

Proprioceptive Activities to Lower Stress (PALS) Program

by

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ABSTRACT

A history of trauma can affect a child's capacity to express emotions due to the neurological footprints left from neglect and abuse. Oftentimes, children do not have a caregiver as a protector which leaves them vulnerable to harm. In response, children use emotional survival strategies of either flight or fight to adapt to their stressful environment. Occupational Therapy Practitioners (OTP) are positioned to address social and emotional development; however, they often feel ill equipped to address the complexity of trauma and its impact on emotions. OTPs need to look at each sensory system from a nurturing/grounding perspective using movement-based strategies as inroads to address the child's emotional capacity. A sensory integration intervention, Proprioceptive Activities to Lower Stress (PALS), was developed to study the effect on a six-year-old boy's expressions of emotions using a single subject design. Three emotions were measured using a facial analysis system, Noldus FaceReader™. The emotions were happiness, sadness, and neutral. Neutral is defined as the level of emotional detachment. Results indicate a statistically significant improvement in the expressions of happiness and sad post the PALS program.

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CHAPTER 1: CONTEXT AND PURPOSE OF ACTION RESEARCH

When trauma occurs early in life, children do not develop the capacity to regulate their experience...to calm themselves down when they're upset, to soothe themselves, to interact in appropriate ways with other people to learn from their behavior.

(Cook, Blaustein, Spinazzola, & Van der Kolk, 2003)

National and Local Context

The United States (U.S.) Department of Health and Human Services (DHS) estimated that the 1,640 child were fatality victims due to maltreatment in 2012 an average of 31 children per week (U. S. Department of Health and Human Services, 2014). Children under four years of age made up 77% of child fatalities, while 42.4% of the victims were less than one year old (DHS, 2014). In the United States, the annual estimated direct cost of medical care for child victims of treatment (i.e. abuse and neglect) exceeded \$33 billion (DHS, 2014). According to the Adoption and Foster Care Analysis and Reporting System, there were 402,378 children in foster care secondary to maltreatment as of September 30, 2013 (DHS, 2014).

There are over 19,000 children in Arizona foster care system with less than 10,000 beds available in foster homes. Approximately 1500 children are living in group homes and shelters and almost 30 children spend the night in a Department of Child Safety office each night. Every year over 800 children are aging out of foster care without a forever family and the current age that these children are considered unadoptable is older than 7 years old (Foster Arizona, n.d.).

There is a need for more programs and interventions to support the emotional needs of children in the foster care system. Challenging behaviors and emotional distress of the child, as well as the caregiver's own feelings and reactions to the child can be

barriers to developing positive interactions. Incorporating a strength-based framework that is grounded in an understanding of and responsiveness to the impact of trauma on the child's emotions is essential to develop a sense of safety and secure attachment.

Emotional Development

Emotional development (Denham, Ferrier, Howarth, Herndon, & Bassett, 2016) in a child's early years is a predictor for future mental health welfare. Denham et al. (2016) describe emotional competence as a set of skills, which includes emotional expressiveness, emotional knowledge, and emotional regulation. Young children who demonstrate emotional expressiveness skills are able to express a range of emotions to reach a goal. Emotional knowledge is a skill that affords the child to make meaning and articulate feelings of their own emotional state and the emotional feelings of others (Denham et al., 2016). Emotional regulation is defined by the ability to modulate the intensity and timing of feelings in the context of the demands of the social environment.

Caregiver-child interaction is the foremost environment in which emotional regulation begins to emerge (Zeanah, 2000). Thomas, Chess, and Birtch (1968) defined emotional regulation as an attempt to monitor, evaluate, and modify emotions, especially to attain a goal. It involves the maintenance or modification of physiological arousal or internal feeling states. Frequency, intensity, or duration of facial expressions, vocalizations, and actions serve as external signals of the internal state. The Still Face Experiment developed by Tronick, Als, Adamson, Wise, and Brazelton (1978) identified how a non-responsive expressionless mother influenced the infant's behavior. In the Still Face Experiment, the caregiver sat across from the child and after a few minutes displayed a face devoid of facial expressions (still face). The child quickly became

dysregulated (upset, crying, reaching out for the mother) because of the expressionless mother.

Trauma

Traumatic experiences compromise the cortical structure of the brain that controls stress. Research in brain imaging has shown that trauma causes physiological changes in the brain (van der Kolk, 2005) which impact development. Children with a history of neglect, abuse, and other traumatic events can also present with sensory processing issues. There is evidence that examines environmental deprivation and sensory processing problems (e.g., environmental deprivation) with sensory processing disorders, or SPD (Cermak & Daunhauer, 1997). Cermak and Daunhauer (1997) studied environmental deprivation on the development of sensory processing in post institutionalized orphans from Romania. They reported evidence of problems in visual, auditory, tactile, and movement processing. Lin, Cermak, Coster, and Miller (2005) studied children from Eastern Europe adopted into homes in the United States and found that sensory processing function is correlated with length of institutionalization.

Occupational Therapy, Sensory Processing, & Emotional Regulation

Occupational therapy (OT) addresses a child's engagement in everyday activities. A child's readiness to engage in activities is influenced by the ability to self-regulate emotions. OT's provide social-emotional support to children and their families through sensory modulation strategies, targeting families who have experienced trauma. Sensory modulation derives from an understanding of the different sensory systems and each one's impact on the central nervous system. Sensory systems include tactile, vision, taste,

auditory, olfactory, vestibular (inner ear receptors which are stimulated by change in head position), and proprioception (joint and muscle receptors).

Traditionally, occupational therapy practitioners (OTPs) work with children who have SPDs. OTPs evaluate the child and adult's sensory processing system as an entry point to understanding the individual's ability to self-regulate emotions. Sensory integration (SI), a process first described by Jean Ayres (1972), an occupational therapist, is one way of understanding how humans organize and use sensation. According to Ayres (1965), sensory processing is the ability to take in sensory information from the environment and from movement of the body and use this information to plan and organize behavior. One type of SPD is Sensory Modulation Disorder (SMD), which relates to the affective meaning of sensory input. For example, one SMD, tactile defensiveness, is the inability to interpret appropriately the meaning of touch or touch experiences. An individual will demonstrate an avoidance of touch, aversive response to touch, and atypical affective responses to non-noxious tactile stimuli (Fisher, Murray, & Bundy, 1991). There are sensory processing disorders related to perception of sensory stimuli which leads to sensory discriminatory problems. For example, poor tactile discrimination is inability to identify where one is being touched, the temporal and spatial qualities of tactile stimuli. Sensory input is being constantly received from the environment and interpreted by the central nervous system.

Proprioception, defined by Sherrington (1906) as the perception of joint and body movements and position of the body in space, can either be passive or active. Active proprioception is generated by an internal stimulus and passive proprioception is generated by an external stimulus. An example of an activity that facilitated active

proprioception is a child playing and lifts his or her legs against gravity by holding on and swinging from a trapeze. An example of an activity to facilitate passive proprioception is when a child has a toy that vibrates (an external source) and moves the toy up and down his arm. Active proprioception provides more input to the nervous system (Fisher et al., 1991).

According to Shafir (2015), interventions using movement-based strategies for emotional regulation have been studied using Damasio's somatic marker hypothesis. The hypothesis posited that emotions are generated by the brain and body connection via proprioceptive afferent input. This hypothesis posited that the sensory input from motor behaviors related to joint and posture changes during movement causes physiological changes in brain activation patterns. These patterns, according to Shafir, (2015) "represent unconscious emotions and correlate with subjective feelings" (p.231). Shafir (2015) stated that active proprioceptive activities influence hormone levels, chemical synapses, cellular growth (trophic factor), and immune system which decreases stress, distress, and despondency.

Currently, the majority of interventions/ strategies to address emotional regulation center on cognitive processes (Shafir, 2015). Developmental, attachment, trauma, and social learning are additional theories that are commonly used to guide intervention. Some examples of interventions are naming emotions, problem solving, talk therapy, child-parent psychotherapy, etc. It is important to consider how sensory processing impacts social-emotional regulation. Fox and Polak (2004) describe sensory integration as a temperamental related process and one of the ways in which individual differences in personality can be understood. An example is an infant who is overwhelmed by sensory

input which results in behaviors, such as, extreme fussiness. Changing the emotional state through motor behavior, such as, use of active proprioceptive activities can be incorporated to address emotional regulation.

Situation Context

There are an inadequate number of behavioral health service providers in Arizona. The Patient Protection and Affordable Care Act (ACA), signed into law on March 23, 2010, was intended to expand access to health insurance coverage for millions of uninsured Americans by expanding eligibility for Medicaid and developing health insurance marketplaces. The ACA laid the groundwork for OTPs to reclaim a role in mental health settings. Currently, the Arizona Occupational Therapy Association is working towards legislation that would identify OTPs as behavioral health providers. It is time for OTPs to identify best practices in order to better serve the children and families at risk. OTPs can provide individual and/or group sessions that focus on addressing trauma triggers and warning signs; developmental issues related to early childhood trauma; symptom stabilization; and learning new coping, health, and wellness strategies, such as sensory processing-related techniques (AOTA, 2015).

Nonetheless, there is still a tenuous footing for OTPs to address the behavioral needs of a child. OTPs often receive referrals for physical concerns that impact the child's performance in everyday activities rather than emotional concerns. Currently in Arizona, if a client is suspected to have a history of trauma, it is not routine or an expectation of the OTP to necessarily explore the client's trauma history; nor is it the norm to collaborate with other behavioral health specialists about the behavioral needs of the family. A trauma-informed assessment is important to evaluate in order to have

trauma focused outcomes (Child Welfare, 2011). Furthermore, due to the nature of reimbursement for OT, billing codes are attached to the child's diagnosis, which creates a division between child services versus family services.

Personal Context

During the first action research cycle conducted in the summer of 2017, I sought to understand how behavioral health specialists felt about behaviors related to the child's sensory system. A focus group of mental health providers from Jewish Family and Child Services (JFCS) in Phoenix Arizona was conducted. JFCS is a non-profit organization that offers high quality behavioral health and social services to children, families and adults of all ages. Many of the children who receive counseling at JFCS have experienced traumatic events and/or are part of the child services system. According to JFCS counselors, many of the children on their caseloads demonstrate difficulties with emotional self-regulation. Through the focus group of 10 clinicians with varied educational background and years of experience working with children and their families in the child protective system, a central theme emerged. Many of their children with trauma backgrounds demonstrated sensory processing concerns, such as, hypersensitivity to sounds or touch and challenges with emotional regulation.

The second action research cycle was conducted in the spring of 2018. A second focus group of OTP from KidzSPOT Pediatric Therapy in Scottsdale were interviewed in order to get an understanding of the behaviors and interventions with children having a trauma background from an OTP perspective. KidzSPOT is a pediatric outpatient therapy which includes a team of occupational, physical and speech-language pathology therapists. I am currently employed at KidzSPOT. Five KidzSPOT OTPs participated in

an informal group interview. The range of experience working with children who have a history of trauma was one to 30 years and represented 10% of their caseload.

The theme that emerged from this interview centered on referral and reimbursement for this population. The primary reason for referral with children with a history of trauma is delayed motor skills versus addressing the psychological aspects of their behaviors. Due to the reason for the referral, OTPs target motor skills and when they address sensory modulation skills, it is not typically from a trauma focused lens.

Problem of Practice

This problem of practice is that the majority of pediatric OTPs in Arizona feel ill equipped to address children on their caseload who have a history of trauma. OTP's with training in trauma and sensory integration interventions can provide arousal regulation intervention in collaboration with other mental health professionals (AOTA, 2015). The goal for this action research is to develop an intervention protocol focusing on the influence of sensory based proprioception intervention on the child's emotions. The hypothesis is that proprioceptive sensory strategies will have an effect on emotions. The Proprioceptive Activities to Lower Stress (PALS) program was developed as an intervention protocol to test this hypothesis for children who have experienced trauma.

The first hypothesis is that the PALS program will have an influence on the child's emotions. The specific emotions that will be measured are happiness, sadness, and contempt. The second hypotheses is that the PALS program will have an influence on the child arousal state. The child's emotions and arousal will be measured using a software program designed to yield data on these expressions of emotions. The Noldus

FaceReader™ software will be further explained in chapter 3. The research questions are:

RQ 1: What is the impact of the PALS program on the child's emotional states (happiness and sadness) as measured by Noldus FaceReader™?

RQ 2: To what extent does the child's participation in the PALS program influence the child's emotional arousal state as measured by Noldus FaceReader™?

L.S and his family agreed to participate in this study to determine the effectiveness of the PALS program and to test the hypotheses. L.S. had a history of multiple home placements until his adoption in June 2018. I began working with him and his OT over a 15-month period, seeing him 1-2 times per week, until he moved to Virginia in March 2019. L.S. was six years and two months old at the end of the study.

CHAPTER 2: REVIEW OF THE LITERATURE

The previous chapter discussed emotional regulation challenges associated with children who have a trauma history. This chapter includes the theoretical frame and a review of existing literature to guide this action research project. The first section briefly describes the need for research to address the problem of practice. The second section describes the theoretical theories that are currently used to guide interventions with this population.

