences (low SES), psychosocial contexts (mental health considerations), and cognitive functioning (executive function skills) are part of the transactional relationship between the person, activity, and environment that can add to the understanding of behavioral organization and regulation in those with dyspraxia. Researchers have found that children with dyspraxia as young as 5 years of age have more frequent experiences with bullying, adding to the contextual experiences that may influence behavioral organization in those with dyspraxia (Bejerot & Humble, 2013; Cairney et al., 2013; Cocks et al., 2009; Piek et al., 2005). Lingam et al. (2009) suggest that factors such as low SES, low birthweight, and premature gestational age have the potential to further impact behavioral regulation in children with dyspraxia. This is of

relevance as researchers have found that these personal factors have the ability to also impact executive functioning in general (Blair & Raver, 2015; Vernon-Feagans et al., 2016). Further, Toussaint-Thorin et al. (2013) completed a study researching executive functions of children with developmental dyspraxia using multiple neuropsychological and ecological assessments. These investigators found that it was common for children with dyspraxia to exhibit executive function (EF) challenges, specifically with the following EF processes: working memory, planning and organization, self-monitor, and inhibition. The literature suggests a possible relationship between praxis and executive functioning, as well as behavioral regulation which is also a manifestation of EF abilities.

Behavioral Regulation

Behavioral regulation is a complex cognitive function that is inconsistently defined in literature. Several investigators (Edossa et al., 2018; Eisenberg et al., 2000; McClelland et al., 2014) indicated that behavioral regulation is an overt and intentional application of multiple EF functions. Executive functions are well-defined, higher cognitive processes that allow us to adapt behavioral responses to our changing environments (Bar-Ilan et al., 2018; Brown, 2021; Delahooke, 2019; Gilbert & Burgess, 2008; Miyake et al., 2000). Further, EF skills support behavior regulation by enhancing control of goal-directed, emotionally related, and socially contextualized behaviors during experiences such as asking a peer to share rather than taking a toy from them or waiting to be called on in class before giving an answer (Aro et al., 2012; Eisenberg et al., 2000; McClelland et al., 2014).

Behavioral regulation has also been categorized as a facet of self-regulation. Self-regulation requires EF skills in order to allow for the abilities of self-monitoring and goal-directed behavior (Hofmann et al., 2012). Self-regulation has been approached as either

unidimensional or multidimensional, where facets (i.e., behavioral regulation and emotional regulation) are defined differently (Edossa et al., 2018). Unidimensional perspectives, such as that proposed by Berkman et al. (2012), conceptualize self-regulation as a "domain general" resource, where self-regulation is singular, limited, and shared across cognitive, behavioral, and affective domains. This unidimensional perspective has been criticized for failing to recognize that, while behavioral and emotional regulatory systems are related, they are also distinct in their value to self-regulation and executive functioning (Edossa et al., 2018; Eisenberg et al., 2000) The leading opinion among researchers is that self-regulation is a multi-dimensional construct that includes elements of emotional, cognitive, and behavioral regulation (Mcclelland et al., 2010).

McClelland and colleagues (2010) proposed that behavioral regulation emerges from EF skills such as attention, working memory, and inhibitory control. Similarly, Gioia et al. (2015) authors of the Behavior Rating Inventory of Executive Function, Second Edition (BRIEF-2), include the executive functions of inhibitory control as well as self-monitoring within a behavioral regulation index. Inhibitory control, or inhibition, is a widely researched domain of executive functioning that is related to behavioral regulation and self-regulation. Inhibitory control is the ability to resist acting on impulse or ignoring irrelevant stimuli in order to stay on-task (Gioia et al., 2015). The capacity to inhibit impulses differs across developmental age groups (Petersen et al., 2016). For example, one may expect school-age children, more so than toddlers, to inhibit impulsive movements during games such as "Simon Says". Simpson and Carroll (2019) suggested that different tasks in childhood require varying "amounts" of inhibition. For example, while a toddler may be able use "smaller amounts" of inhibition to search and engage with toys, "larger amounts" of inhibition are required for various school-age

games. When examining behavioral regulation in children, the development of executive functioning should be considered.

Behavioral Regulation Development and Challenges

A child's ability to regulate behavior is an outgrowth of both age-related brain development and experiences demanding routine use of executive functions. While a child may seem to be "misbehaving," it is possible the child is developmentally unable to withhold impulsive responses (i.e., "control" their observable behaviors) (Delahooke, 2019). Regulation of behavior is thought to manifest as children's executive functions expand throughout early brain development (critical periods of neuroplasticity) and in light of environmental influences (Vernon-Feagans et al., 2016). Childhood, specifically the preschool years, is a sensitive period in which experiences strongly influence the development of executive functioning (Masten & Barnes, 2018; Valcan et al., 2018; Zelazo & Carlson, 2012). This may be due to demands on executive functioning increasing in complexity during this age (i.e., transitioning into school) (Zelazo & Carlson, 2012). Dowsett and Livesey (2000) found that children's ability to regulate behavior, such as inhibiting of impulses, can be attributed to age-related development of the prefrontal cortex. These investigators also found that this regulation of behavior could be enhanced by experiences with tasks that require practice of EF skills (Dowsett & Livesey, 2000). It is important to note that the transition into and through adolescence continues to represent a critical period of neural plasticity where executive functioning skills are still maturing (Masten & Barnes, 2018; Petersen et al., 2016; Valcan et al., 2018; Zelazo & Carlson, 2012).

Challenges with EFs influence behavior regulation and further impact childhood participation and performance in occupations and activities such as school readiness, social skills, adaptability, etc. (Blair & Raver, 2015; Hong & Matson, 2021; Masten & Barnes, 2018;

Vaidya et al., 2020; Valcan et al., 2018). Behavioral regulation challenges are considered socially inappropriate behaviors that could potentially cause harm to others or oneself, and/or alter community, social, and educational experiences throughout the lifespan (Emerson et al., 2001; Hong & Matson, 2021). As previously noted, behavioral regulation is influenced by the context of one's environment. Studies have shown that contextual experiences impacting the development of behavioral regulation include such things as conditions of living environments, socioeconomic status, parent education levels, and parenting styles (Blair & Raver, 2015; Valcan et al., 2018; Vernon-Feagans et al., 2016). Valcan et al. (2018) found that positive, safe living environments fostered by positive parental behaviors enhance children's EF, versus stressful, lonely environments with negative parental behaviors restricting cognitive development. In addition to context, behavioral regulation may also be influenced by specific skill deficits resulting from certain diagnoses (Hong & Matson, 2021).

Regulation and EF challenges have been linked to characteristics of diagnoses/neurotypes such as attention-deficit hyperactivity disorder (ADHD), autism, and other learning and developmental disabilities (Eisenberg et al., 2000; Vaidya et al., 2020; Valcan et al., 2018). It is estimated worldwide that 1 in 160 children have a diagnosis/neurotype of Autism while 7.2% of the world's population, aged 18 and under, are diagnosed with ADHD (CHADD, 2020; WHO, 2021). Studies have shown EF challenges are core deficits in both diagnoses. Researchers have clearly connected ADHD with explicit EF domains of inhibition, attention, working memory (Bar-Ilan et al., 2018; Hantson et al., 2012; Lee et al., 2021; Tye et al., 2014), whereas literature linking autism and EF deficits have contrasting findings. Johnston et al. (2019) found that a sample of autistic adults did not demonstrate a significant relationship between EF impairments and autism (Johnston et al., 2019). However, several investigators found challenges

with EF to be consistent in autistic children including but not limited to EF domains of attention, working memory, inhibition, planning (Lee et al., 2021; Margari et al., 2016; Tye et al., 2014; Vaidya et al., 2020). It is important to note that research has shown a high co-occurrence of ADHD symptoms or diagnosis/neurotype among autistic children (Leitner, 2014). The high prevalence of comorbidity of ADHD and autism, along with overlapping challenges reported within certain EF domains between the two diagnoses emphasizes the need to further understand how various challenges children experience may specifically impact behavioral regulation skills.