Background

Adverse Childhood Experience Study

The Adverse Childhood Experiences study brought attention to the link between childhood abuse and neglect and long-term consequences of adult health risks (Felitti et al., 1998). A questionnaire about adverse childhood experiences was mailed to 13,494 adults who had completed a standardized medical evaluation at Kaiser Permanente, with 9,508 (70.5%) responding to the survey. Seven categories of adverse childhood experiences were studied: psychological, physical, or sexual abuse; violence against mother; living with household members who were substance abusers, mentally ill or suicidal, or previously imprisoned. Persons who had experienced four or more categories of childhood exposure, compared to those who had experienced none, had a 4-12-fold increase in health risks for alcoholism, drug abuse, depression, and suicide attempt; a 2-4-fold increase in smoking, poor self-rated health, and a 1.4-1.6-fold increase in physical inactivity and severe obesity.

Trauma

Maltreatment

Trauma events are sudden, unexpected, and extreme. There are two types of trauma: acute and chronic. Acute trauma is a one-time event, such as, a car accident. Chronic trauma occurs when children experience repeated and prolonged traumatic events. Usually these events involve emotional abuse, physical abuse, emotional neglect, physical neglect, domestic violence, and substance abuse, mental illness of a caregiver, caregiver criminal activity or caregiver absence. Child traumatic stress is the physical and emotional response a child has to events that pose a threat to himself or someone important to him.

Neurological Physiological Implications

Previous research has indeed shown an association between the quality of caregiver behavior and adrenocortical (stress hormone) activity in children. Stress is an essentially normal response to feeling overwhelmed or threatened. Fight, flight and freeze are survival responses that developed to protect us from danger. In moments of stress, hormones release and, heart beats, blood pressure, and breathing rate increases. Traumatization is stress frozen in place where one is locked into a pattern of neurological distress that doesn't go away by returning to a state of equilibrium. Traumatization promotes ongoing disability that can take many mental, social, emotional and physical forms (Brandt, Perry, Seligman, & Tronick, 2014). Haley and Stansbury (2003) showed caregiver responsiveness is related to greater emotional and physiological recovery in five and six-month-old infants during an experimental laboratory stressor called the still-face procedure (Albers, Johnson, Hostetter, Iverson, & Miller, 1997). Additionally, it is

important to have a strong understanding in the neurological changes that can occur because of traumatization. Perry and Pollard (1997) used computed tomography (CT) scans to compare the brains of a healthy three year old and a three year old with a history of severe sensory deprivation. The child with sensory deprivation had a significantly smaller than average brain and an abnormally developed cortex.

In many autonomic functions, the sympathetic and parasympathetic systems have opposite effects including acceleration and deceleration of the heart rate, or dilation and constriction of the pupil. Cannon (1915) found that fear, rage and pain tend to result in massive activation of the sympathetic system, a reaction known as the fight or flight response (also called the alarm or stress response). Porges (2011) argued that Cannon made a mistake in his focus on the sympathetic system in relation to emotions, neglecting parasympathetic contributions to emotionally induced cardiovascular reactions.

According to Porges (2011), the parasympathetic innervation of the heart is modulated by affective responses in the brain. According to Porges (2011) when an environment is perceived as physically and/or socially unsafe a fight-flight mode of conduct can occur. This might be evident in aggressive (i.e., and negative) emotions and conduct that is consistent with the metaphor of either attacking or retreating.

Zeanah (2000) posited that it is the limbic system that is the site of development associated with attachment behaviors. The limbic system is a brain structure that supports a variety of functions such as emotions, motivation, memory, new learning, adapt to changes in the environment, among others. Schore (2003) stated, “Evidence to show that attachment experiences, face to face transactions of affect synchrony between caregiver and infant, directly influence the imprinting, the circuit wiring of the orbital prefrontal

cortex” (p.60). The orbital prefrontal region has been implicated to have a relationship with emotions due to its interconnection with the limbic system. Other common functions related to this structure are response inhibition, decision making, and connecting to the autonomic nervous system (ANS; Zeanah, 2000). This structure is especially expanded in the right hemisphere of the brain which is specialized for inhibitory control (Garavan, Ross, & Stein, 1999). The right hemisphere interprets nonverbal information such as gestures, facial expressions, vocal tone (Bowers & Veronen, 1993). Therefore, Schore (2003) stated that the right hemisphere “is centrally involved in what Bowlby described as the social and biological function of the attachment system” (p. 62).

Attachment Theory

Numerous studies have been developed regarding the relationship between attachment, psychiatric disorders, and childhood trauma. Fratto (2016) describes attachment as one of the core domains impacted by exposure to chronic, interpersonal trauma. It is instrumental to integrate attachment theory successfully in the field of mental health, specifically the type of attachment that is observed between the child and the caregiver. The term attachment is characterized by Brandt, Perry, Seligman, and Tronick (2014) as a constellation of behaviors and processes such as,

proximity seeking, distress when separation is not understandable, happiness and reunion, grief/sadness at loss, a secure base behavior (the ability to explore when attachment figure is present), confidence that the attachment figure has an enduring commitment, and capacity for mutual enjoyment. (pp. 97-98)

John Bowlby’s work on attachment theory can be viewed as starting in the 1930’s when he worked in a home for maladjusted boys (Cassidy, 1999). The disruptions of two of the boys’ relationships with their mothers made a marked impression on him. He later published a retrospective examination of these boys (Bowlby, 1988). His observations,

alongside those of others (Bender & Yarnell, 1941; Goldfarb, 1943), convinced him that disruptions in the mother–child relationship could lead to later psychopathology. Bowlby stated that the early relationship with the mother was of great immediate importance to the child as well as being important for later functioning. Along with his colleague, James Robertson, he later noticed that children experienced intense distress when they were separated from their mothers, even if they were fed and cared for by someone else (Bowlby, Robertson, & Rosenbluth, 1952). When he was postulating attachment theory, Bowlby became aware that babies sometimes became attached to people who did not feed them. This differed from the dominant theories (psychoanalytic and social learning) of the time that suggested that ties to the mother were secondary, evolving because she feeds the infant. Being dissatisfied with these traditional theories, Bowlby drew on ideas from many fields including developmental psychology, cognitive science, evolutionary biology, ethology, and control systems theory. Consequently, he postulated a theory that states that childhood attachments are essentially evolutionary, arising from a biologically based desire for proximity that has resulted from a process of natural selection.

Attachment theory highlights the importance of continuity and sensitive responsiveness in the caregiving relationships as key features of the environment of upbringing (Rutter, Silberg, O'Connor, & Simonoff, 1999). It places the caregiver–child relationship within an ethological, cognitive and control systems framework (Bowlby, 1969). The development of selective attachments serves a vital process in that they provide emotional security and protection against stress. Drawing heavily from cognitive psychology, attachment theory also suggests how early processes may carry forward effects of earlier relationships into later life.

Bowlby (1969) proposed that the organization of the attachment behavioral system involves a cognitive component; mental representations of the attachment figure, the self and the environment which are built largely on experiences. Bowlby (1969) referred to these representations as “internal working models”, and explained that they are largely subconscious. He argued that such models allow individuals to anticipate the future, as well as selecting which attachment behavior should be used with a specific person in a given situation. Children have an internal working model (Bowlby, 1988) of how adults will respond, based on their previous experience of how their abusive or neglectful caregivers did or did not respond. Bhreathnach (2008) stated “as a result the child can appear under-reactive (disassociate), collapse (sudden loss of tone), falsify regulation (compulsive compliance), or become impulsive, hyperactive, and aggressive towards self or others” (p.14). The developing sensory system is influenced by the activation of the pathways that process information for survival. For example, Bhreathnach (2008) posited that “there is an over reliance on the visual and auditory system for distal warning, therefore these children present with auditory and visual hypervigilance. A high proportion of children who have been traumatized are also defensive to nurturing touch” (p. 14).

Sensory Integration Theory

Sensory input is being constantly received from the environment and interpreted by the central nervous system. Sensory integration, a process first described by Jean Ayres (1972), is one way of understanding how humans organize and use sensation. It is important to consider the ways in which sensory processing impacts the child- caregiver relationship. Fox and Polack (2004) describe sensory integration as a temperamental

related process and one of the ways in which individual differences in personality can be understood. An example is an infant who is overwhelmed by sensory input which results in behaviors, such as, extreme fussiness. This fussiness can jeopardize the relationship with the caregiver because of the stress related to time expended to calm the child. An intervention of using calming sensory strategies to reduce ANS stress can be a protective strategy for strengthening family interactions. The purpose of the sensory strategies is to produce a calming effect upon the ANS system, but also increases shared joy experienced by the child and caregiver while jointly participating in the sensory activities. The calming and shared joy benefits from the sensory strategies could have an influence of the relationship through the social-emotional interaction between the child and caregiver.

Sensory integration theory, as first conceptualized and articulated by A. Jean Ayres (1972), describes how an organism senses, registers, interprets, and responds to information from the environment. It is a bottom-up approach that focuses on foundational sensory systems, auditory, vestibular (gravity and movement), proprioception (muscles and joints), tactile, and visual, which contribute to increasingly complex behaviors (ability to concentrate and organize, self-esteem, emotional regulation, self-confidence, academic learning, and specialization of each part of the body).

Sensory Modulation Disorder

The inability to integrate sensory information adaptively has been termed sensory processing disorder, or SPD (Ahn, Miller, Milberger, & McIntosh, 2004). Sensory modulation, a subtype of sensory processing, is defined as the ability to regulate and organize sensory input and to respond in an adaptive manner, neither under nor over

responding (Reynolds, Lane, & Gennings, 2010). This process requires the registration and interpretation of the sensory information and a graded response to it (Parham & Mailloux, 2001).

Children and adults can develop a tendency to be over reactive or under reactive to typical environments. Over responsivity has been documented in electrophysiological research (Miller, 1999). Anzalone and Ritchey (2014) describe sensory modulation in terms of the zone of optimal engagement. In the zone there is an upper and lower threshold for optimal arousal and attentiveness. Too much or too little sensory input can lead to the individual being disorganized or dysregulated. Interventions to identify triggers and experiences that move the individual to the upper or lower thresholds may have an impact on the ability to self- regulate.

Children who have suffered trauma are at risk of living in a dysregulated state of arousal (Koomar, 2009). Dysregulated state of arousal is a term to describe when a child has difficulty with managing their emotions to successfully engage in daily activities. Emotional abuse, loss of a caregivers, inconsistency, and chronic mis-attunement contribute to a large number of psychiatric problems (Dozier, Stovall, Albus, Cassidy, & Shaver, 1999).

Within the domain of emotional regulation there are key building blocks. One of the building blocks is *modulation*. The ability to cope effectively and appropriately modulate emotional responses is another tenet of the psychological and emotional domain of well-being essential for healthy development of children into adolescence. A child with a history of neglect learns to distrust their emotions and frequently copes with uncomfortable emotions by disconnecting (Cook, Blaustein, Spinazzola, & Van der Kolk,

2005). Children and adolescents with maladaptive coping often present as withdrawn, hyperactive, and aggressive, and frequently have behavioral difficulties (Arvidson, Kinniburgh, & Howard, 2011). *Modulation* specifically addresses awareness of internal emotional states and works to assist an adolescent in managing physiological arousal and emotional experiences through the development of effective strategies (Kinniburgh, Blaustein, & Spinazzola, 2005).

Bechara, Damasio, and Damasio (1994) identifies emotions as being a change in neural activity patterns of the somatosensory system. Neural activation is affected by proprioceptive and interoceptive input's relation to bodily state (Shafir, 2015). Therefore, regulation of feeling can be accessed through motor behavior or bodily state as a product of proprioceptive input (Shafir, 2015). Physical activity that is high in intensity and duration and in muscular activation can change the ANS (Shafir, 2015). Josefsson, Lindwall and Archer (2014) conducted a meta-analysis and found that exercise intervention had positive outcomes for individuals with emotions of depression. Shafir (2015) stated that exercise causes a release on endogenous opioids in the frontal-limbic area of the brain. This area had a role in affective ability (Perez et al., 2016). Inversely, emotional state can impact body movements (Shafir, 2015).

Russell Circumplex Model of Affect

Some psychologists describe affect using a two-dimensional circular space due to the indistinct boundaries defining emotions. According to Posner, Russell, and Peterson (2005) this two-D model of affect has been described in different ways but derive from “statistical techniques of multidimensional factor analysis of subjective reports of emotional words, faces, and experiences” (p. 1) Such a model holds promise for gauging

the extent of an individual's emotional state, or affect, through an observational coding system that quantifies reactions as they are occurring in real time. Russell (1980) describes affect as a set of dimensions on a horizontal axis which represents valence or pleasant (positive valence)/unpleasant (negative valence) and a vertical axis which represents state of arousal or active (arousal)/de-active (no arousal). Each affect is an intersection of valence and arousal. Evidence supporting valence and arousal-neural activity formed the basis for Russell's (1980) Circumplex Model of Affect which is used in the Noldus FaceReader™ software to measure emotions.

Valence Activity

Valence activity related to negative and positive emotions. Positive emotions are associated with the pleasure and reward system. These feelings are thought to be associated with the mesolimbic system and connection with the amygdala, hippocampus, caudate nucleus, and prefrontal cortex (Posner et al., 2005) via dopamine channels. Studies of drug addiction have shown activation of the mesolimbic system. Neuroimaging studies show abnormalities in mesolimbic system in individuals with depression (Posner et al., 2005).