Assessing Behavioral Regulation in Children

The difficulty defining behavioral regulation may be an outgrowth of the tools used for assessment. There are various approaches to measuring behavioral regulation in children, including parent/teacher ratings, indirect measures, and direct measures. Each of these methods may have limitations such as inter- or intra-rater reliability, relevance to school or home settings, or poor construct validity. Parent and teacher rating measures such as the Children's Behavior Questionnaire (Putnam & Rothbart, 2006) or the Child Behavior Checklist (Achenbach & Ruffle, 2000) may impact inter-rater reliability (parent vs. teacher) among rating observable behaviors. This may be due to differences in the behaviors that parents and teachers see for a given child due to the context of the environment in which they observe the child. Additionally, direct measures such as the Head-Toes-Knees-Shoulders Task, a 5 to 7 minute task measuring behavioral regulation and EF as a predictor of academic achievement, may not capture levels of variability in children from various demographic backgrounds (Gonzales et al., 2021).

The BRIEF-2 is a well-known rating scale that gathers parent and teacher responses to questions about a child's (between ages 5-18) behaviors related to EF (Gioia et al., 2015). The BRIEF is intended to be used with any child with self-regulation concerns including children

identified as autistic or children with attention disorders, learning difficulties, depression, brain injuries, developmental disorders, and other medical conditions (Gioia et al., 2015, p.1). The measure includes clinical scales, each of which represents a construct of executive functioning (e.g., inhibit, self-monitor, shift) (Gioia et al., 2015). These scales are grouped into three indices; of interest for this study is the Behavioral Regulation Index (BRI) (Gioia et al., 2015). With the nature of ambiguity surrounding the construct of behavioral regulation, and for the purposes of this study, our definition of behavioral regulation aligns with that of Gioia et al. (2015). The BRI is composed of two scales, the Inhibit scale, reflecting the ability to not act on impulse at appropriate times, and the Self-Monitor scale, reflecting the ability to understand the impact of one's own behavior on the people around them, their environment, and other outcomes (Gioia et al., 2015). Inhibiting is useful in goal-directed behaviors where children may need to resist distractions or withhold inappropriate or inappropriately timed behaviors (Carlson & Moses, 2001; Miyake et al., 2000). Self-monitoring allows one to learn from their experiences and allows opportunities to employ other executive functioning skills, such as learning from prior consequences to inhibit responses that may offend someone else. The authors also created three scales in an effort to aid examiners in considering the validity of informant (parent/guardian or teacher) responses, specifically assessing inconsistency, infrequency (endorsing items in atypical fashion), and negativity (items endorsed in an unusually negative manner relative to the clinical sample of responses) in the informant response.

Summary of Literature Review

From the supporting literature we can conclude that behavioral regulation, as well as praxis skills, are predictors of childhood occupation outcomes. Children with behavioral and/or praxis challenges may experience challenges with overall daily functioning and participation in

childhood occupations such school, play, and social participation (Ayres & Cermak, 2011; Blair & Raver, 2015; Hong & Matson, 2021; Masten & Barnes, 2018; Valcan et al., 2018). Engaging in outdoor camps has been shown to support behavioral, social, self-esteem, and overall functioning outcomes for children of varying abilities (Dimock & Hendry, 1929; Flynn et al., 2019; Frainšic et al., 2016; Halsall et al., 2016; Henert et al., 2021; Sendak et al., 2018; Wozencroft et al., 2019). While research has given insight into these topics, more evidence is needed to gain further understanding regarding behavioral regulation and praxis, as well as the relationship between them, and the impact an outdoor camp could contribute to them.

Identifying the Knowledge Gaps

Outdoor camps have been shown to support various child outcomes, although there is a lack of literature regarding the benefits of outdoor camps for children with a range of sensory, praxis, or behavioral challenges. While a body of research has contributed common themes in defining behavioral regulation, there is a need for deeper understanding of how behavioral regulation skills can be enhanced in children with behavioral, sensory, and praxis challenges. Additionally, research has explored how behavioral regulation may be influenced by contextual childhood experiences, but there is a need to further understand how challenges, such as dyspraxia, may impact behavioral regulation in children. There is currently limited research examining the potential relationship between behavioral regulation and praxis skills in children. In this research study we will investigate the changes in behavioral regulation pre- and post-camp, as well as examine the relationship between behavioral regulation and praxis. The following research questions are addressed:

1. How does participation in Camp Jabiru impact behavioral regulation in children with behavioral, praxis, and sensory challenges?

2. What is the relationship between behavioral regulation and praxis pre- camp and post-camp?

CHAPTER 3: METHODS

Institutional Review Board/Ethics Committee

Ethical approval was granted from the Human Research Ethics Committee at the University of Newcastle, Australia, #H-2018-0438. Parental consent and child assent were obtained from all participants prior to enrollment in the study.

Research Design

The research design is a pre-test, post-test, cohort study. Parent report data collected prior to and following Camp Jabiru in April 2019 was utilized for this retrospective study. This project is part of a larger study investigating the impacts of Camp Jabiru on childhood occupational participation and performance.

Author's Positionality

As a 2022 Master of Science Student at Colorado State University (CSU), I began Colorado State University's Occupational Therapy (OT) Program and this thesis/manuscript during the COVID-19 pandemic. Inevitably, this means I was unable to participate at Camp Jabiru during my time completing this thesis. While I did not personally attend Camp Jabiru, my thesis advisor, Shelly Lane, committee member, Hannah Burke, both collected data for this study. Additionally, CSU's OT program provides the opportunity to apply to work on a thesis project of interest. I chose to work with retrospective data from Camp Jabiru, as I have held years' worth of camp counselor experiences and always wondered the impact of outdoor camps on child development. Further, I have been diagnosed with ADHD since childhood and have found interest in learning about supports for children with behavioral and sensory challenges.

Due to the multiple perspectives and complexity surrounding terms, theory, and evidence presented in this paper it is important to note the relevance of language we use. In this study, I will be respecting the growing advocacy for neurodiversity. First, I will use identity-first language when referring to autistic individuals, as this has been advocated for by much of the autistic community. For example, instead of using person-first language such as, "person with autism", I will use "autistic person". Additionally, identity-first language is increasingly being used as a means to foster positive social identities and to combat the marginalization of autistic individuals while supporting neurodiversity (Botha et al., 2021; Vivanti, 2020). Autistic individuals, researchers, and parents have called to replace the medical view of defining autism as "atypical" or a disorder, and instead advocating for consideration of a neurodiverse lens (Adams & Young, 2021; Kapp et al., 2013; Pellicano & Houting, 2021). Judy Singer (2017), first introduced the term of neurodiversity in hopes to create recognition surrounding that alike gender, sexual orientation, and ethnicity, humans are also neurocognitively diverse. Walker and Raymaker (2021) argued that viewing autism from a medical paradigm creates an assumption that divergences from societal norms of cognition means that one is "other than normal", "atypical", or embodies a kind of deficit and/or defect. Due to this, I will be not be using language that reinforces misconceptions of "deficits" or "disorders" commonly associated with autistic individuals, and rather focus on the unique strengths, challenges, or differences of each individual or group of individuals.

Another terminology topic of relevance is that of dyspraxia and developmental coordination disorder. The two terms are often used interchangeably within literature, and while similar at their core, there are differences in how these terms are defined (Gibbs et al., 2007; Green & Payne, 2018). For example, while both terms highlight challenges with the process of

motor planning that are developmental, the ideology behind dyspraxia notes that these challenges being associated to sensory integration challenge is foundational, not a possibility. While this review centers around dyspraxia, we also included relevant literature using the term DCD as it is relevant to the population in this study despite the nuances between dyspraxia and DCD.

Participants

All participating overnight campers at Camp Jabiru were invited to take part in this study (n=41). Campers included in this study were 36 children, 9 girls and 27 boys, ranging from 8-12 years of age. Participants had been identified as having sensory and behavioral differences. While they had a variety of primary diagnoses, the majority of participants were identified by their parents as having an autistic diagnosis/neurotype (Table 2). Both Caucasian (n=34) and Asian (n=2) children participated in camp. Campers were predominantly of Australian ethnicity, while other campers were of Asian or European ethnicities.

Table 2

Demographics of Camp Jabiru Overnight Participants

Primary Diagnosis	N	Age Range (Months)	Gender (M:F)
ADHD	2	101-140	1:1
Autism	28	104-155	22:6
SPD	2	123-134	0:2
Other	4	113-134	3:1

Camp Jabiru

Camp Jabiru, conducted in Australia, is held during school holidays (April) in a well-established YMCA camp environment. Camp combines typical YMCA activities with occupational therapy support and intervention throughout the entirety of camp to support camper participation. Camp Jabiru originated 13 years ago and was modeled after Camp Avanti, United States. Camp Jabiru uses a client-centered approach with a staff to camper ratio of (1:1.5) supporting individualized treatment for each child's needs. Campers range in age from 4-12 years and are assigned to groups of 6-10 peers based on age and abilities. Although only overnight campers (who stay at camp for 5 days, 4 nights) participated in this study, other Jabiru campers may attend full-day or a 4-hour partial-day camp, dependent on age and maturity.

Staffing for overnight camp consists of two lead occupational therapists, 2-4 occupational therapy students, a practicum occupational therapist, and one YMCA camp staff per group. At the time of this study, lead occupational therapists (8 total) for the overnight groups had an average of 6.6 years of experience in pediatric occupational therapy (range 2-10 years, SD = 2.56 years). At Jabiru there are also master-level clinical support therapists to mentor one overnight camp group and two-day camp groups each. All master-level clinicians had a minimum of 28 years of experience in pediatric occupational therapy. These clinical support therapists provided clinical reasoning expertise to the daily camp clinical processes.

Typical Camp Day and Occupational Therapy Integration

A typical camp day incorporates YMCA camp activities including crafting, kayaking, canoeing, ropes courses, games, and other cooperative and social activities. Activities of daily living (ADLs) and instrumental activities of daily living (IADLs) are naturally incorporated into the camp day (e.g., toileting, caring for personal hygiene eating meals in groups, transitioning to

other activities, resting). The YMCA camp staff lead outdoor adventure activities with assistance from the therapy team to create a "just right challenge" for each camper. Overnight campers participated in two YMCA activities each day, with therapists planning additional activities throughout the camp day. Therapist-planned activities include such things as water play on a slip and slide, tie-dying, capture the flag and other groups games, and some quiet time.

At Jabiru the practices and foundations of occupational therapy are integrated throughout each day. Therapy teams consider their group's needs and challenges to craft group occupational therapy interventions throughout the day, as well as develop individualized therapy support plans daily for each child. Therapy team members review campers' individualized treatment plans and plan interventions to address goals parents identify for their children. In an effort to keep the intervention process consistent and ensure continuity between therapists working with each camper, a daily log is completed to communicate and document clear intervention plans for each camper.

Therapists familiarize themselves with individual and group needs in order to design activities using occupational therapy theory and models. (ASI®) and the Developmental, Individual Difference, Relationship-based Model (DIR®) models are integrated to support group and individual camper interventions. ASI™ and DIR® are well-known models used in occupational therapy intervention; they are core to Jabiru's model of occupational therapy integration. ASI™ was developed by A. Jean Ayres, PhD, OTR, and emphasizes the importance of understanding sensory integration theory in order to assess and construct interventions for clients who may have challenges with processing sensory information (American Occupational Therapy Association, 2008). The DIR® model uses the developmental capacities (i.e., functional milestones) of children, individual differences in sensory processing, and the relationships and

environment necessary to support nurturing of emotional, social, and cognitive development (Wieder & Greenspan, 2003).

Fidelity

Master clinicians developed a preliminary treatment fidelity tool (Appendix 1) to reflect core elements expected from each therapist with each child, each day of camp. The fidelity tool was completed daily by clinical support staff and practicum therapists, independently. In order to establish adherence to the Jabiru model, fidelity ratings of 80% were expected. Intervention fidelity for one of the groups was <80% on day 1 of camp, but subsequently the 80% threshold was reached for all age groups daily.

Outcome Measures

For this study the focus is on behavioral regulation and praxis skills in children with behavior and sensory challenges. Two parent report tools were used to understand parents' perceptions of child behavioral regulation and sensory processing.

Behavior Rating Inventory of Executive Function; Second Edition (BRIEF-2)

The BRIEF and the revision used in the current study, BRIEF-2, measure children's executive functioning (EF) within the everyday environment of daily life activities (Gioia et al., 2015). Further, they assess how children employ EF to problem-solve in day-to-day life scenarios. These tools include both parent and teacher informant questionnaires. The original BRIEF included 86 items, clustered into eight clinical scales: Inhibit, Shift, Emotional Control, Initiate, Working Memory, Plan/Organize, Organization of Materials, and Monitor. These scales were combined into two indices: the Behavioral Regulation Index (BRI) composed of the Inhibit, Shift, and Emotional Control scales and the Metacognition Index (MI) composed of Initiate, Working Memory, Plan/Organize, Organization of Materials, and Monitor scales. Studies

utilizing exploratory and confirmatory factor analysis indicated that the original BRIEF formed a three-factor model (Donders et al., 2010; Gioia et al., 2002). A three-factor model confirmatory analysis was conducted for the development of the BRIEF-2 in order to determine the best fit of clinical scales into three indices: Behavioral Regulation Index (BRI), Emotional Regulation Index (ERI), Cognitive Regulation Index (CRI). Comparative fit index values ranged from .95 to .99, standardized root mean square residual values ranged from .02 to .05, and root mean square error approximation values ranged from .07 to .13 (Gioia et al., 2015). The findings from the confirmatory analysis supported a three-factor model as an acceptable fit. The BRIEF-2 reflects the three-factor model.

The BRIEF-2 Parent Form is a 63-item questionnaire assessing nine clinical scales of EF. The scales parallel those of the BRIEF, with slightly revised titles: Inhibit, Self-Monitor, Shifting, Emotional Control, Initiation, Working Memory, Planning and Organizing, Organization of Materials, and Task Monitoring. Scales are grouped into the three summary indices previously mentioned: Behavioral Regulation Index (BRI; Inhibit, Self-Monitor scales), Emotional Regulation Index (ERI; Emotional Control and Shift scales), and Cognitive Regulation Index (CRI; Initiate, Working Memory, Plan/Organize, Task-Monitor, and Organization of Materials scales), and one overall composite summary score (Global Executive Composite). For this study's purposes, only the BRIEF-2 Parent Form was used due to the camp setting; the BRI scores were the focus. This index is a representation of a child's ability "to regulate and monitor behavior effectively" (Gioia et al., 2015, p. 37).