Arousal Activity

Arousal activity is controlled by the reticular formation which is hypothesized to receive information from the amygdala through association network found in the parietal lobe and has projections to the primary sensory, association, and frontal cortices (Posner et al., 2005). Arousal regulates cortical activity, such as consciousness, attention, and alertness via acetylcholine, norepinephrine, dopamine, histamine, and serotonin channels (Posner et al., 2005). According to Russell's (1980) circumplex model of affect, emotions

of the negative valence and high arousal continuum hold feelings of mood and anxiety that co-occur. This model illustrates how these feeling could co- occur due to relationship between valence and arousal (Posner et al., 2005). An individual with depression and anxiety may benefit from medication to address the valence system. Since the mesolimbic system has a key role in valence, medications that alter this system would be beneficial, such as, antidepressants (Posner et al., 2005). The affect circumplex for children has a more abbreviated description of emotions due to developmentally, children perceive emotions with less complexity (Posner et al., 2005). Two emotions (happy and sadness) were chosen to be measured for multiple reasons. One reason is due to the premise that children have a less sophisticated affect circumplex and these two emotions were defined on the child's affect model.

Sensory Attachment Intervention

Childhood trauma theory and neurodevelopmental trauma theories, such as those proposed by Perry (2002) and Porges (2011) are bottom up approaches to intervention. Bhreathnach (2008) SAI frame of reference draws from each of these theories, and makes a link between sensory patterns and attachment. Bhreathnach (2008) posited that there are associated sensory patterns that are linked to attachment patterns that illustrate if a child is in fight/ flight (the sympathetic nervous system [SNS]) or freeze/dissociation and emotional numbing (parasympathetic nervous system [PNS]) due to the child's perception of danger. These patterns are illustrated in Figure 1. Use of sensory strategies to address when child is in SNS or PNS stress can be an integral part of intervention. If the child presents with a sensory pattern of over responsiveness it is important to investigate if the arousal state is triggered by a sensory experience and/or by others. An

attachment history needs to be taken into account in order to identify if the child presents with a SNS stress bias (mobilized, impulsive, aggressive) or a PNS stress bias (numbing, collapse in muscle tone) as a result of trauma. Children with a trauma background often are accompanied by chronic stress which leads to changes in the brain network that is responsible for coping and regulation (Compas, 2006).

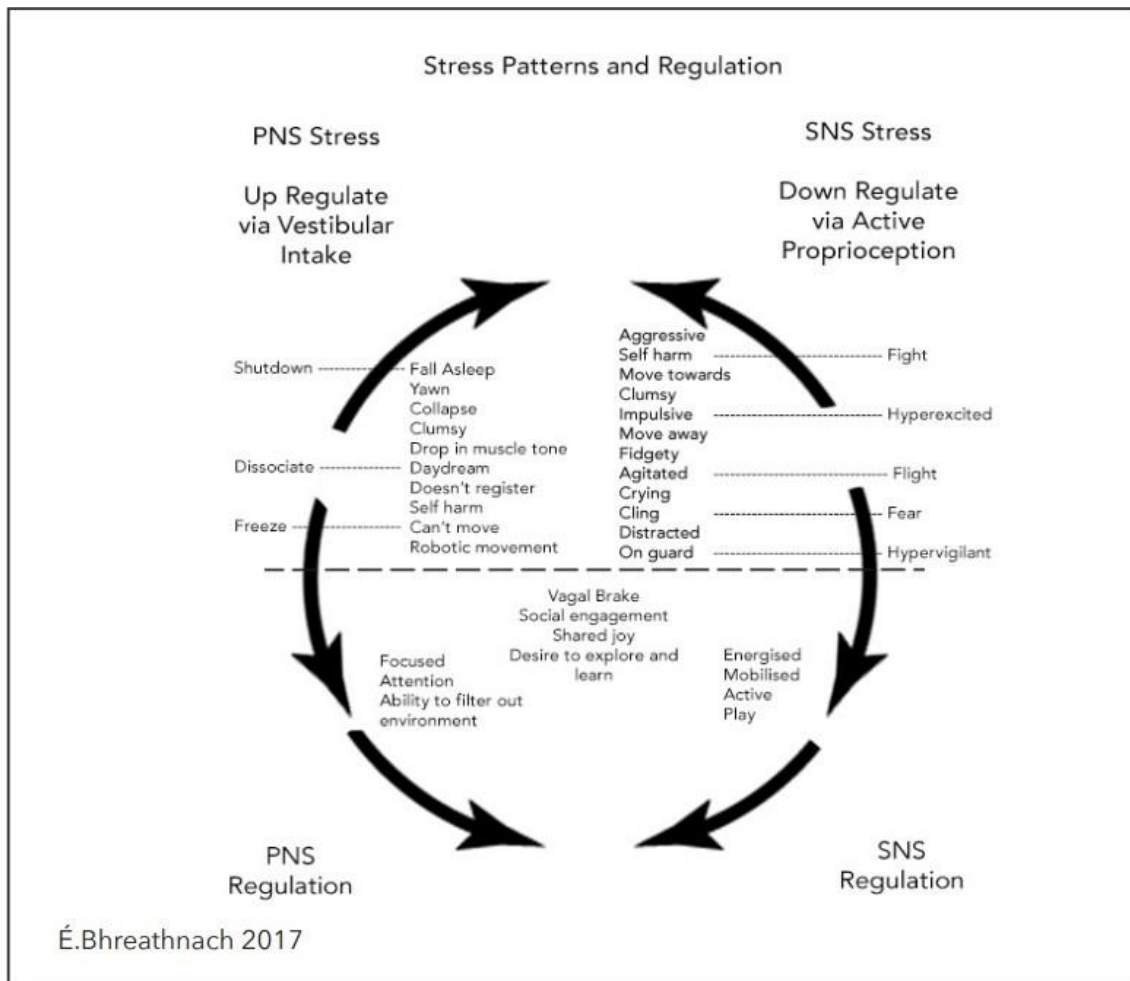


Figure 1. Component of Bhreathnach's (2008) SAI model. Permission to use in Appendix E.

SAI clinical applications include the child's capacity to modulate emotions/arousal states through active engagement with the environment. The caregiver provides the just right balance of nurture and challenge, and that the therapist provides enriched environments. Occupational therapy intervention (using SAI techniques) is developed from a thorough evaluation of the child. The SAI evaluation process involves creating a child profile is created by assessing levels of the child's ANS system and sensory processing in the context of the child's attachment profile using Crittendon's (2005) dynamic-maturational model of attachment.

The first level assesses the ANS functions, which include sleep/wake cycle, temperature regulation, digestion/elimination, cortical tone, and state maintenance. Bhreathnach (2008) notes that the reason to assess the ANS function is to get a picture if the child is demonstrating SNS activation (heart rate increases) or PNS activation (heart decreases). Bhreathnach (2008) also suggested that the bias of the ANS (SNS or PNS activation) depends on the relationship that the child has had with the attachment figure. This is also influenced by the child's social history and environment.

The second level assesses the sensory- emotional modulation which evaluates the child's the ability to organize incoming sensation. Sensory modulation is the ability to regulate excitatory and inhibitory sensory signals coming from the child's individual internal and external environment (Bhreathnach, 2008). An individual with SMD may over-responds, under respond, or fluctuate their responses. OTPs measure sensory modulation through caregiver questionnaires and observations. Dunn's (2014) Sensory Profile 2 is often used by OTP to assess the child's sensory processing patterns related to modulation.

The third level is Interpretation of Sensory & Emotional Information for Use. This level assesses sensory discrimination. It enables a child to perceive touch, body scheme, spatial awareness, and visual and auditory perception. In addition, Bhreathnach (2008) also includes emotional discrimination which is the capacity to interpret engagement experiences with others.

The fourth level is Organized Response to Interaction which is an organized response to cognitive, affective, and sensory information. In addition, the child, if organized, will demonstrate secure attachment patterns (Bhreathnach, 2008).

Emotional regulation impacts relationships with the family, teachers, and peers (Denham et al., 2016). Attachment theory clearly articulates how the emotions is a reciprocity or serve and return between the child and caregiver. The child's emotional development needs to be protected by the family and the professionals who serve this population. Currently, OTP will give the caregivers sensory strategies for the child to do at home. OTP are taught that proprioceptive activities are overall calming to the nervous system. However, there are few studies that measure proprioceptive activities influence on emotions. It is crucial to find alternative interventions to support the child's emotional development if the child demonstrates deficits in emotional regulation.

CHAPTER 3: METHODOLOGY

Chapter 2 provided a theoretical frame and research-based support on the need for this study. This chapter will provide a description of the setting and participants, my role as a researcher/teacher, the innovation, data sources and collection, and the analytical strategies for analysis.

Description of Setting and Participants

Context

This action research study took place at KidzSPOT Pediatric Therapy in Scottsdale, Ariz. KidzSPOT has provided specialized pediatric outpatient therapy since 1985 and includes a team of occupational, physical and speech-language pathology therapists. Families are referred for comprehensive pediatric therapy services by physicians to address the special needs of children and their families. Children with special needs who are referred for pediatric services receive an evaluation, treatment, education and coordination of resources. OT's focus on goals related to the improving the child's capacity to interact with other and their environment more independently and with success. Typically, children are seen one to two times per week and depending on insurance benefits, goals are written for six months. Depending on severity of impairments related to the child's diagnosis, child may receive outpatient services for years.

Participant

L.S. is the participant in this study. Inclusion criteria included a child, age range from 4 years old to 7 years old with a social history of childhood trauma. Childhood trauma is defined as having had multiple home placements in foster care system and

history of neglect. Inclusion criteria also included a referral for OT services to address emotional regulation. Exclusion criteria consisted of no history of childhood trauma and children under age of 4 years old. In addition, if the child did not have a primary caregiver.

L.S. currently receives OT services at KidzSPOT. Participation in the study was voluntary with no consequences for non-participation and no privileges or rewards for participation. Upon first OT session, L.S., was a 5 years and 7 months old boy who was referred for OT services to assess delayed acquisition of fine motor and motor planning skills related to self-care skills and academic performance, as well as, sensory modulation difficulties, anxiety, and aggressive behaviors impacting social interaction skills with family and peers. L.S. had a diagnosis of specific development disorder of motor function. L.S.'s social history includes being removed from his home by child protective services for neglect and suspected parental substance abuse at 2 years of age. He was then placed with 5 different foster families. His first foster placement was disrupted due to foster family's difficulty with managing his behaviors of hitting and scratching himself and others. During his last foster placement, the foster family would stack books in front of his bedroom door as a deterrent to leaving his room in the middle of night because he had difficulty sleeping. The intention of the stacked books was to create noise (after pushing the books over) to scare him back into bed. He was removed from this foster home due to the actions of the foster family. Currently, he is in the care of a loving and nurturing foster family, with his biological two-year-old sister. The foster family has three biological older sons and have recently adopted L.S. and his sister.

L.S completed an OT evaluation which included observations and standardized assessments commonly used in OT. The assessments related to sensory processing and behaviors included Bhreathnach's (2008) ANS profile, the Sensory Processing Measure, and the Structured Observations of Sensory Integration-Motor (SOSI-M).

Bhreathnach's (2008) ANS profile. Bhreathnach's (2008) ANS profile is a questionnaire used to identify the child's physiological stress symptoms and behaviors to identify if the child presents with a SNS or PNS stress bias. There are no psychometric measurements for the ANS profile. After L.S.'s mother completed the ANS profile, L.S. presented with a SNS biased (mobilized, impulsive, and aggressive) as demonstrated by the behaviors listed below, per caregiver report:

1. history of unpredictable care;
2. an intense level and get the attention from my caregiver;
3. aggressive, defiant, and impulsive behaviors;
4. history of neglect and abandonment;
5. sleep issues;
6. anxiety;
7. sweats often;
8. constipated upon arrival to current family (would not eliminate for 4-5 days);
9. would not complain of pain when falling upon first arrival to current family;
10. overly aware of background noises;
11. did not like to be the center of attention;
12. was frequently on the "lookout" (checking what is happening in his surroundings);

13. constantly on the go;
14. found it difficult to sit still;
15. was quick to emotionally react;
16. became aggressive when over-excited; and
17. reacted angrily when asked to do something that is difficult to carry out.

Sensory Processing Measure. The SPM is a parent and teacher rating scale which provides a complete picture of children's sensory processing difficulties at school and at home for children 5-12 years old. It is based on a nationally representative sample of 1,051 children. Additional data were collected on a clinical sample of 345 children. SPM-P is based on a nationally representative sample of 651 typically developing 2-5 year olds. The child's primary caregiver responds the 75-item questionnaire by reflecting on his or her frequency (never, occasionally, frequently, or always) of specific behaviors observed at home. The SPM is designed to assess a child's ability to process input in the following eight areas: social participation, vision, hearing, touch, taste and smell, body awareness, balance and motion, and planning and ideas. The SPM psychometric properties are internal consistency measured with Cronbach's alphas ranged from .93 to .99 in the first pilot study and .70 to .99 in the second pilot study. Children who were typically developing were correctly classified 92.3% of the time, and children with sensory issues were correctly classified 72% of the time.

Scores are reported as "typical," as "some problems" (mild-moderate difficulties-respond well to interventions), and as "definite dysfunction" (significant sensory processing problem that may have a noticeable effect on the child). A total sensory

systems score is obtained by summing the raw scores for the aforementioned areas. L.S. had scores as listed below.