The BRIEF-2 is a reliable and valid standardized assessment that includes a behavior rating scale of executive functions in children (Gioia et al., 2015). Validity statistics available for the BRIEF show strong construct validity with the ADHD-IV Hyperactivity Impulsivity scale

with the following correlations: Inhibition ($r = .73$, $p < .01$), Shift ($r = .59$, $p < 0.1$), and emotional control ($r = .56$, $p < .01$). The measure also shows acceptable predictive validity with parent ratings on the inhibition scale predicting 85% of group membership accurately to ADHD, combined type diagnosis (Gioia et al., 2000). The BRIEF-2 has high internal consistency ($\alpha > .90$) for parent forms, specifically the BRI index measured intended constructs with an internal consistency of the clinical sample ($\alpha = .91$) and standardization sample ($\alpha = .90$) (Gioia et al., 2015). Within the parent form, test-retest reliability is acceptable across clinical scales ($r = .81$) and BRI index ($r = .84$). Hendrickson and McCrimmon (2019) noted that while the BRIEF-2 has strong internal consistency, test-retest reliability, internal validity, and concurrent validity, the measure may be susceptible to responder bias due to utilizing observations from parent and teacher informants. However, the BRIEF2 is a commonly used, quick and effective way to measure executive functioning in both clinical and research settings.

The Sensory Processing Measure (SPM)

The SPM provides a unique perspective on children's sensory functioning at home, school, and in the community. Core to the SPM is sensory integration theory (Ayres, 1972), which recognizes that differences or challenges with sensory integration may be impact children's daily activities. The SPM assesses sensory integration challenges of children between the ages of 5-12, and the contributions of these challenges to social participation and praxis (Parham et al., 2007).

The assessment produces 8 norm-reference standard scores: Vision (VIS), Hearing (HEA), Touch (TOU), Body Awareness (BOD), Balance and motion (BAL) which all provide information regarding sensory processing or responsivity, and Social Participation (SOC), Planning and Ideas (PLA), and Total Sensory Systems (TOT) which are higher integrative

function scales informed by the specific sensory scales. For this study I will use the PLA scale, which consists of 9 items that examine a child's praxis abilities. Additionally, this study is based on the SPM Home Form consisting of 75 items completed by a parent or guardian. Each item is rated based on a 4-point Likert scale reflecting frequency of behavior: Never, Occasionally, Frequently, or Always (Parham et al., 2007).

The measure's normative data was gathered with a sample of 1051 typically developing children within the age range of 5-12 years. The SPM Home Form shows strong convergent validity with the Sensory Profile assessment (Parham et al., 2007). Home score scales internal consistency range from α =.77 to .95, with a median of α =.85, while test-retest reliability range from r =.94 to .98, with a median of r =.97 (Parham et al., 2007). The SPM has strong discriminant validity for every scale (0.81-1.25), illustrating its ability to distinguish between typically developing and clinically referred children (Parham et al., 2007). Overall, the SPM is effective for use in a range of educational, clinical, and research settings (Brown, 2021).

Procedures

The parents of all overnight camp participants (n=41) and their child, were invited to participate in the study. Of this, 36 parents consented and child participants assented. Parent questionnaires (BRIEF-2 Parent Form and SPM Home Form) were mailed to all enrolled overnight campers' homes and completed approximately three months prior to camp, providing pre-test data. Follow up measures were mailed to parents approximately three months after camp to collect post-test data.

Data Analysis

We ran paired samples t-tests to determine change in behavioral regulation and praxis pre and post camp. We used a linear mixed model approach to examine a relationship between

behavioral regulation and praxis. Linear mixed modelling takes into account both fixed effects (constant variables) and random effects (unpredictable). This model allows us to examine a relationship between a response variable (PLA) and covariates in our data set(Pinheiro & Bates, 2000). First, raw scores we transformed to Z-scores to allow for the comparison of scores from both measures. The linear mixed model was fit using our praxis variable, PLA, as the dependent variable. Time (pre, post), Zbrief, and Time*Zbrief interaction were included in the model as fixed effects. All data was analyzed using IBM SPSS Statistics (Version 26) predictive analytics software.

CHAPTER 4: JOURNAL ARTICLE

Overview

Background: Behavioral regulation and praxis skills are both crucial to childhood participation and performance in occupation. Behavioral regulation is the ability to employ executive functions in order to regulate, monitor, and adapt behavior to interact within one's own environment. Praxis is the child's ability to recognize object and environment affordance, develop an idea for action, plan the action and then perform it. It is reflected by the child's successful interactions with people and things in their environment. Purpose: This study examines the impact of a 5-day outdoor camp with integrated occupational therapy supports on behavioral regulation and praxis in 36 children with sensory processing, praxis, and behavioral challenges. Methods: Pre-test/post-test retrospective cohort design. Data were drawn from two parent-report questionnaires completed 3 months pre and 3 months post camp: the Behavior Rating Inventory of Executive Function-2 (BRIEF-2) and the Sensory Processing Measure (SPM). Findings: Linear mixed modelling revealed an association between behavioral regulation and praxis throughout the 6-month timespan. Paired samples t-tests showed significant change in praxis, and positive non-significant change in behavioral regulation. Implications: Practitioners should consider contexts and factors contributing to children's praxis and behavioral regulation skills, as well as the interface between the two characteristics. The use of outdoor camps should be considered in occupational therapy intervention for enhancing children's praxis abilities, as well as participation and performance in occupations.

Introduction

Outdoor summer camps are a typical childhood experience that multiple investigators have shown to benefit child self-esteem, physical activity, positive behavioral changes, self-regulation, social skills and participation, academic and future workplace readiness, play, cognitive and physical skills. (Frainšic et al., 2016; Halsall et al., 2016; Henert et al., 2021; McCurdy et al., 2010; Thurber et al., 2007; Uhls et al., 2014; Wilson & Sibthorp, 2018). Unfortunately, a majority of outdoor camps target typically developing children. While camps inclusive to children with disabilities exist, these tend to be diagnosis-specific (e.g., only for children with diabetes) (Browne et al., 2019). Consequently, camps catering to the needs and inclusion of children with broader behavioral and sensory challenges are limited (Clark & Nwokah, 2011). This is unfortunate as researchers have shown that outdoor camps can be beneficial to children of a variety of abilities, although few have adequately explored the impact of outdoor camps on children with behavioral and/or sensory challenges (Browne et al., 2019; Clark & Nwokah, 2011; Frainšic et al., 2016; Hantson et al., 2012; Henderson, 2018; Henert et al., 2021; McCarthy, 2015; Sendak et al., 2018; Wozencroft et al., 2019)

Behavioral regulation is crucial to performance and participation in human occupations (Aro et al., 2012; Duncan et al., 2017; Sektnan et al., 2010a). While inconsistently conceptualized in literature, behavioral regulation can be defined as the ability to regulate and monitor behavior effectively through use of executive functions (Gioia et al., 2015). Executive functions are a collection of higher cognitive processes that support goal-directed behavior, cognitive development, learning, problem-solving, and emotional and behavioral regulation (i.e., working memory, shifting, inhibition, emotional control, initiation, planning and organizing, self-monitoring, organizing of materials) (Gioia et al., 2000). Of this array of cognitive functions,

researchers generally concur that inhibitory control is the prominent executive function influencing behavioral regulation (Becker et al., 2014; Gioia et al., 2015; Mcclelland et al., 2010; Petersen et al., 2016). The expression of inhibitory control, or the ability to resist acting on impulses in order to complete goal-directed tasks, matures gradually across development (Gioia et al., 2015; Petersen et al., 2016). Executive function skills, such as inhibition, support behavioral regulation by enhancing control of goal-directed, emotionally related, and socially contextualized behaviors that impact engagement in occupations such as school, play, social participation, and other activities of daily living (Aro et al., 2012; Eisenberg et al., 2000; McClelland et al., 2014).

Behavioral challenges reflect a broad group of concerns related to difficulties with behavioral regulation. Behavioral regulation challenges may be observed as socially inappropriate behaviors that could potentially cause harm to others or oneself, and/or alter community, social, and educational experiences throughout the lifespan (Emerson et al., 2001; Hong & Matson, 2021). Challenges with behavioral regulation in children can create barriers in activities of daily life related to occupations such as school and social participation, self-care, play, and leisure (Romero-Ayuso et al., 2018).

Beyond development, behavioral regulation is also influenced by context and challenges arising from different developmental trajectories. Behavioral regulation challenges may arise as an outgrowth of contextual factors (conditions of living environments, socioeconomic status, parent education levels, and parenting styles) or performance factors related to concerns around such things as sustained attention, planning, or organizing. Karasinski (2015) found relationships between behavioral concerns and performance factors related to Attention Deficit Hyperactivity Disorder (ADHD), such as challenges with inhibition and externalization of behaviors (self-

monitoring). Challenges with behavioral regulation skills have also been identified in other children with neurodiversity, such as autism, developmental disorders, and learning difficulties (Blijd-Hoogewys et. al, 2014). Clinically, the cognitive foundations of behavioral regulation skills and challenges have primarily been studied in laboratory settings (Cameron Ponitz et al., 2008; Mcclelland et al., 2010). Thus, there is a need to study the outward manifestation of behavioral regulation skills in the context of participating in the childhood occupations encountered in real-life situations, in order to better understand this construct. Further, while examining child behavior, the way in which a child takes in the world around them cannot be overlooked, as it is documented that children with challenges processing sensory information frequently demonstrate executive function challenges (John & Mervis, 2010).

Differences with the processing of sensation and the development of motor praxis can lead to disruption with participation and engagement in a manner similar to what has been reported for challenges with behavioral regulation. When a child presents with challenges in processing and/or integrating sensory stimuli, their ability to plan and organize behavior may be negatively impacted (Bundy & Lane, 2020). This phenomenon is explained by the theory of sensory integration, which links observable behaviors with underlying neurological functions (Reynolds et al., 2017). Sensory integration has been defined as "the neurological process that organizes sensation from one's own body and from the environment and makes it possible to use the body effectively within the environment" (Ayres, 1972, p.11). Praxis is a core component of sensory integration and is a child's ability to conceptualize, plan, and perform motor actions in order to interact adaptively with the physical environment (Ayres, 1985; Ayres & Cermak, 2011). Praxis is dependent on the integration of sensation from vestibular, proprioceptive, tactile, and visual systems, which contribute to postural control and balance, knowledge of position in

and movement through space, and the ability to perceive affordances in the environment (Ayres & Cermak, 2011).

The term dyspraxia is used to reflect difficulties with ideation, planning, and/or execution of motor tasks (Ayres, 1985; Ayres & Cermak, 2011; Bundy & Lane, 2020; Lane et al., 2019). Dyspraxia may impact participation in all childhood occupations requiring a component of motor planning such as play, social participation, education, instrumental activities of daily living (IADLs), and activities of daily living (ADLs) (Bodison, 2015; Kinnealey et al., 2012; O'Brien & Kuhaneck, 2019). Researchers have examined aspects of dyspraxia in children with autism, developmental coordination disorder, ADHD, Down syndrome, and other motor coordination deficits, but research into dyspraxia in the absence of specific medical diagnoses is limited (Fidler et al., 2005; Lane et al., 2019; Miller et al., 2014; Remigereau et al., 2018; Romero-Ayuso et al., 2020). Interventions with the potential to impact a broad range of praxis and behavioral regulation skills in children should be further explored.

The available literature highlights the importance of behavioral regulation, sensory integration, and praxis in relation to participation and performance in childhood occupations. Researchers have also identified potential benefits of children participating in outdoor camps. Missing from the literature is an understanding of the benefits of outdoor camps that are inclusive to groups of children with a range of sensory, praxis, and behavioral challenges on behavioral regulation. In addition, limited research is available that connects behavioral regulation with praxis yet challenges with both can negatively impact engagement in childhood occupations. We examined how participation in a one-week, intensive (occupational therapy supports and interventions), outdoor camp (Camp Jabiru) impacted behavioral regulation and praxis for children with behavioral and sensory challenges.

Methods

We conducted a pre-test, post-test, cohort study. Parent-report data collected prior to and following Camp Jabiru in April 2019 were utilized for this retrospective study. This project is part of a larger study investigating the impacts of Camp Jabiru on childhood occupational participation and performance.

Institutional Review Board/Ethics Committee

Ethical approval was granted from the Human Research Ethics Committee at the University of Newcastle, Australia, #H-2018-0438. Parental consent and child assent were obtained from all participants prior to enrollment in the study.

Participants

The parents of all overnight camp participants (n=41) and their child, were invited to participate in the study. Of this, 36 parents consented and child participants assented. Participants included 9 girls and 27 boys, ranging from 8-12 years of age (M =10.3, SD = 1.2). Participants had been identified as having sensory and behavioral differences. While they had a variety of medical diagnoses, the majority of participants were identified by their parents as having an autistic diagnosis/neurotype (Table 3). Both Caucasian (n=34) and Asian (n=2) children participated in camp.

Table 3

Demographics of Camp Jabiru Overnight Participants

Primary Diagnosis	N	Age Range (Months)	Gender (M:F)	Mean ± *SD*
ADHD	2	101-140	1:1	10 ±1
Autism	28	104-155	22:6	10.4 ±1.3
SPD	2	123-134	0:2	10.5 ±0.5
Other	4	113-134	3:1	9.75 ±0.8

Note. M = male; F = female; SD = standard deviation; ADHD = attention deficit/hyperactivity disorder; SPD = sensory processing disorder.

Measures

For this study the focus was on behavioral regulation and praxis skills in children with behavior and sensory challenges. Two parent report tools were used to understand parents' perceptions of child behavioral regulation and sensory processing.

Behavior Rating Inventory of Executive Function; Second Edition (BRIEF-2)

The BRIEF-2 measures children's executive functioning (EF) within the everyday environment of daily life activities (Gioia et al., 2015). Further, it assesses how children employ EF to problem-solve in day-to-day scenarios. The BRIEF-2 is a 63-item questionnaire assessing nine clinical scales of EF. Scales are grouped into three summary indices: Behavioral Regulation Index (BRI; Inhibit, Self-Monitor scales), Emotional Regulation Index (ERI; Emotional Control and Shift scales), and Cognitive Regulation Index (CRI; Initiate, Working Memory, Plan/Organize, Task-Monitor, and Organization of Materials scales), and one overall composite summary score (Global Executive Composite). For this study, the BRIEF-2 Parent Form was

used due to the camp setting; the BRI scores were the focus. This index is a representation of a child's ability "to regulate and monitor behavior effectively" (Gioia et al., 2015, p. 37).

Evidence suggests the BRIEF-2 is reliable and valid (Gioia et al., 2015), with high internal consistency ($\alpha > .90$) for parent forms. The BRI index measured intended constructs with an internal consistency in a clinical sample ($\alpha = .91$) and standardization sample ($\alpha = .90$) (Gioia et al., 2015). Within the parent form, test-retest reliability is acceptable across clinical scales ($r = .81$) and BRI index ($r = .84$) (Gioia et al., 2015). Differences between raters were noted, as inter-rater reliability scores were found to be weak to moderate (Hendrickson & McCrimmon, 2019)

The Sensory Processing Measure (SPM)

The SPM provides a unique perspective on children's sensory functioning at home, school, and in the community. The SPM assesses sensory integration challenges of children between the ages of 5 and 12, and the contributions of these challenges to social participation and praxis (Parham et al., 2007).