Social Participation Scale. L.S. scored in the definite dysfunction range, which may demonstrate more pervasive social problems across multiple settings and with both children and adults. During the time of the study, L.S. had not been attending school due to aggressive behaviors. He also had difficulty playing with his sister. Overall, L.S.'s mother responded that he occasionally (some of the time) will participate in joint play with others, appropriately take part in social events, such as, mealtime conversation, and family outings. Per his adopted mother, during summer camp he had difficulty with social interactions in camp. During one- on- one OT sessions, L.S. was able to participate in all activities and has not demonstrated aggressive behaviors. During the OT sessions, he did like to be “in charge” of the activities, but could be redirected.

Vision Scale. L.S. scored “some problems” with vision. The items in this category represent a range of visual processing vulnerabilities, such as, distracted by environments that are visually rich or have difficulty with functional activities that depend on vision, for example reading, or copying material from the blackboard. Mom stated that L.S. walks into objects as if they are not there. L.S. presents with behaviors that reflect under-responsiveness and sensory seeking. Under- responsiveness describes when children are not getting the input that they need from their environments, so they seek it out by running, jumping, falling, and being very physical in an attempt to get the balance, organization and focus that they need. Mom indicated that L.S. enjoys looking at moving objects out of the corner of his eye frequently, which may be a sign of sensory seeking.

Hearing Scale. L.S. scored in the Definite Dysfunction category. Overall L.S. scored over- responsive to auditory processing. Mom indicated that L.S. frequently seems bothered by ordinary household sounds, such as the vacuum cleaner, hair dryer, or toilet flushing which may be a sign of sensory over-responsiveness. L.S. frequently responds negatively to loud noises. L.S. frequently seems easily distracted by background noises such as a lawn mower outside, an air conditioner, a refrigerator, or fluorescent lights.

Touch Scale. L.S. scored in the Definite Dysfunction category. Overall L.S. scored over- responsive to most of the questions regarding tactile stimulation. Mom indicated that L.S. frequently prefers to touch rather than be touched. He always becomes distressed when his or fingernails or toenails cut. He frequently seems bothered when someone touches his face. He frequently dislikes brushing his teeth more than other children his age. He does demonstrate sensory seeking behaviors, such as, enjoying sensations that should be painful such as crashing into the floor or hitting his own body which may be a sign of sensory seeking. He always has an unusually high tolerance for pain. He frequently has trouble finding things in his pocket, bag or backpack using only touch (without looking) which could indicate problems with perception.

Body awareness, balance and motion, and planning and ideas. L.S. scored in the Definite Dysfunction category in all three areas. Body awareness refers to the proprioceptive system, which is the child's ability to sense their body in space. It is a foundational skill for coordination. The child can appear clumsy and can be too rough with others and when playing with objects. Mom indicated that L.S. frequently demonstrates the following: is driven to seek activities such as pulling and pushing, seems unsure how to raise or lower his body during movement activities, grasps objects

loosely, uses too much force when petting animals, bump into other children, and chews on objects more than others. L.S. scored in the Definite Dysfunction for Balance and Motion. Balance and motion reflect the vestibular system, which is our sensory system that is activated with head movements and ability to maintain balance and upright posture. It is also an important component of coordinated movement. Mom indicates that he frequently avoids balance activities, falls out of the chair when shifting his body, fails to catch himself when he is falling, demonstrates poor coordination and leans on other people and furniture when sitting or when trying to stand. L.S. fell within the Definite Dysfunction category for Planning and Ideas (PLA), refers to Praxis, the ability to plan and organize movements in order to complete unfamiliar motor tasks. Praxis is not itself a sensory system, but rather a high-level cognitive function that depends on the integration of multiple sensory systems. The PLA items address ideation, and motor planning. A child who scores definite dysfunction in this category may show consistently poor performance in many activities that require motor skill and problem solving. He may not know what to do or how to begin. He may refuse unfamiliar tasks, preferring familiar versus novel tasks. The child may appear uncooperative because there is a need to feel in control of the situation and what exactly to expect.

Structured Observations of Sensory Integration- Motor. The SOSI-M is a nationally standardized assessment of sensory-based motor skills, based in Ayres Clinical Observations, and developed by well-regarded experts in sensory integration. The SOSI-M includes 14 sets of administered items that assess proprioceptive and vestibular processing, and motor skills. The following tests were given: forearm Alternating Movements, Sequential Finger Touching, Finger to nose, Eye movements, Arm extension

test, Supine flexion, Antigravity/prone extension, Dynamic postural control, Protective extension, Weight bearing and joint stability, and Gravitational insecurity. L.S. demonstrated difficulty in all the above areas regarding processing vestibular and proprioception sensation which leads to poor postural control, proximal instability, and bilateral motor coordination. L.S. had difficulty with jumping jacks and skipping which indicated problems with bilateral coordination. L.S. switched hands when writing and cutting. L.S. chose the same toys, which did not require more complex motor skills, and during sensory activities that challenge using his muscles L.S. fatigued quickly.

Design Type: Single Subject Design

Single subject design was chosen because the setting of the research is in a clinical setting. As a clinician, it is optimal to have the research participant be his own comparison baseline because withdrawing treatment has its own ethical challenges, and finding a large number of participants poses a challenge. In addition, occupational therapy intervention is a very individualized so this type of design lends itself to the dynamic and unique contextual aspects of the treatment services. This type of design does not require sampling of individuals and the averaging of experimental results to arrive at group means. The structure of single-subject designs is an experimental design because unique conditions must be operationalized.

Two core elements to the structure of a single subject designs are repeated measurement (baseline) and design phases (intervention) which is referred to as baseline logic (Gast, 2010). Baseline logic allows for detecting a change between a baseline measurement and the intervention measurement is probable. The purpose, measurement,

confidentiality, and data collection, are a part of the information needed for informed consent.

The type of single subject of this study is an A-B design. A-B design or a simple time series design is considered a quasi-experimental design (Gast, 2010). In this type of design, the dependent variable is measured under two conditions or phases, A and B (Gast, 2010). Phase A represents the baseline or probe period of measuring the dependent variable. Once a trend or a stable baseline is achieved in Phase A, Phase B is introduced and measures the dependent variable after intervention (PALS program).

Dependent Variable

The dependent variable is L.S.'s expression of emotions measured by Noldus FaceReader™. The software measures the following emotions: happy, sad, angry, surprised, scared, disgusted, and neutral (Loijens & Krips, 2018). For the purpose of this study, three of the seven emotions will be discussed (happy, sad, and neutral).

Independent Variable

The independent variable is the PALS program. The PALS program was developed by the researcher and took place at KidzSPOT pediatric outpatient clinic. The proprioceptive activities were incorporated in the context of play.

Baseline (Phase A). The baseline phase is treatment as usual condition. Participants must also understand that the onset of the intervention is likely to be delayed until either a baseline pattern emerges or some assigned time period elapses. During the baseline phase, addressing the goal of emotional regulation skills through sensory integration intervention was limited. Instead, behavioral strategies (i.e. rewards system and ignoring non preferred behaviors) were used to address emotional regulation. The OT

session during this time focused on his OT goals related to fine motor and visual motor skills to support school participation requirements of writing and cutting. It also included OT goals related to bilateral skills required for self-care skills, such as, manipulating fasteners for dressing and tying shoe laces.

Procedure. During the baseline period, between three to five OT sessions, L.S. was videotaped during a 3 to 5 minutes table top activity at the beginning of the OT session. Videotaping used a camera on the laptop. All videos were secured on the ASU laptop with password protection. The researcher and researcher assistants had access to videos.

Intervention (Phase B). The PALS program was introduced once a stable baseline is established. During each OT session a Pre-PALS and Post PALS measurement was taken using the Noldus FaceReader™. Pre-PALS is the measurement taken before L.S. began the program during the OT session and Post PALS is the measurement taken after he has participated in the PALS program.

Purpose of the PALS program. When the stress response is activated in an extremely prolonged or repetitive manner the neural networks involved undergo a “use dependent” alteration (Bhreathnach, 2008). The end effect is an alteration in the baseline activity and reactivity of the stress response systems. The child operates as if under persistent threat. In the face of perceived threat, the child will either operate in the hyperarousal continuum or in the dissociation continuum, whichever is perceived to be the most adaptive survival strategy (Bhreathnach, 2008). Use of proprioceptive input is a movement-based strategy for emotional regulation. In addition, Bhreathnach (2008) posited that proprioceptive input decreases the stress/arousal response with children who

demonstrate a SNS bias. This single subject design was developed to test Bhreathnach's conceptual theory of the SAI model.

PALS program. The PALS program is a sensory integration intervention to address the sensory processing challenges related to L.S.'s stress response (SNS bias) as identified by the Bhreathnach (2008) ANS profile. The duration of the PALS program is 40 minutes. Each 40 minutes session consists of 1-4-minute activities that target proprioceptive input. A menu of proprioceptive activities was developed. L.S. was able to choose from the menu of activities. Since he cannot read, I would ask him which activities from the menu he would like to participate during his OT session. A description of the menu of proprioceptive activities are listed below in Table 1. The PALS program was developed in adherence to the fidelity components for sensory integration (SI) therapy provided by Parham et al. (2007). The PALS program is a modified version of SI therapy, with the focus is primarily providing opportunities to participate in proprioceptive activities. The purpose of intentionally providing proprioceptive activities is to study the effect of proprioceptive input on emotions. The proprioceptive receptors are located in the muscles and joints. It provides a sense of body awareness and detects/controls force and pressure. The proprioceptive system also has an important regulatory role in sensory processing

Table 1

PALS Menu

PALS Menu (circle each activity used during the 40 minute session)		
Proprioceptive activities	Functional activities	Oral activities
Hand pushes	Wiping table and erasing white board	Blowing bubbles
Chair push-ups	Moving sensory equipment	Drinking semi solids or thick liquids from a straw (i.e. jello)
Thera band on chair	Carrying heavy toys during clean up	Blow cotton balls using a straw
Squeezing a stress ball	Moving child size furniture	Blowing a whistle or musical instrument
Wall and floor push ups		Chewing crunchy food
Lifting weighted objects		
Jogging in place		
Tug of war		
Climbing rock wall		
Throwing and catching a weighted ball		
Crawling obstacle course		
Animal walks		
Push/pull therapy ball		

Fidelity in sensory integration intervention. According to Parham et al. (2007) there are central features identified with sensory integration intervention. A systematic evaluation of the fidelity of the intervention was developed to evaluate delivery of the intervention and ensure that the intervention can be replicated. It is considered a component of construct validity to see the degree to which the sensory integration constructs can be operationalized and if the constructs are being incorporated into the intervention (Parham et al., 2007). Parham et al. divided fidelity measurements into two

parts structural features and process elements. Structural features of sensory integration intervention are divided into two categories, environmental design (equipment and layout of the room) and therapist qualifications (formal and post- secondary education, SIPT or SCSIT certifications, clinical experience). Process elements of an intervention are the parameters to which sensory integration principles are followed during an intervention session. Through their review of 34 studies, Parham et al. (2007) found and defined ten core process elements derived from therapist's behavior and attitude. The ten elements are providing sensory opportunities, provide just right challenge, collaboration of activity of choice, supporting optimal arousal, creating a context of play, maximizing child success, ensuring physical safety, arranging room to engage child, and fostering a therapeutic alliance.

Structural elements of sensory integration fidelity (therapist qualifications). I provided L.S. occupational therapy intervention services implementing the PALS Program. I graduated in 2008 with a master's degree in OT from an accredited university. I passed the National Board for Certification in Occupational Therapy in 2008 and have since been licensed in the state of Arizona. I have been working with children with sensory processing difficulties on and off for over 10 years. Initially worked in school-based setting and developed sensory rooms in Kyrene school district, conducted sensory assessments, such as Dunn's Sensory Profile and Sensory Profile™ 2, Sensory Processing Measure™. In addition to school-based practice, I have worked in an outpatient pediatrics which includes working with children with sensory processing disorders in various setting (home-based, clinic-based, and hospital-based). Post-secondary courses I have completed include: Sensory Processing Measure™, Sensory

Smarts, Alert Program- How Does Your Engine Run, Therapeutic Listening Program Certification Course, Practical Sense in Sensory Integration, Part 1,2 & 3, How to Become a Sensory Chef, Sensory Processing Measure Workshop, Bal-A-Vis-X, Brain Gym, and Tools for Tots: Sensory Strategies for Toddlers and Preschoolers.

More recently, I have attended the ATTACH conference, which provides training to parents and professionals to promote healthy attachment and healing trauma, a six-day Sensory Attachment Intervention (SAI) course with Eadaoin Bhreathnach. Bhreathnach is a pediatric OT and attachment counsellor in Ireland. Bhreathnach started a private practice in 1990. Her clients are challenging cases who are referred from statutory agencies. From treating this population for many years, she has observed common traits among her clients. The behaviors include heightened and a persistent sense of fear, over or under reaction to sensory experiences, and difficulty engaging with others. Her clinical experience and training with Dr. Patricia Crittenden led to the development of her trauma model, SAI. In September, 2018 I attended a 3-day workshop by Dr. Patricia Crittenden on Attachment and Psychopathology course which focused on development, prevention, and treatment of psychological disorders using her Dynamic – Maturational Model (DMM).

Structural elements of sensory integration fidelity (safe environment). For each session, the set-up of the room consisted of mats, cushions, and pads under all suspended equipment. Per owner of KidzSPOT, Debbie Hines OTR/L, there is routine and frequent monitoring of equipment and equipment is stored at the side of the room to ensure safety. The physical environment has adequate space to allow for play, quiet space (under loft), and bungee cords to hang suspended equipment, and flexible arrangement of

equipment and materials. Available equipment at the clinic includes bouncing equipment (trampoline), therapy balls, ropes for pulling, platform swing, flexion swing, tire swing, bolster swing, weighted objects, scooter and ramp, crash pillow, spandex fabric, ball pit, variety of tactile materials, visual targets, climbing rock wall, ladder to a loft, props for play, and items to practice daily living skills.

Process elements of sensory integration fidelity (ensures physical safety). To ensure safety, there are key points that I followed: placing mat under L.S., remained in close proximity to L.S, and anticipated safety concerns.

Process elements of sensory integration fidelity (presents sensory opportunities). According to the fidelity measurement, the child needs to be presented with two out of three types of sensory opportunities (tactile, vestibular, and proprioception). PALS focuses on providing opportunities in the sensory area of proprioception.

Process elements of sensory integration fidelity (therapist helps child to attain and maintain appropriate levels of alertness). Key issues included supporting and encouraging co- regulation and facilitates changes in intensity, frequency, and duration of sensory input.

Process elements of sensory integration fidelity (challenges postural, ocular, and/or bilateral control). The following challenges were provided: postural changes, resistive whole- body activities, bilateral challenges (swinging from a trapeze bar), oral input (sucking jello through a straw), and action sequences (creating an obstacle course).

Process elements of sensory integration fidelity (challenges praxis and organization of behavior). During the session, there were demands placed on motor

planning, initiating and sequencing a task, set up of activities, and re-arranging equipment.

Process elements of sensory integration fidelity (collaborates in activity choice). The goal was for L.S. to be self-directed. He was encouraged to choose activities that provided more intense proprioceptive input. However, I did provide structure and support during the PALS program.

Process elements of sensory integration fidelity (just right challenge). I made adjustments as needed if L.S. was becoming bored, disengaged, or frustrated. In addition, I did grade the activity depending on demands of the task. Some ways to upgrade or downgrade the activity included changing his position, height of equipment, number of steps, and weight of object.

Process elements of sensory integration fidelity (ensure activities are successful). The focus was to facilitate success through adaptive responses to challenges.

Process elements of sensory integration fidelity (support child's intrinsic motivation to play). The key issue is creating a setting that supports play as the vehicle to engage L.S.

Process elements of sensory integration fidelity (establishing a therapeutic alliance). During each session, it is important to create a climate of trust and respect for L.S.'s emotions. In addition, the PALS program's purpose is to defuse negative emotions or feeling of stress.

Baseline/repeated measures. Repeated measures of the dependent variable over time forms a basis for comparison with another series of measurements after the independent variable is introduced. It serves as a reference point with which to compare

change associated with the introduction of the independent variable. In this study, repeated measures were taken during the first five OT sessions. The purpose of the repeated measure is to see any trends or variability in the client's behaviors. In order to analyze L.S. emotions, each 3-5-minute videotape captured and measured his expression every second.

Sequencing and Timing of the Procedures

The following information list the steps of the PALS study.

1. A comprehensive evaluation was completed which included clinical observations as well as standardized assessments measuring the child's ability to complete daily activities.
2. Parent completed the parent report measures including: Sensory Processing Measure™, SOSI-M, Bhreathnach's (2008) ANS Child's Profile, and Noldus FaceReader™.
3. Parent took part in an individualized goal setting session with their therapist, during which time problem behaviors were identified as well as selection of the behavior probe to be used as the repeated measure.
4. Baseline was collected until the emotional measurements are stable. All baseline data were collected prior to the start of treatment.
5. Intervention consisted of individualized occupational therapy utilizing principles of the PALS program. Fidelity to treatment was insured through fidelity measurements taken via supervision of a SIPT trained occupational therapist.

6. Intervention data was collected for Pre-PALS and Post-PALS measurements during each OT session using Noldus FaceReader™. Each OT treatment session was fifty minutes, 1- 2 times per week x 5 months. The first three minutes began with L.S.'s videotaped using the Noldus FaceReader™ to measure his emotions during a table top activity. This event was labeled Pre-PALS. The next forty minutes, L.S. participated in child led activities, choosing from a menu of proprioceptive activities. The remaining 3 minutes, L.S. was videotaped using the Noldus FaceReader™ during a table top activity. This event was labeled Post PAL.s. Each proprioceptive activity can range from 60 seconds to several minutes.

L.S. completed a comprehensive occupational therapy evaluation. The parents completed a questionnaire about perception of their child's emotional regulation function. Parents participated in goal setting session with their OT about targeted behaviors related to social emotional function. Parents signed a video release form for the clinic and the research study. L.S.'s facial expressions will be analyzed at the beginning and at the end of each OT session.

In summary the intervention uses proprioceptive activities as a movement- based strategy and to study its effect on emotions. In addition, incorporating the SAI construct, which hypothesizes that proprioceptive activities downregulate the child's ANS for children who have a SNS stress biased profile (Bhreathnach, 2008). The purpose of the intervention for this action research study is to develop a sensory based intervention to target emotional development.

Instruments and Data Collection Procedures

Noldus FaceReader™

FaceReader software automatically analyzes and records facial expression, valence, and arousal classifications. There are 500 sites on the face that is analyzed using five different algorithms. It classifies expressions into the following categories: happy, sad, angry, surprised, scared, disgusted, and neutral (Loijens & Krips, 2018). The emotions are taken from Ekman's studies on basic emotions. The facial expression classification ranges from intensity of 0 to 100. "Zero" means that the expression is absent and "one hundred" means that the expression is fully present. If the intensity of an emotion is above 60 or 0.60 then the emotion is experienced. Valence classifications indicates a pleasant or unpleasant emotional state. Happy is the only pleasant or positive expression. Sad, angry, scared, and disgusted are seen as negative expressions. Surprised can be seen as pleasant or unpleasant so is not used to calculate valence. Valence is calculated as the intensity of happy (-1.0 to 1.0) minus the highest negative expression (Loijens & Krips, 2018). The arousal classification describes the participant's affective arousal (active or not active). Arousal or activation defined by Noldus FaceReader™ (Loijens & Krips, 2018) centers around the concept of the expression "Neutral". Neutral refers to the level of emotional detachment. The higher the neutral score the more the child is detached from their emotional state (less active). It has an inverse relationship with all the other measured expressions. For example, if neutral is high, the other emotions will be low and vice versa. It is important to make the distinction between the term arousal used in OT versus in context of the Noldus FaceReader™. In OT, arousal refers to the ability to maintain an optimal performance level and level of alertness

needed to sustain attention and complete tasks as the environment demands. The term arousal, in the Results section, will be using the Noldus FaceReader definition. The construct validity of the Noldus FaceReader™ has been measured by comparing the results to a highly standardized test, Amsterdam Dynamic Facial Expression Set (ADFES), for facial expressions.

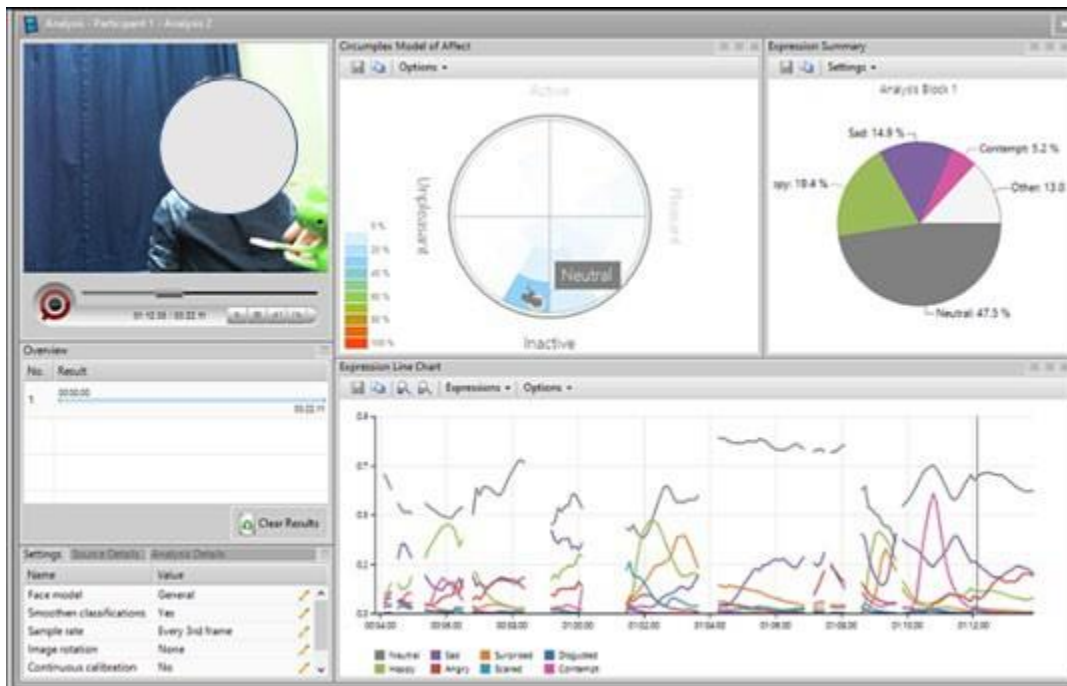


Figure 2. Noldus dashboard.

Data Analysis

The phases of the single subject design are summarized on a graph which will be visually inspected. Visual analysis will be constructed by level of magnitude from baseline valence, arousal, and facial expression classifications summarized into a single observation by using the mean and then drawing a line for each phase separately. The Two Standard Deviation Band Method and the binomial test was used to analyze the

data. According to Portney and Watkins (2009) the Two Standard Deviation Band Method “involves assessing the variability within in the baseline phase by calculating the mean and standard deviation of data points within that phase” (p.260). The C Statistic estimates trends in time-series data (Portney & Watkins, 2009).

Reliability and Validity

Considerations and precautions were taken to address threats to reliability and validity. Reliability refers to the degree to which test measures yield consistent numerical scores each time it is administered (Smith & Glass, 1987). The A-B design does have potential threats to both internal and external validity. Therefore, in an A-B design, it cannot be determined if a change in the dependent variable is the result of the intervention. However, in an A-B design, correlational conclusions can be made (Gast, 2010).

Threats to Reliability

In single subject designs, there are three major components to reliability: reliability of effect, reliability of measurement, and procedural reliability (Gast, 2010).

Reliability of Effect

Reliability of effect is the confidence that the outcome of the intervention is true. The term “true” means that the outcome would be the same if the study was replicated. Typically, a single subject design study experiment is replicated through use of multiple participants, implementation in various settings, and using different investigators (researchers). Replication of this study was not done due to the restraints of the study timeline.

Reliability of Measurement

The reliability of measurement has two components. One component is the accuracy of the measurement. The Noldus FaceReader™ was used to measure the dependent variable (expression of emotions). Each expression has its own reliability measurement: happy (100%), sad (89.8%), and neutral (100%) (Loijens & Krips, n.d.). The second component was the consistency with which data was collected. All data was collected by video tape. Throughout the study, a three- to five-minute video of L.S. (participating in a table top activity) were recorded. From the videos, Noldus FaceReader™ software analyzes L.S.'s expressions to the seconds.

Procedural Reliability

Procedural reliability refers the fidelity of the intervention. To maximize reliability, a menu of proprioceptive activities was created so it was clear which types of activities could be included in the PALS program. Secondly, the PALS program is considered a modified sensory integration-based intervention. There are fidelity measurements for conducting sensory integration treatment. I enlisted an OT, who is Sensory Integration Praxis Test (SIPT) certified to observe if the central elements of sensory integration treatment were evident during the PALS program. Using a context expert was important for ensuring the validity of the intervention.

Threats to Internal Validity

History and Maturation

Typically, a well-designed single subject study completed with one subject has strong internal validity through repeated measurements and inter-subject replication (Satake, Jagaroo, & Maxwell, 2008). Repeated measurements and inter- subject

replication provide experimental control for threats to internal validity (Horner et al, 2005). Baseline, pre- and post-PALS repeated measurements were taken. However, intra-subject replication was not done in this study. An intra- subject replication would be a phase of returning to baseline (withdrawal or absence of intervention) for comparison (Gast, 2010). In addition, there were two other major threats to internal validity in my study; these threats were (a) history and (b) maturation.

Historical Threat

Historical threats to internal validity include events that occur during the course of the program that might impact the final outcome. To address this threat, there is a withdrawing and reintroducing of the independent variable or staggering the introduction of the intervention using a multiple baseline design (Gast, 2010).

Maturation Threat

Maturation threats may be age related physiological or psychological development. Maturation effect can be reduced by conduction a shorter study, such as, designing a to start and end within four to six weeks. However, my study was conducted over a 5- month period. Withdrawal and staggering the intervention can also decrease maturation threat.

Threats to External Validity/Selection Bias

According to Gast (2010), A-B designs most common threats to external validity include (a) Hawthorne effect and (b) experimenter effects.

Hawthorne Effect

The Hawthorne effect refers to participant's behavior not being represented of his natural behavior because the participant wants to be on their "best" behavior. L.S. was

not aware that he was being observed for research purposes so this would not affect his emotions. L.S. was referred for OT services because of aggressive behaviors at school and at home. Interesting to note, during the year that I treated him, he did not ever demonstrate any aggressive behaviors.