The assessment produces 8 norm-reference standard scores: Vision (VIS), Hearing (HEA), Touch (TOU), Body Awareness (BOD), Balance and motion (BAL) which all provide information regarding sensory processing or responsivity, and Social Participation (SOC), Planning and Ideas (PLA), and Total Sensory Systems (TOT) which are higher integrative function scales informed by the specific sensory scales. For this study, the PLA scale was the focus, which consists of 9 items that examine a child's praxis abilities. We used the SPM Home Form, consisting of 75 items completed by a parent or guardian. Each item is rated based on a 4-point Likert scale reflecting frequency of behavior: Never, Occasionally, Frequently, or Always (Parham et al., 2007).

The measure's normative data was gathered with a sample of 1051 typically developing children within the age range of 5-12 years. The SPM Home Form shows strong convergent validity with the Sensory Profile assessment (Parham et al., 2007). Home Form score scales have internal consistency ranging from α =.77 to .95, with a median of α =.85, while test-retest reliability ranges from r =.94 to .98, with a median of r =.97 (Parham et al., 2007). The SPM has strong discriminant validity for every scale (0.81-1.25), illustrating its ability to distinguish between typically developing and clinically referred children (Parham et al., 2007). Overall, the SPM is effective for use in a range of educational, clinical, and research settings (Brown, 2021).

Procedures

Camp Jabiru, conducted in Australia, is held during school holidays (April) in a well-established YMCA camp environment. Camp combines typical YMCA activities with occupational therapy support and intervention throughout the entirety of camp to support camper participation. Overnight campers participated in two YMCA activities each day, with therapists planning additional activities throughout the camp day. Therapy teams consider their group's needs and challenges to craft group occupational therapy interventions throughout the day, as well as develop individualized therapy support plans daily for each child. Therapy team members review campers' individualized treatment plans and plan interventions to address goals parents identify for their children. In an effort to keep the intervention process consistent and ensure continuity between therapists working with each camper, a daily log is completed to communicate and document clear intervention plans for each camper.

Master clinicians developed a preliminary treatment fidelity tool to reflect core elements expected from each therapist with each child, each day of camp. The fidelity tool was completed daily by clinical support staff and practicum therapists, independently. In order to establish

adherence to the Jabiru model, fidelity ratings of 80% were expected. Intervention fidelity for one of the groups was <80% on day 1 of camp, but subsequently the 80% threshold was reached for all age groups daily.

The parents of all participants completed two questionnaires (BRIEF-2 Parent Form and SPM Home Form) approximately 3 months prior to camp, providing pre-test data. Follow up questionnaires were mailed to parents approximately 3 months after camp to collect post-test data.

Data Analysis

We calculated paired samples *t*-tests to determine change in behavioral regulation and praxis pre and post camp. We used a linear mixed model approach to examine a relationship between behavioral regulation and praxis. Linear mixed modelling takes into account both fixed effects (constant variables) and random effects (unpredictable). This model allows us to examine a relationship between a response variable (PLA) and covariates in our data set (Pinheiro & Bates, 2000). First, we transformed raw scores to *Z*-scores to allow for the comparison of scores from both measures. The linear mixed model was fit using our praxis variable, PLA, as the dependent variable. Time (pre, post), Zbrief and Time*Zbrief interaction were included in the model as fixed effects. All data was analyzed using IBM SPSS Statistics (Version 26) predictive analytics software.

Results

No outliers were identified within the data for either questionnaire. Post-SPM PLA score was missing for one child. Little (1988), proposed Missing Completely At Random (MCAR) for multivariate quantitative data to determine if significant differences exist between the means of

different missing-value patterns. The significance (p = .645) of Little's MCAR test indicated the data was missing completely at random.

Paired sample t-tests revealed a significant change in SPM PLA scores (t = 2.426, df = 34, p = 0.021) pre and post camp. Behavioral regulation showed positive change pre and post camp, but this change did not reach significance (t = 0.842, df = 35, p = 0.406). Using linear mixed modelling (LMM) (Table 4), we found evidence of a positive association between ZBRIEF BRI and ZSPM PLA (F =10.145, p = 0.002). These results inform our second question. The estimated slope corresponding to ZBRIEF BRI at Time = 2 is +0.365 and at Time = 1 the slope is +0.297 (Figure 1). There was no evidence of a difference in these slopes, indicating there was not a significant interaction of time and ZBRIEF BRI (F = .302, p = .586) (Table 4). Based on this analysis, we did not find a difference in the relationship between BRI and PLA when comparing pre and post (F = 2.493, p = 0.124). These results further inform our first and second questions.

Table 4

Type III Tests of Fixed Effects[a]

Source	Numerator *df*	Denominator *df*	F	Significance	Estimate
Intercept	1	34.052	.017	.897	-.070
Time	1	34.100	2.493	.124	.177
ZBRIEFBRI	1	64.441	10.145	.002	.365
Time * ZBRIEFBRI	1	35.070	.302	.586	-.068

Note. Dependent Variable: ZSPMPLA = Sensory Processing Measure PLA (praxis) scale scores; ZBRIEFBRI = Behavior Rating Inventory of Executive Functioning

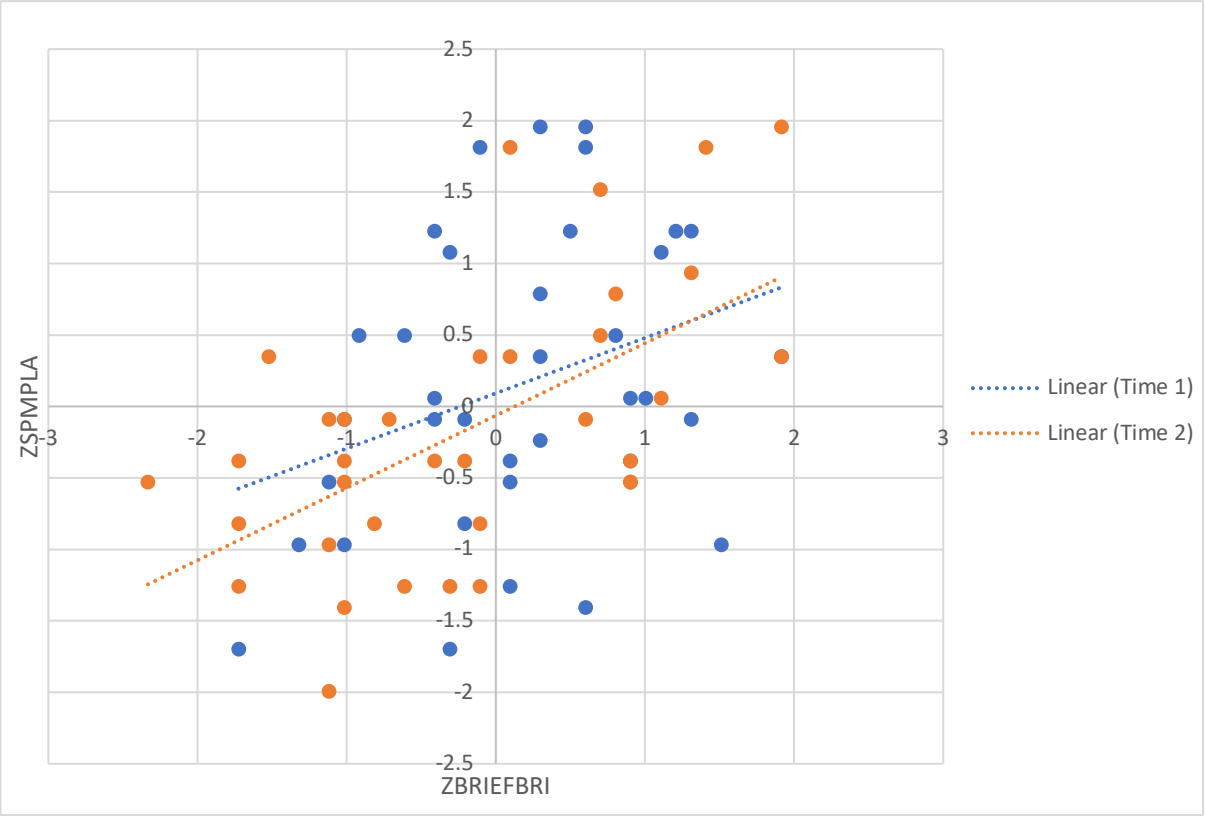

Figure 1

Scatter Plot of Relationship Between BRI and Praxis at Times 1 and 2

Note. BRI = Behavioral Regulation; ZSPMPLA = Sensory Processing Measure Praxis scale Z scores; ZBRIEFBRI = Behavior Rating Inventory of Executive Functioning-2 Behavior Regulation Index Z scores.