Experimenter Effects

Selecting only certain participants limits analysis (Gast, 2010). In the study, inclusion and exclusion criteria are defined to control for selection bias. It should be noted that some results might be skewed by the therapist/family relationship inherent in this study. The family may have felt obligated to participate because I treat their child. In addition, L.S. has had OT services prior to this study. He also has been with his adopted family (permanent placement) for over 6 months. These 2 variables could be confounding factors to changes with his stress response. However, L.S. has not had OT service for the past 2 months because of summer vacation. Per mother, his behaviors have regressed, and he was recently removed from school due to aggressive outbursts. Due to regression in behaviors, the influence of his home placement has not yet made permanent changes to his emotional regulation.

Generalization

Generalizability which is related to external validity, poses the question can the result of one observation generalize to others or to a target population. Generalizability can be achieved through including multiple participants (at least three participants) and using different measures of the dependent variable (Gast, 2010). However, action research is not focused on generalizability because the study is practitioner-focused research.

Social Validity

Social validity is also identified in single subject designs. Social validity measures the social importance of the study (Horner et al, 2005). Social participation is an integral component to a person's quality of life. OT practitioners analyze the person, task, and environment to assess which areas are limiting or enhancing an individual's social participation capacity. Emotional regulation impacts social participation. The focus of this study is to gain insight on the expression of emotions and degree of detachment from emotions using a high-fidelity measurement tool, Noldus FaceReader™. By understanding the emotional makeup of a child with a history of trauma, OT practitioners can use this knowledge to develop more effective treatment plans.

CHAPTER 4: ANALYSIS AND RESULTS

Repeated Measurement of L.S.'s Baseline of Emotions

Quantitative data results from this single subject design show the effects of the treatment based on the response of a single client, L.S., under controlled conditions. The initial results from the Baseline (Phase A) of L.S.'s expressions are seen in Figure 3. The table described the magnitude of all expressions from a magnitude scale of 0-1. The expressions were neutral, happy, sad, angry, surprised, scared, disgusted, and contempt. L.S.'s two expressions that have the highest magnitude are happy ($\bar{x}x = 0.1768$) and sad ($\bar{x}x = 0.2090$). Since happy and sad were the expressions with the highest magnitude, happy and sad expressions were selected to be of the most important expressions to measure in the study.

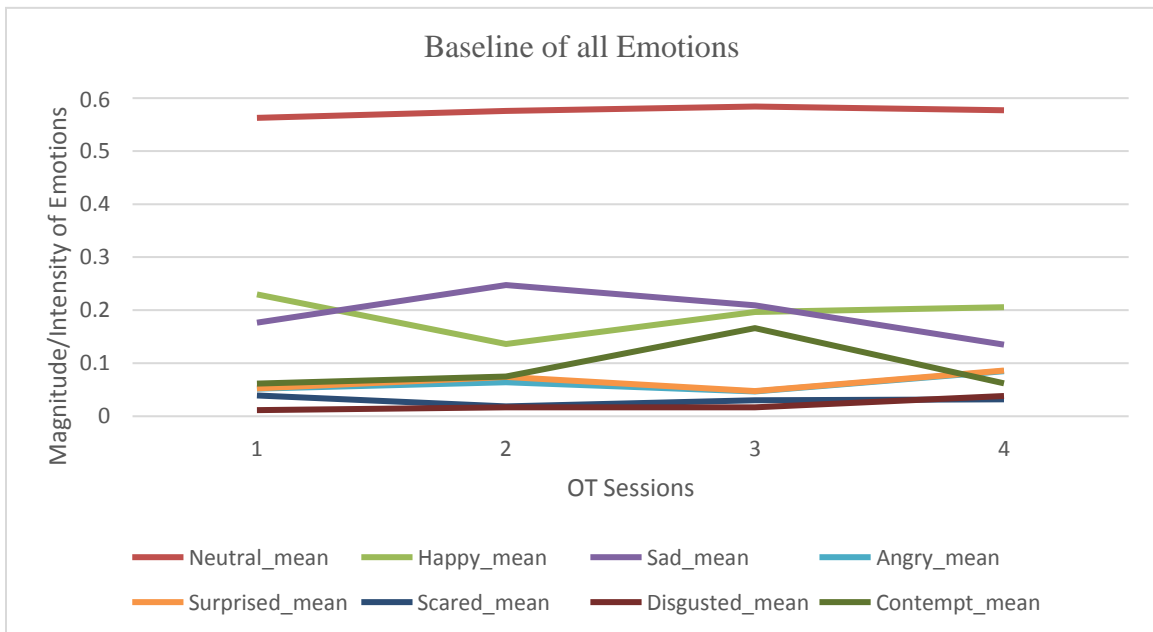


Figure 3. Noldus FaceReader baseline of all expressions.

Once the two expressions with highest magnitude were chosen, baseline repeated measures were analyzed for happy (see Table 2) and sad (see Table 3). To determine if there is a significant trend across the Baseline phase, a calculation of C statistic-baseline data was performed. Once a C statistic was calculated, a score was obtained. The expression of happy has a z score of 1.9047 and because the $z \geq 1.645$, there is a significant trend in baseline (Portney & Watkins, 2009). A significant trend can be interpreted as L.S. is not similar to the normal population. This is not surprising, considering his social history of neglect. In Table 3, Baseline Sad Expression, the z score is 2.5341 which is also greater than 1.645, which indicates a significant trend.

Table 2

Baseline Happy Expression (Repeated Measures)

Baseline	Mean	SD	C statistic	SE	z score	p value
1	0.22969	0.1769				
2	0.13634	0.1769				
3	0.19662	0.1769				
4	0.20563	0.1769				
			0.6954	0.3651	1.9047	0.0262

$z \geq 1.645$, there is a significant trend in baseline

Table 3

Baseline Sad Expression (Repeated Measures)

Baseline	Mean	SD	C statistic	SE	z score	p value
1	0.17667	0.14287				
2	0.24729	0.14287				
3	0.20932	0.14287				
4	0.13488	0.14287				
			0.9252	0.3651	2.5341	0.0057

$z \geq 1.645$, there is a significant trend in baseline

Visual Analysis

Visual analysis of data is traditionally used in single subject design. For this study a Two Standard Deviation Band Method was used to analyze the data. This evaluates the variability within the baseline phase by using the mean and standard deviation (Portney & Walkins, 2009). If at least two data points from the intervention fall outside the band, the intervention is considered significant. Figure 4 compares the expression of happy using the Two Standard Deviation Band Method ($\bar{x} = 0.1920$, $SD = 0.0396$). There are two data points that fall outside the band and therefore the intervention is considered significant. Additionally, to test the null hypotheses that the intervention has not changed the relative positions of the data points across phases or in other words, that any change in the baseline is due to chance. A procedure called the binomial test was calculated

($p = .003$). The probability score is less than 0.05 and therefore considered statistically significant. The null hypotheses can be rejected, since the treatment created a statistically significant change in the outcome (expressions of happiness) from baseline to intervention.

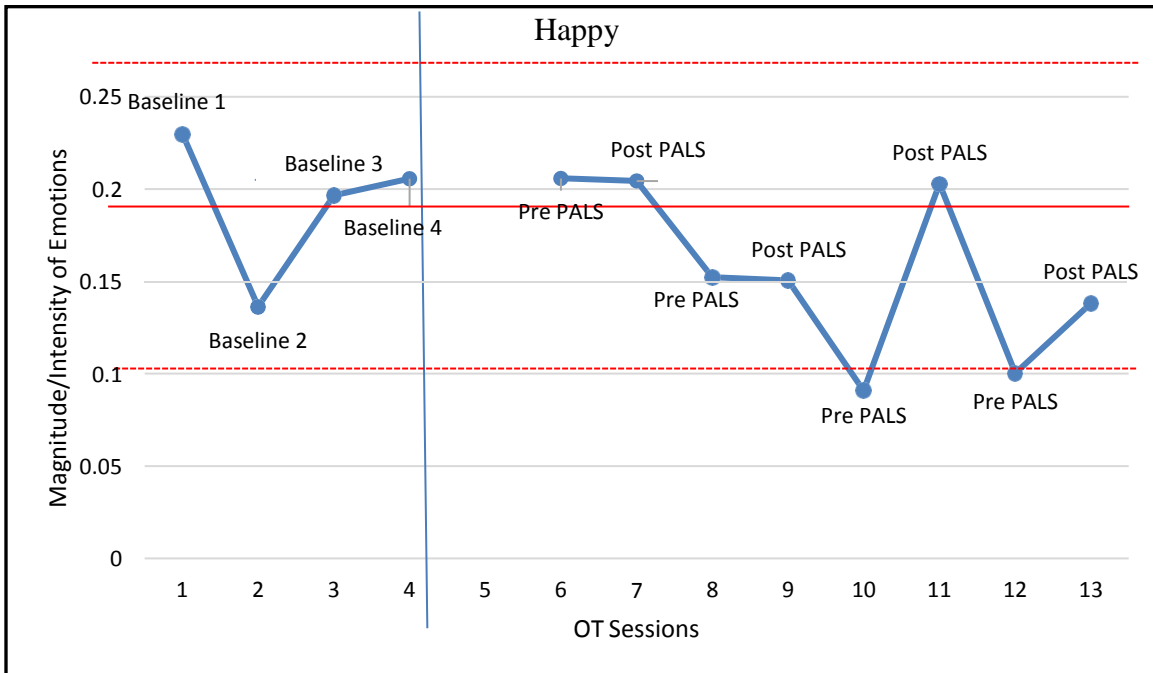


Figure 4. Noldus FaceReader™ happy expression.

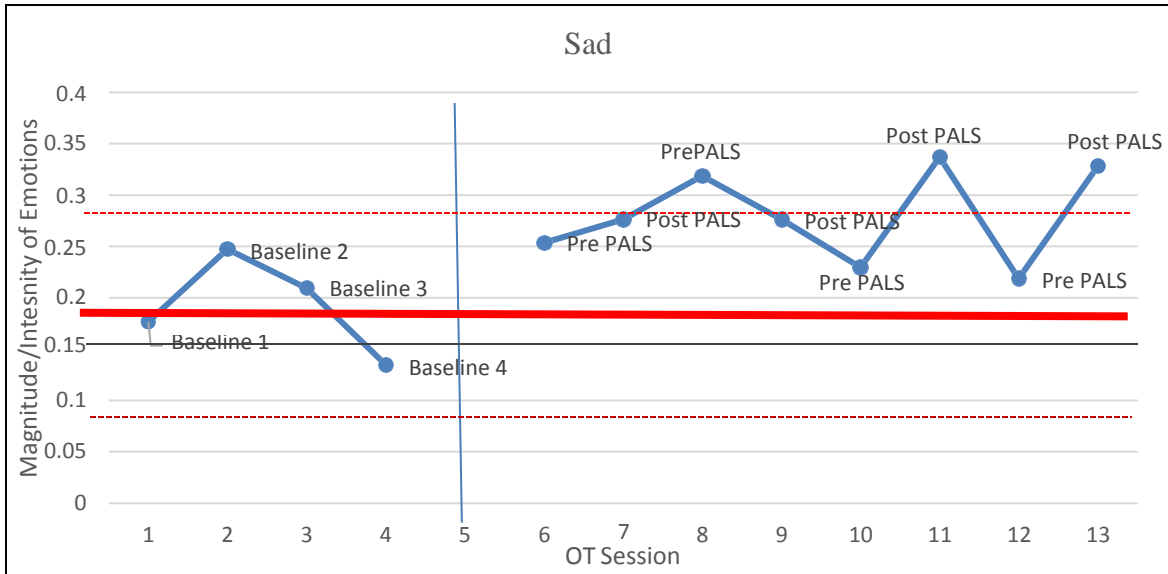


Figure 5. Noldus FaceReader™ sad expression.

The Two Standard Deviation Band Method and binomial test was conducted for the expression sad. Figure 5 compares the expression of sad using the Two Standard Deviation Band Method ($\bar{x} = 0.1920$, $SD = 0.0478$). There are more than two data points that fall outside the band and therefore the intervention is considered significant. In addition, to test the null hypotheses that the intervention has not changed the relative positions of the data points across phases or in other words, that any change in the baseline is due to chance. A procedure called the binomial test was calculated ($p = .003$). The probability score is less than 0.05 and therefore considered statistical significant. The null hypotheses can be rejected, since the treatment created a statistical significant change in the outcome (expressions of sadness) from baseline to intervention. The PALS program created a significant change with both expressions of happiness and sadness.

Research Questions

RQ 1

What is the impact of the PALS program on the child's emotional states (happiness and sadness) as measured by Noldus FaceReader™?

According to the data analysis, there was a significant difference between baseline and intervention phases. However, due to the variability of L.S.'s emotions, it was difficult to see a trend in the data. In Figure 4 (baseline and intervention happy expressions), there are a total of eight data points. The first data point is the pre PALS mean and the second is the Post PALS mean for the same day. The second pair of data points is the Pre and Post PALS score for the subsequent therapy session, and so forth. The first two data points show no change between Pre and Post PALS. The same is true for the second pair of data points. The third and fourth pair of data points to show an increase in expression of happiness between the Pre and Post PALS test.

In Figure 5 (baseline and intervention sad expressions) after a visual analysis of the data, the expression of sadness does not seem as variable as the expression of happiness. When comparing Pre and Post PALS averages, it appears the expression of sadness also increased for the majority of the pair of data sets. Considering an overall increase in happiness and sadness, it may appear contradictory. However, L.S. increase in expression of emotions may indicate a move away from his detachment of emotions.

RQ 2

To what extent does the child's participation in the PALS program influence the child's emotional arousal state as measured by Noldus FaceReader™?

In order to measure arousal, the expression of neutral needs to be considered. Overall, L.S. still demonstrates levels of detachment that continue to need to be addressed. In order to demonstrate a state of an active emotional state (arousal), the mean scores of each expression should approach a minimum threshold of 0.60. After the PALS program he still falls significantly lower in expressions of happiness ($\bar{x} = 0.1920$) and sadness ($\bar{x} = 0.1920$) compared to the threshold mean.

CHAPTER 5: DISCUSSION

The purpose of this study was to identify if there is a relationship between the PALS program intervention and L.S.'s change in magnitude of emotional expression and arousal state (level of detachment from his emotions). The hope was that the PALS program would reduce his level of detachment from his emotions in order to increase his capacity to participate in the world around him. The goal of OT clinical practice is to design interventions that facilitate a positive change in quality of life through understanding the client's limiting factors, maximizing their strengths, and increasing the capacity to successfully navigate their environment. This study provides information regarding a trend of data to describe the emotional state of a child who has a history of trauma. The major findings of this study included (a) baseline levels of emotional expression and detachment of a child with a history of trauma, (b) correlation between PALS and increase of expression of emotions, and (c) correlation between PALS and arousal activity related to detachment.

Discussion of the Complementarity of the Quantitative and Qualitative Data

This was a quantitative research study. However, qualitative information was collected to provide insight about the KidzSPOT OT practitioners' level of confidence in treating children with a history of trauma. An informal interview was conducted with OT practitioners at KidzSPOT. From the interview, the majority of the concerns were related to their knowledge base. Some examples of knowledge base barriers included: level of understanding of the principles of trauma informed care, lack of familiarity with attachment theory, and feeling ill equipped to work with this population. In addition, healthcare system barriers were discussed during the group interview. Some barriers

included reimbursement for services, following a medical model versus a social model, and the role of OT in mental health. The information gathered from the group interview supported the need to develop more evidence-based intervention methods for this population.

Findings and Relevance to Research

The literature clearly articulates the relationship between the child's attachment to the primary caregiver and the child's emotional regulation, and feelings of security, which enable the child to have trust in others and in the environment. Self-regulation (the capacity to effectively manage and respond to an emotional experience) is acquired through the experiences of modeling, imitation, and reinforcement (Bandura, 1971). Young children rely on their caregiver to help soothe when overwhelmed or distressed (e.g. swaddling, rocking, singing). Subsequently, children develop sophisticated methods of regulation that no longer require the assistance of a caregiver. Ainsworth (1967) posited that attachment is more than external behaviors, it is also internal, "being built into the nervous system, in the course and as a result of the infant's experience of his transactions with the mother" (p. 429). L.S. history of attachment is closely knit to his history of trauma (neglect from his biological parents and some of his foster families). A child who is traumatized may not be able to trust others, may not feel safe, and may have difficulty handling life changes (Brandt et al., 2014).

After analyzing L.S.'s baseline emotions, the level of magnitude of his detachment from his emotions does not fall within the normative distribution of the population. This study examined the level of detachment of a child who has experienced trauma. PALS program did show a statistical significance between baseline and post

intervention scores, as evidenced by, L.S. moving away from detached (neutral) feelings to increased expressions of happy and sad. He continued to demonstrate significant detachment after the study; however it is important to note that minor increases in expressing emotions can be indicative of a shift in L.S's active affect. Fujuwara, Mizuki, Miki, & Chemtob (2015), studied children who experienced a traumatic event during the Great East Japan earthquake. The study highlights emotional numbing as a symptom of post-traumatic stress syndrome (PTSD). The study found that the magnitude of neutral facial expressions (emotional numbing) had a positive correlation to PTSD symptoms (Fujuwara, Mizuki, Miki, & Chemtob, 2015). It was also found that PTSD scores were inversely related to the magnitude of sad expression, in other words, children who demonstrated higher expressions of sadness also had less PTSD symptoms (Fujuwara, Mizuki, Miki, & Chemtob, 2015). In this study, L.S. had a high neutral score. The PALS study adds to the literature about the relationship between neutral facial expressions and symptoms of trauma. In addition, after the PALS program, L.S. demonstrated a higher magnitude of sad expressions which is also in agreement with the findings that higher expressions of sadness suggests lower symptoms of PTSD (Fujuwara, Mizuki, Miki, & Chemtob, 2015). Chisum (2018) has found that children with Autism Spectrum Disorder (ASD) have similar high neutral scores. One of the hallmark features of ASD is difficulty with social communication. It is interesting to note that emotional detachment is seen in children with ASD considering the social impact of the condition. It also provides a possible reason for his difficulty in regulating his emotions. L.S. would prefer to detach from any emotions and in the event of environmental challenges that overwhelm him, it is his survival mechanism to lash out

aggressively to protect his need for detachment. A child who did not develop within a safe and supportive care-giving environment learns alternative ways to cope with distress including hyperactivity, aggression, self-harm, and sleeping problems (Arvidson et al., 2011).

Lessons Learned About Implementation of the Action

Lessons learned about the implementation of the action circles around the participation of the caregiver. When I first met the family and spoke to L.S.'s adopted mother, I assumed that she understood that she would be expected to attend most of L.S.'s OT sessions. As I was thinking about how I could have better encouraged the mother's involvement, I reflected upon the KidZSPOT interviews. The group discussed barriers to parent involvement during therapy sessions. One barrier was that parents get in the habit of dropping off their children for therapy, specifically school age children. In addition, it is not a common practice for therapists to make caregiver participation mandatory during therapy. The attachment theory proposes that the presence of a responsive, consistent, and sensitive caregiver assists a child in recognizing their own emotions and behavior, and allows a child to seek comfort from others, cultivating a child's sense of security, social competency, empathy, and emotional intelligence (Bowlby, 1969). Occupational therapists need to fully understand the psychology of attachment theory, specifically the role of the caregiver in the child's emotional development and regulation. This subject matter can be emphasized more in OT universities and in continuing education courses.

Limitations

Initially, the research study was to be a comparative study using a multi-treatment single subject design in order to demonstrate experimental control. Experimental control in single subject designs is achieved by designing the study to measure change in the dependent variable at three points in time (Horner et al., 2005). The three points of time were to have included baseline, intervention #1 (PALS program with the OT) and intervention #2 (PALS program with the primary caregiver). However, L.S.'s mother was not able to attend many of the sessions; therefore, the design changed to an A-B design.

Due to conducting an A-B design, there are many threats to the validity of my study. Without repeating measures of the dependent variable (expressions of emotions) through replicating the treatment, having multiple treatments, and/or withdrawal or staggered introduction of treatment, it is impossible to isolate the variables responsible for behavioral change (Gast, 2010).

The relationship between the participant and the therapist, and its influence on the PALS program was difficult to control. Both the child and the therapist participate in the PALS activities. Therefore, the therapist's participation is a confounding factor. However, if the therapist did have an impact on the PALS results, this underpins a potential for greater gains if it is the caregiver who participates with their child in the PALS program. In addition, if the caregiver cannot participate in the PALS program, the therapeutic alliance with the child may also have a positive impact on the child's expression of emotions. This positive impact could be a means to create a safe place for the child.

Implications for Practice

Through the implementation of PALS, the data from the Noldus FaceReader™, focus groups, and literature search, there are several implications for OT practice. The implications for practice focus on five areas: social and emotional development, caregiver participation, system change, OT practitioner feeling ill equipped to address caregiver/child dyad, and shared joy with sensory intervention.

Social and Emotional Development

L.S.'s baseline data from the Noldus FaceReader™ indicated that L.S. is very detached from his emotions. A consequence of emotional detachment may be that a child has only learned to mimic expressions of emotions versus truly feeling an emotion. Social and emotional development is an area that OT's address in therapy. It would be beneficial for therapists to be aware of the possibility that a child with a history of trauma is only mimicking socially "appropriate" behaviors. Oftentimes, one of the measurements of goals related to increasing social and emotional skills is a child's use of non-verbal expressions. For example, a child's frequency of demonstrating eye contact, smiling, and nodding are non-verbal expressions that therapists use to measure social and emotional skills. It is important for therapists to consider how the intervention is addressing social and emotional skills. Is it the goal to mimic expressions of emotions or feel emotions?

Caregiver Participation

In this study, the expectation that the adopted parent would participate in the PALS program was challenging. Unexpected life events occur, busy schedules, taking care of siblings, all can be barriers for caregivers to attend therapy sessions. Therefore, caregiver participation can be challenging and therapists need to communicate the

expectations regarding the role of the parent as part of intervention planning. Challenges related to parent's participating in treatment, as well as, parent follow through with home programs were also expressed during the KidZSPOT group interview. Additionally, attachment research clearly states that the relationship between the caregiver and child is the essential mechanism for the child's emotional development. Bowlby (1969) emphasizes that the presence of a responsive, consistent, and sensitive caregiver assists a child in recognizing their own emotions and behavior, and allows a child to seek comfort from others, cultivating a child's sense of security, social competency, empathy, and emotional intelligence. It would be of the utmost importance that the caregiver be included in therapy when the therapists address goals related to a child's social and emotional development.

System Change: Healthcare System

Healthcare system issues are defined as the organizational structure that influences therapy. Some examples of organizational structures that impact OT include: reimbursement for OT services, the medical model, OT practice, and the role of OT in mental health. Reimbursement has a strong influence on OT practice. Currently, in Arizona, there are not specific mental health treatment codes for OT's which deters employers from utilizing OT's in this area. In addition, OT's are not reimbursed for family services. OT's receive reimbursement for working with the child only. The medical model focuses on the physical and biological aspects of medical conditions. This lends itself to a reductionist mindset, in other words, therapists focus on reducing the limiting factors of their clients. An example of a limiting factor is a child's poor social and emotional skills. The child's social and emotional development is evaluated and

treated from the vantage point of the child's limiting factors versus within the context of the caregiver and child dyad (social model). This view of social and emotional development can hinder therapists from taking a more holistic view of child's needs. In addition, a child's diagnosis when referred to OT does not indicate emotional concerns. Typically, children are referred to OT due to delay in the motor skills development that is impacting activities of daily living. Therefore, the focus tends to be related to motor skills versus social and emotional skills. When a child is referred to OT there may be no indication of emotional concerns. Even if emotional behaviors are identified, it is not common practice for OTPs to consider a trauma history as part of the evaluation process.

OT Training: Educational Aspects of the Study

It is important to consider the base of knowledge that the therapist receives through training and education in trauma informed care. Increasing training at the OT graduate school level may be a way to address the therapist's level of confidence. Some ideas to embed more training opportunities in the educational system could include adding trauma informed care content at multiple points in the OT curriculum and developing a reflection component during the student's rotation in the clinical setting about the social and emotional issues of their client.

Shared Joy with Sensory Intervention

One of the fidelity elements of sensory integration (SI) is the therapeutic alliance between the child and the therapist. There needs to be SI fidelity measurements developed for this population of children with a history of trauma. Again, reiterating attachment influence on emotional development, there needs to be a shift from the therapeutic alliance between therapist and child to the therapeutic alliance between the

caregiver and child. One idea is using a concept from Bhreathnach (2008) SAI frame of reference which is: the shared joy between caregiver and child during SI intervention is the mechanism of integration. Shared joy can be elicited by caregiver and child doing sensory activities together during OT sessions and at home.

Future Research

A trend of data can be described and a starting point for future studies. Future research is warranted by using a more rigorous single subject design method. The results of an A-B design can provide only a weak correlational conclusion. My future research would include an A-B-A or A-B-A-B design in order to be able to make stronger cause and effect conclusions. I would try changing the design by withdrawal of the intervention, incorporating replication of the experimental effect with similar participants (at least three participants), expanding the number of cases and using a multiple single case study design.

I would incorporate caregiver surveys at the beginning and at the end of the intervention to understand caregiver's perception of participating in the PALS program. This would allow me to identify barriers to caregiver participation in therapy sessions.

In future studies, I would continue to use the Noldus FaceReader™ to measure levels of detachment with this population. There is limited data on measurements of detachment with children who have a history of trauma using the Noldus FaceReader™. Measurements of detachment would be invaluable to add to the body of attachment literature. There are some challenges using the camera to videotape the participant. If the participant moves out of range, the face cannot be analyzed. It would be of interest to analyze the face when the child is participating in a proprioceptive activity. If a camera

could be attached using a GoPro type system, it may allow for videotaping when the individual is moving frequently during physical activity.

Findings from this research demonstrate that the level of L.S.'s detachment from emotions is quite higher than the normative population ($z \geq 1.645$). According to the literature, a traumatic event can affect the way a child views self, the world around him, and his future. A child who is traumatized may not be able to trust others, may not feel safe, and may have difficulty handling life changes (Brandt et al., 2014). Crittendon (2005) viewed the attachment patterns as defense strategies to protect oneself. Further studies would be needed to explore and validate the relationship between detachment and children with history of trauma using the Noldus FaceReader™ software. If detachment is a phenomenon that is frequently identified using the software with this population, then this could provide more evidence to support the need to include attachment principles into therapy. Using Noldus FaceReader™ software to video tape both the child and caregiver simultaneously during the PALS program to study their interaction would add to the body of knowledge regarding the nuances of the caregiver and child relationship.