Discussion

The aim of this study was to examine how participation in a 1-week, intensive (occupational therapy supports and interventions), outdoor camp (Camp Jabiru) impacted behavioral regulation and praxis for children with behavioral and sensory challenges. Additionally, we sought to determine if there was a relationship between behavioral regulation and praxis pre and post camp. Our results indicate that behavioral regulation and praxis hold a significant association pre and post camp; in fact, changes in behavioral regulation were found to be predictive of changes in praxis. To our knowledge, there is limited to no research surrounding

this particular relationship of these two variables. These findings contrast to some extent with our original hypothesis that was guided by ASI ®. As previously discussed, Ayres and Cermak (2011) argued that "the importance of praxis to the organization of behavior cannot be overemphasized" (p. 47). It was suggested that praxis allows us to connect the elements of our "physical world and of our physical and intellectual selves" in order to act with purpose on and within our world (Ayres & Cermak, 2011). In other words, praxis was hypothesized to be a foundation for overall organization of behavior. Organization of behavior being the organization and integration of sensory inputs which is foundational to motor, cognitive, perceptual, and emotional output (Hebb, 1949). Our results suggest that this unidirectional relationship between praxis and behavioral organization may need to be reconsidered. To our knowledge, when our behavior is dysregulated, we are unable to express coordinated movement, and further are unable to interact with people and our environment the way that is expected. This suggests that behavioral regulation may also be foundational to the organization of behavior. Due the complexity of both praxis and behavioral regulation, the intricacy of their relationship requires further research. Our findings suggests that behavioral regulation and praxis should be investigated beyond their distinct individuality as variables, and further explored as inter-related variables holding an interesting relationship.

In regard to Camp Jabiru's impact on praxis and behavioral regulation, we were able to document significant changes in praxis, but not behavioral regulation. These findings are interesting because the relationship between these variables did not change pre- and post- camp and we found a significant association between the variables. Relative to behavioral regulation, there is no globally agreed upon definition of 'behavioral regulation'. (Edossa et al., 2018; Eisenberg et al., 2000; McClelland et al., 2014). Due to behavioral regulation being

inconsistently defined in literature, it is difficult to understand which measures most accurately capture the phenomenon, as the specific executive functions contributing to behavioral regulation are still debated. For example, researchers generally agree that inhibitory control is the prominent executive function impacting behavioral regulation (Becker et al., 2014; Gioia et al., 2015; Mcclelland et al., 2010; Petersen et al., 2016). Gioia et al. (2015) also recognizes self-monitoring as influencing executive function. However, McClelland et al. (2010) believe attention and working memory contribute to behavioral regulation. Due to a lack of consensus around behavioral regulation and its supporting executive functions, we may have overlooked aspects of behavioral regulation that could have possibly changed from outdoor camp. For example, it is possible that further examination of the Working Memory scale within the Cognitive Regulation Index on the BRIEF-2 should have been taken into consideration in our analysis. Additionally, behavioral regulation is thought to be influenced by a variety of factors external to the child, such as parenting styles, age related brain development, SES, living environments, comorbidities, and parent/guardian levels of education (Blair & Raver, 2015; Valcan et al., 2018; Vernon-Feagans et al., 2016). Controlling or considering these factors may have lessened or provided further understanding of the variability among behavioral regulation results in this study.

Although our findings did not indicate behavioral regulation changes, other research conducted at Camp Jabiru examined performance changes relative to parent-established Canadian Occupational Performance Measure (COPM) (Law et al., 2000) goals; some of these goals were related to executive function and emotional regulation (Stackhouse et al., 2022). Investigators documented significant and clinically meaningful changes between pre- and post-camp performance ratings on many of the goals. Therapist ratings of child performance

supported the parent-rated changes. Goals set by parents on the COPM (Law et al., 2000), are arguably more meaningful to parents or easier for the parents to see change in. This is likely due to these goals reflecting specific behaviors parents would like to see change in, and therefore making change more likely recognizable. Future research could further examine parent established COPM goals in relation to our study's behavioral regulation results.

In previous literature, outdoor camps have been shown to be beneficial in supporting improvements in self-esteem, physical activity, positive behavioral changes, self-control, social skills and participation, academic and future workplace readiness, play, cognitive and physical skills, and independence (Frainšic et al., 2016; Halsall et al., 2016; Henert et al., 2021; Thurber et al., 2007; Uhls et al., 2014; Wilson & Sibthorp, 2018). From our findings, we add that outdoor camp also benefits motor praxis skills in children. The opportunities at camp to engage in novel activities often required children to develop and implement plans for action. Due to this, Camp Jabiru was likely a contributor to increase improvements in praxis abilities in that participants were provided appropriate motor challenges and supported to participate by occupational therapy throughout all activities.

Limitations

There were limitations to the present study. While more than 30 child participants were involved, there was a noteworthy amount of variability in pre- and post- camp scores, especially in regard to behavioral regulation, a larger sample size may have more clearly supported change. Our study did not use performance measures of either praxis or behavioral regulation, but rather we relied on parent report tools which are susceptible to recall bias (Hendrickson & McCrimmon, 2019). However, these tools were used so that data collection did not interfere with camp activities; participants were able to be fully immersed in all aspects of camp rather than

being pulled out of activities for assessment purposes. Another limitation was the absence of a comparison group. Funding and time pose challenges in including a comparison group study given the intense nature of the Camp Jabiru intervention.

Recommendations for future research

In this study we examined the end point of adequate sensory integration (praxis) as well as looking at an end point of behavior (behavioral regulation). We did not dissect the intricacies of praxis. In future research, perhaps examining sensory discrimination and the underpinnings related to praxis abilities would provide more insight to our results. A measure to be considered is the Sensory Integration and Praxis Tests (SIPT) (Ayres, 1996), which is named the gold standard assessment for sensory integration and praxis challenges (Schaaf & Smith Roley, 2006). The SIPT includes 17 tests that assess various aspects of sensory discrimination, perception, reactivity, and the contribution of those to praxis and abilities to participate in everyday life (Ayres, 1996). This tool also looks more deeply at praxis, which would add richness to our understanding of the gains in this area that might be related to participation in camp. As for behavioral regulation, due to the complexity surrounding the definition of the construct itself, it may be useful to look further into other executive functions supporting regulation, such as attention and working memory. Adding a performance assessment to parent report of behavioral regulation might also provide insight into changes in this area. One such assessment is the go/no-go test. Go/no-go tasks measure inhibition, influencing behavioral regulation, as participants typically are asked to perform a quick motor task such as pressing a button on a keyboard when a stimulus is presented on a computer or tablet screen, while also resisting this action for other specified stimuli (Meule, 2017). Future research should consider examination of intervention intensity with outdoor camps, for example 5 days of camp may not be enough time to see an

impact on some participant characteristics. Lastly, further research is needed regarding behavioral regulation's predictive relationship with praxis to better understand the impact these results could have on children.