Lastly, from the findings of this study, L.S.'s expressions of emotions are far from the norm mean ($\bar{x} = 0.6$) (J. Chisum, personal communication, 2019). L.S.'s two highest emotions were happy ($\bar{x} = 0.1768$) and sad ($\bar{x} = 0.2090$) which are very far from 0.6. It would be interesting to study if children learn to mimic expression of emotions when detached. Understanding the difference between whether the child is mimicking emotions versus feeling emotions would be instrumental for treatment outcomes. Mimicking can be a compensatory method for a child to be able to fit into social situations. The overarching consideration is that the use of the Noldus FaceReader™ can provide a baseline

measurement of the child's emotional state which could be used for guiding intervention planning.

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APPENDIX A
IRB APPROVAL



APPROVAL: EXPEDITED REVIEW

Danah Henriksen
 Division of Educational Leadership and Innovation - West
 -
 Danah.Henriksen@asu.edu

Dear Danah Henriksen:

On 10/11/2016 the ASU IRB reviewed the following protocol:

Type of Review:	Initial Study
Title:	Perspective on child and caregiver's self-regulation abilities and impact on quality relationships
Investigator:	Danah Henriksen
IRB ID:	STUDY00004957
Category of review:	(6) Voice, video, digital, or image recordings, (7)(b) Social science methods, (7)(a) Behavioral research
Funding:	None
Grant Title:	None
Grant ID:	None
Documents Reviewed:	<ul style="list-style-type: none"> • Protective Factors Survey.pdf, Category: Measures (Survey questions/Interview questions /interview guides/focus group questions); • JFCS Case Manager Consent Form.pdf, Category: Consent Form; • Script for JFCS Case Managers for Sensory Profile Assessments.pdf, Category: Participant materials (specific directions for them); • Interview Questions for Case Managers or Parent or Caregivers.pdf, Category: Measures (Survey questions/Interview questions /interview guides/focus group questions); • SP 2 7 mo to 35 mo.pdf, Category: Measures (Survey questions/Interview questions /interview guides/focus group questions); • Adult and Adolescent Sensory Profile (002) (1).pdf, Category: Measures (Survey questions/Interview

	questions /interview guides/focus group questions); • Script for Protective Factors Assessment.pdf, Category: Participant materials (specific directions for them); • JFCS Parent or Caregiver Consent Form.pdf, Category: Consent Form; • ASU IRB.docx, Category: IRB Protocol; • Child Sensory Profile 3 to 14 years old.pdf, Category: Measures (Survey questions/Interview questions /interview guides/focus group questions);
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The IRB approved the protocol from 10/11/2016 to 10/10/2017 inclusive. Three weeks before 10/10/2017 you are to submit a completed Continuing Review application and required attachments to request continuing approval or closure.

If continuing review approval is not granted before the expiration date of 10/10/2017 approval of this protocol expires on that date. When consent is appropriate, you must use final, watermarked versions available under the "Documents" tab in ERA-IRB.

In conducting this protocol you are required to follow the requirements listed in the INVESTIGATOR MANUAL (HRP-103).

Sincerely,

IRB Administrator

cc: Lara Taggart
Lara Taggart

APPENDIX B

IRB APPROVAL MODIFICATION



APPROVAL: MODIFICATION

Danah Henriksen
 Division of Educational Leadership and Innovation - West
 -
 Danah.Henriksen@asu.edu

Dear Danah Henriksen:

On 12/2/2016 the ASU IRB reviewed the following protocol:

Type of Review:	Modification
Title:	Perspective on child and caregiver's self-regulation abilities and impact on quality relationships
Investigator:	Danah Henriksen
IRB ID:	STUDY00004957
Funding:	None
Grant Title:	None
Grant ID:	None
Documents Reviewed:	<ul style="list-style-type: none"> • Script for JFCS Case Managers for Sensory Profile Assessments.pdf, Category: Participant materials (specific directions for them); • Child Sensory Profile 3 to 14 years old.pdf, Category: Measures (Survey questions/Interview questions /interview guides/focus group questions); • Script for Protective Factors Assessment.pdf, Category: Participant materials (specific directions for them); • Adult and Adolescent Sensory Profile (002) (1).pdf, Category: Measures (Survey questions/Interview questions /interview guides/focus group questions); • JFCS Case Manager Consent Form.pdf, Category: Consent Form; • SP 2 7 mo to 35 mo.pdf, Category: Measures (Survey questions/Interview questions /interview guides/focus group questions); • Interview Questions for Case Managers or Parent or Caregivers.pdf, Category: Measures (Survey

	<p>questions/Interview questions /interview guides/focus group questions);</p> <ul style="list-style-type: none"> • Email correspondence, Category: Other (to reflect anything not captured above); • Liz- Parker Johnson Letter of Support, Category: Off-site authorizations (school permission, other IRB approvals, Tribal permission etc); • JFCS Parent or Caregiver Consent Form.pdf, Category: Consent Form; • JFCS Letter of Support, Category: Off-site authorizations (school permission, other IRB approvals, Tribal permission etc); • ASU IRB.docx, Category: IRB Protocol; • Protective Factors Survey.pdf, Category: Measures (Survey questions/Interview questions /interview guides/focus group questions);
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The IRB approved the modification.

When consent is appropriate, you must use final, watermarked versions available under the “Documents” tab in ERA-IRB.

In conducting this protocol you are required to follow the requirements listed in the INVESTIGATOR MANUAL (HRP-103).

Sincerely,

IRB Administrator

cc: Lara Taggart
Lara Taggart

APPENDIX C
FAMILY INFORMED CONSENT

Dear Family,

My name is Lara Taggart MS, OTR/L and I am a doctoral student in the Mary Lou Fulton Teachers College (MLFTC) at Arizona State University (ASU). I am working under Dr. Danah Henriksen, a faculty member in MLFTC. We are conducting a research study to explore if there is a relationship between the child and caregiver's ability to self – regulate their emotions and the quality of the relationship.

We are asking for your help, which will involve your participation in completing three surveys. The three surveys will be completed by the parent/caregiver who spends the most time with their child. Two of the three surveys will help us to better understand how you and your child engage in particular behaviors and why you and your child prefer certain environments and experiences. The third survey will help our understanding of your family's protective factors (family functioning/resiliency, social support, concrete support, nurturing and attachment, and knowledge of parenting/child development). We will look at the three surveys and begin to explore if there is a relationship between behaviors and your relationship with your child. We anticipate the surveys to take a total of 20- 30 minutes.

Your participation in this study is voluntary. If you choose not to participate or withdraw from the study at any time, there will be no penalty whatsoever. You must be 18 years of age or older to participate.

The benefit to participation in that ultimately, group-based interventions that focus on self-regulation and sensory modulation, as well as educating parents and teachers about healthy discipline, including the use of positive behavioral supports and

ways to effectively deal with crises would be developed. In addition, providing trauma-informed sensorimotor arousal regulation interventions in collaboration with mental health professionals would be implemented. The study will lead to teaching children mindfulness strategies to reduce stress and to cope with overwhelming emotions. Finally, providing environments and opportunities intentionally designed to increase a traumatized child's sense of mastery, connection, and resiliency.

Your responses will be confidential. Results from this study may be used in reports, presentations, or publications but your name will not be used.

If you have any questions concerning the research study, please contact the research team – Danah Henriksen danah.henriksen@asu.edu or 517-256-2344 or Lara Taggart at lara.taggart@nau.edu or (480) 297-1367.

Thank you,

Lara Taggart MS, OTR/L, Doctoral Student

Danah Henriksen

If you have any questions about your rights as a participant in this research, or if you feel you have been placed at risk, you can contact Danah Henriksen at 517-256-2344 or the Chair of Human Subjects Institutional Review Board through the ASU Office of Research Integrity and Assurance at (480) 965-6788.

APPENDIX D
PARENTAL PERMISSION FORM

Parental Permission Form

INTRODUCTION:

The Purposes of this form are to provide information that may affect decisions regarding your child's participation and to record the consent of those who are willing for their child to participate in this study.

RESEARCHERS:

Lara Taggart, MS, OTR/L

DESCRIPTION OF RESEARCH STUDY:

A sensory integration intervention, Proprioceptive Activities to Lower Stress (PALS), was developed to study its effect on a 6 years old boys expressions of emotions using an AB single subject design. Three emotions were measured using a facial analysis system, Noldus FaceReader™.

BENEFITS:

The possible benefits of your child's participation in the research are connecting with your child on a deeper level, as you will understand your child's level of arousal during certain situations. We will be reconnecting with families and therapists at the end of the study to provide an educational component and help you discover what your child is going through emotionally. Through our facial recognition software, we will be able to analyze if their expressed emotions depict what they truly feel. These results will be shown with you and the therapist at the end of the study. This is also a chance for the therapists to improve patient care and obtain more knowledge about their patient's behaviors, so they can best connect with them.

VIDEOS:

The videos will be used to analyze and understand your child's emotions while watching short Pixar videos. In the clinic, one of the researchers will set up two short clips from different Pixar movies for your child to watch. You and the therapist will be the only people present in the room, the researcher will leave to avoid any discomfort for your child. We want to maintain that comfortable environment for your child and decrease any uneasiness that could rise. A camera would be set near the laptop screen to record your child's expressions—this will occur once pre-study and once post-study. Throughout the study we ask you to record your child on either a mobile device or laptop each time you show your child the Pixar videos we will provide. The reason for this is to be able to analyze if there are any measurable shifts in your child's emotions over the 8-week period while watching the provided Pixar videos. Analyzing the videos will take place in our lab at Arizona State University on one encrypted computer and encrypted thumb drive disconnecting from the internet.

CONFIDENTIALITY:

The results of the research study may be published but your child's name or identity will never be revealed. In order to maintain confidentiality of your child's records. The investigators –consisting of the thesis director Dr. Chisum, tech support data analyzer Glenn Brown and I—will only have access to the data. Analyzing the data will be performed throughout the study in our motivational interviewing lab on an encrypted computer and encrypted thumb drive.

Data will also be stored in an encrypted computer and encrypted thumb drive. A private gmail account: asuresearch19@gmail.com has been created solely for purposes of the study and as a form of contact for you and the therapists. You and child's identity will never be revealed throughout the study and will instead be identified using a randomized number to avoid any identity exposure. After the initial meeting and signing of the consent form, you will provide a confidential email where your randomized number will be given to you. Our data analyzer will generate the numbers stored in his encrypted computer email and email them to the participants via our private email. At the end of the study, the children's facial pixels will be skewed so their identity cannot be recognizable. The results of this study may be used in reports, presentations or publications but your name or any data that determines you or your child's identity will not be compromised. Instead, you will be referred to as your randomized number.

EXCLUSIONARY CRITERIA:

In order for your child to participate in this study, your child must be between 4 to 8 years. For this study, the children will not be removed from their area of comfortability in the clinic. Throughout the study, the children will be evaluated by their caregivers or parents in their home environment, avoiding any change in comfortability. The caregivers of parents will be filling out a questionnaire after observing their child's emotions during the Pixar clips. There will be two questionnaires per week that should be taken right after observing your child, which will take approximately 5 minutes to fill out. Parent or caregiver participants would also be able to read and write fluently in English.

RISKS:

If you do decide to have your child participate in the study, we are not projecting any psychological or physiological risks to the participants in the study with the Pixar videos chosen.

NEW INFORMATION:

You will be contacted if new information is discovered that would reasonably change your decision about your participation in this study.

WITHDRAWAL PRIVILEGE:

If you choose not to have your child participate or to withdraw your child from the study at any time, there will be no penalty. It will not affect your child. Likewise, if your child chooses not to participate or to withdraw from the study at any time, there will be no penalty.

COSTS AND PAYMENTS:

There are no costs or payments associated with this study.

COMPENSATION FOR ILLNESS AND INJURY:

Since we do not have any compensation for participation, there will not be any compensation for illness or injury. Agreeing to your child's participation does not waive any of your legal rights. However, no funds have been set aside to compensate you in the event of injury. In the event that your child suffers harm as a result of participation in this research project, you may contact the local hospital or you may contact the Chair of the Human Subjects Institutional Review Board through the Research Compliance Office at (480) 965-6788.

VOLUNTARY CONSENT:

By signing this form, you are saying 1) that you have read this form or have had it read to you, and 2) that you are satisfied you understand this form, the research study, and its risk and benefits. The researchers will be happy to answer any questions you have about the research. If you have any questions, please feel free to contact Lara Taggart or Dr. Kathleen Puckett at lara.taggart@nau.edu

If any time you feel pressured to allow your child to participate, or if you have any questions about your rights or this form, please call the Chair of the Human Subjects Institutional Review Board through the ASU office of Research Integrity and Assurance at (480)965-6788

Note: By signing below, you are telling researchers Yes, that you will allow your child to participate in this study. Please keep one copy of this form for your records.

Your child's name (please print): _____

Parent 1: Your name (please print): _____

Your Signature: _____

Parent 2: Your name (please print): _____

Your Signature: _____

Date: _____

INVESTIGATOR'S STATEMENT:

I certify that this form includes all information concerning the study relevant to the protection of the rights of the participants, including the nature and purpose of this research, benefits, risks, costs, and any experimental procedures.

I have described the rights and protections afforded to human research participants and have done nothing to pressure, coerce, or falsely entice the parent to allowing this child to participate. I am available to answer the parent's questions and have encouraged him/her to ask additional questions at any time during the course of the study.

Investigator's Signature: _____

Date: _____

APPENDIX E

PERMISSION TO USE FIGURE 1

Hi Lara,

I have just sent you an email giving you permission to use the chart. What did you finally settle on for your research question and what were the outcomes.

Hope you are keeping well.

Warm Regards

Eadaoin.