Implications for practice

The findings of the present study suggest that practitioners should keep an open mind regarding factors that could contribute to children's praxis and behavioral regulation skills, as well as the interface between the two characteristics. Additionally, we found that outdoor camps, such as Camp Jabiru, that integrate occupational therapy supports with a typical summer camp experience, could improve practic skills in children with behavioral regulation and praxis differences. Occupational therapists should consider incorporating outdoor camps, groups, and/or interventions into their practice as a means to enhance children's participation and performance in occupations.

CHAPTER 5: REFLECTIONS

We found that participation in a 1-week, intensive (occupational therapy supports and interventions), outdoor camp (Camp Jabiru) can significantly impact praxis skills in children. This could be due to the amount of opportunities children have at camp to engage in motor movements and novel tasks requiring the development and implementation of planning of actions. This study also provided interesting preliminary evidence for an association between the child characteristics of behavioral regulation and praxis. To our knowledge, no other study has uncovered this type of relationship. This is interesting as we originally hypothesized that improvement in praxis would be a foundation for change in behavioral regulation, but we found the opposite. I believe with the literature and theory that exists it would be reasonable to hypothesize praxis or behavioral regulation impacting one another. Personally, I believe it is reasonable to suggest that if a child is presenting challenges with motor actions, whether that be ideation, planning, or executing that a motor task may be overwhelming and impact a child's ability to regulate their behavior. On the other hand, it also understandable to think that a child who is presenting challenges with regulating behavior may also be too overwhelmed to efficiently ideate, plan, and/or execute a motor task sufficiently. While these are reasonable hypotheses, the evidence we found of a behavioral regulation and praxis association illustrates that we do not have enough evidence to make an explicit conclusion on the relationship.

Evidence in this study did show change in the right direction for the impact of outdoor camps on behavioral regulation, however it was non-significant change. I do not find this positive, yet non-significant change to be surprising, as behavioral regulation is a phenomenon that is still lacking explicit definition. Without full understanding of behavioral regulation

unclear results are plausible as measures may not be accurately capturing the phenomenon. This may be due to lack of consistent definition, overlapping definitions with emotional regulation and self-regulation, as well as lack of consensus surrounding the executive functions that contribute to the phenomenon.

Further research expanding upon our study's results could possibly add to our understanding of sensory processing, cognitive functioning, and human behavior. In addition, further research is needed to understand how outdoor camps can enhance intervention surrounding child development, as well as participation and performance in occupations. I hope this study will highlight the complexity of behavioral regulation and praxis and the interface between the two in order to warrant the need for further research. Additionally, I hope to enhance awareness of the affordances outdoor camp with integration of occupational therapy intervention and supports can have on child characteristics, as well as their performance and participation in occupations.

Personal Reflections

Working on this thesis has provided me a greater understanding of sensory integration, behavioral regulation, as well as executive functioning. It also has highlighted that while I have a greater understanding of these topics, that they all are very complex phenomena that need further exploration. Diving into the complexities of these topics has deeply reinforced the importance of being client-centered and occupation-based in my practice as a future occupational therapist. There is still more to understand regarding neuroscience, human behavior, and the relation to individual performance, participation, and meaning in human occupation. Staying client-centered will allow me as a practitioner to collaborate with each client and family on the unique needs of that particular client whether individually or in a group. While multiple clients I work with in the

future may present differences with praxis or behavioral regulation, this thesis has reinforced that the way each client will experience those differences will be heterogeneous. Likewise, this thesis has further reinforced the principle of keeping my future practice occupation-based. Having this depth of knowledge surrounding childhood behavioral dysregulation, dyspraxia, sensory processing differences, and executive dysfunction, as a researcher alone, makes me curious to understand what interventions can enhance skills pertaining to these challenges. As an occupational therapy researcher and future practitioner, I am curious to how executive function, praxis, sensory processing, and/or behavioral regulation challenges may be impacting the occupations that are meaningful to my clients and can further inform collaborative intervention.

Working on this thesis also challenged my understanding of assessments; there is no measure that gives the full picture of children's behavioral regulation skills, and the use of both performance-based measures and respondent rating scales or questionnaires may be necessary based on the client's personal and contextual factors. I hope to use the BRIEF-2 in the future in conjunction with performance-based measures to try to gain a fuller perspective of what challenges may be impacting my clients' abilities to perform or participate in occupations.

Finally, this thesis has fueled my desire to advocate for emerging practice areas within OT. It is my hope to aid in OT's growth within the nature-based therapy realm. I believe in the affordances the outdoors can provide to humans, in relation to their occupations. I plan to advocate for accessibility in all spaces, especially within community and outdoor environments. To do so, I hope to be involved in further research on occupational therapy intervention in outdoor spaces, combat occupational deprivation or disruption limiting access to outdoor spaces, and emphasize environmental learning. I am grateful for the experience and knowledge I have

gained from this thesis process. I am looking forward to applying what I have learned in my final fieldwork this summer at a nature-based pediatric outpatient clinic.

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APPENDIX A

Camp Jabiru ® Group Number: _____ Date: April ___ 2019 Rater: _____

Camp Jabiru® Fidelity Tool - Group
(Stackhouse, Hacker, Burke, Burke, Lane, 2019)

For the following elements, **rate what happened today** by circling your choice on the provided scale:

1. **a. The team utilized mindful clinical reasoning.**

Strongly disagree Disagree Agree Strongly agree

1. **b. The team made adjustment(s) to the treatment plan based on mindful clinical reasoning through the SpIRiT© model and Jabiru team process.**

Strongly disagree Disagree Agree Strongly agree

2. **The team provided relationship-based intervention.**

Strongly disagree Disagree Agree Strongly agree

3. **The team provided access to meaningful activities.**

Strongly disagree Disagree Agree Strongly agree

4. **The team provided opportunities that promoted a sense of playfulness.**

Strongly disagree Disagree Agree Strongly agree

5. The team **provided** sensory-integration informed treatment including:
   a. **Use/influence of individualized sensory-based input.**

Strongly disagree Disagree Agree Strongly agree

   b. **Activities/interactions that targeted foundations of S-A-M.**

Strongly disagree Disagree Agree Strongly agree

   c. **Activities/interactions that provided a JRC.**

Strongly disagree Disagree Agree Strongly agree

   d. **Activities/interactions that evinced an adaptive response.**

Strongly disagree Disagree Agree Strongly agree

   e. **Frequency, intensity, duration, and rhythmicity of sensation that was purposefully selected and targeted based on clinical reasoning.**

Strongly disagree Disagree Agree Strongly agree

6. **The quality, timing, and consistency of intervention was "intensive."**

Strongly disagree Disagree Agree Strongly agree

7. **The intervention utilized the elements of the STEPSI.**

Strongly disagree Disagree Agree Strongly agree

8. **The social milieu was facilitated to foster belonging.**

Strongly disagree Disagree Agree Strongly agree

9. **The SpIRiT© Model reflected the children's individual profiles.**

Strongly disagree Disagree Agree Strongly agree

10. **Activities/interactions were directed at/to campers goals.**

Strongly disagree Disagree Agree Strongly agree

11. **A daily, individualized intervention for each child and group was written and followed.**

Strongly disagree Disagree Agree Strongly agree

12. **Overall, the camp experience/intervention was a good match for the children and their goals.**

Strongly disagree Disagree Agree Strongly agree

If there were children (one or more) in the group that **did not seem to meet the fidelity standards** for the group (and you rated this on Q11) OR **if you answered "Disagree" or "Strongly Disagree"** to any elements above, describe the discrepancy here. Indicate what **actions** were/will be taken to correct this each day/across the week: