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Neurobiological Effects of Trauma and The Efficacy of Play Therapy in a School-Based Setting

Laurie M Smith
lsmith47@lesley.edu

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Lesley University

Abstract

There is evidence that play therapy, used in a school-based setting, can be effective when working clinically with children who have experienced developmental trauma and exhibit the resulting maladaptive behaviors and symptoms. There are benefits and drawbacks to working within the schools to access children in need. Some benefits are consistent access to the clients and working with a team of other professionals to meet children's needs. Drawbacks can be the lack of access to families and the infrequency of treatment. This paper explores the literature on the neurological impacts of developmental trauma on multiple levels of children's functioning to provide a better understanding of the many challenging behaviors seen in schools. Also explored is how the age at which the trauma occurs has identifiable outcomes based on neurodevelopment. In particular, I will explore using Bruce Perry's (2009) neurosequential model of therapeutics and how this framework can be applied to treatment and clinical decision making. Then considered is the question of effectiveness of treatment in a school-based setting based on the identified clinical approaches that are expected to work best, in particular, the use of play therapy. The overall purpose of this paper is to provide support for the strength of clinical work that does take place despite the limitations of the school-based setting.

Introduction

Clinicians in the mental health fields are often seeking ways to decrease unwanted behaviors, manage overwhelming emotions, and support relationship building and healing for their clients. Clinicians pursue a career in mental health and strive to deepen their knowledge and skill set, hoping to foster changes for clients in the areas of self-regulation, self-awareness, capacity for insight, and create an internal sense of possibility and what Purvis (2007) called 'felt safety' in pursuit of change and healing for our clients.

There are many modalities, theories, and approaches that clinicians can study over the course of their professional education and career. Clinicians may go to conferences and trainings to learn more or to gain further certification in a modality that aligns with the work they are doing. Or, they may spend time searching online for new and more effective ways to support their clients in their journey for change

Despite extensive education, training and internal motivation to do the work, clinicians often come face to face with the realities of the field: The intense needs of clients, the flaws in the systems we rely upon to support our clients, and the fractured nature of client's families, communities and selves. These challenges become starkly apparent over time. The interventions, theories and ideas that are taught and revered when in school or during an internship collide with bureaucracy. The day to day realities demand a personal and professional reckoning regarding what can actually be done.

In my current work with school age children, I am often asked to explain to parents, teachers, and guidance counselors what it is that I do when conducting a therapy session with their child or student. Those questions may include: What is play therapy? How does play therapy work? Why are you allowing kids to throw a ball at the wall repeatedly? Why are you

blowing? It often feels that the expectation is that I, as the therapist, should be talking to them about their behaviors? Or asking "What were they thinking" when they behaved that way? Even I wonder "how is it therapy if I only see a kid once a week for 5 minutes and do not insist they sit with me for the whole 45 minutes?" Parents and teachers, desperate to be effective in managing challenging behaviors, are often asking themselves, each other, and me "why won't this kid simply listen, follow directions, think before they act, sit still or react calmly?"

I am also seeking to answer these same questions but from a different perspective. My perspective, through the therapeutic lens, includes questions about what has happened in the child's life that makes it so difficult to react calmly to challenges, keep their emotions contained, or relate to peers, teachers or family in culturally acceptable ways. I am also asking myself why it takes so long (or seems to not happen at all) to support even the most incremental change for our students and their families? I am curious about why a student will sit with me in the therapy space and show me a vulnerable, thoughtful and, frankly, amazing self then walk out into the hall and immediately revert to aggressive and defensive behaviors with peers and staff.

My particular interest is in looking at the effects of abuse, neglect, and early ruptures in caregiving. This curiosity emerges from my clinical relationships with, and observations of, the students and families I work with. Many of my clients have had their primary caregiving relationships interrupted at early ages as a result adverse life experiences (ACEs) (see Appendix A). These ACEs include, but are not limited to, a caregiver's drug or alcohol addiction, witnessing of domestic violence, experiencing neglect and/or abuse and, generational trauma and violence and/or histories of mental illness. I am curious to explore if, and how, the effects of those early ruptures and early life stress (ELS) (Hambrick. et al. 2019) can be mitigated. Are there are differences in outcomes for students who have survived chronic maltreatment based

how old they were at the time of the rupture? Are there treatment implications, based on the timing of trauma, that inform what intervention or approach I could use therapeutically? I want to know if what I am doing as a school-based therapist is effective when I am rarely engaging the family or caretaking system in which my clients live a large percentage of their lives. On a very fundamental level, are my choices of focusing on relational/felt-safety, consistency, the sensory, non-verbal, repetitive activities and interactions truly as therapeutic and healing as I believe?

The increase in awareness and influence of the neurosciences and neurobiology in the therapeutic fields offers clinicians new perspectives and approaches that can help answer these questions and provide ways of seeing our clients (Dion, 2018; Kestley, 2014; Malchiodi & Crenshaw, 2015) that allows us to better understand their struggles. These emerging ideas can help to inform clinical choices in terms of training, as well as how clinicians assess and work therapeutically with clients. Specifically, these fields offer the perspective that no intervention, training, modality, or specific approach will have any deep or lasting effect until a child experiences mental, physical and emotional safety (Dana, 2008; Purvis, 2008; Schore, 2008; van de Kolk, 2005). To clarify, until an individual who is grappling with a traumatic history feels truly safe in their relationships, families, communities, bodies and brains, many therapeutic approaches may be less effective.

According to many of the proponents of neurobiological perspectives in the psychiatric fields (Hambrick et al 2018, 2019; Perry, 2009, 2013; Schore, 2008, 2002; Siegel, 2006; van der Kolk, 2005), until the old neural pathways that were created by traumatic experiences are balanced by new neural connections, clients will not be able to maintain healthy relationships or feel safe enough to consider behavior change, insight, or self-awareness. The challenge with these approaches lies in just how many new neural connections are necessary as well as the need

for a very long view for the path to change. As a clinician working with kids who have experienced multiple traumas across multiple life domains it helps me to remember that established neural pathways cannot fixed or erased; instead we can support the creation of new pathways and connections to provide moments of relief, greater internal regulation and positive changes in behavior.

According to many of the theorists and researchers already cited, the first step in creating new neural pathways is being a consistent, safe and predictable presence in their lives, even if it is just for 5 or 45 minutes a week, or are 18 and heading out into the world with their still struggling with the maladaptive behaviors that have been previously self-protective. The frustration many clinicians experience when we do not see 'progress' with our clients is often because we are not attending to this most basic need of safety. Instead, we end up frustrated when cognitive oriented talk therapies don't work. It is easy to forget or misunderstand the original purpose of these behaviors. Bessel van der Kolk (2005) reminds us that "many problems of traumatized children can be understood as efforts to minimize objective threat and to regulate their emotional distress" (p. 403) and that "when trauma emanates from within the family, children experience a crisis of loyalty and organize their behavior to survive within their families…they acclimate in any way they can to entrapment in abusive or neglectful situations (p. 404).

There are number of emerging and established frameworks for approaching clients through a neurobiological lens, such as Dan Siegel's (2006) interpersonal neurobiology (INPB), Stephen Porges polyvagal theory (Dana, 2018, Wheeler & Dillman, 2016) and Bruce Perry's (2013) neurosequential model of therapeutics (NMT). These are neurobiologically informed frameworks that support the idea that clinicians need to look towards a child's earliest and

subsequent traumatic experiences to inform how to approach therapeutic interventions. These frameworks support seeing clients through a lens of developmental trauma rather than a cluster of challenging symptoms, behaviors or diagnoses. With these frameworks a clinician can consider at what point a client's brain was first impacted by trauma and what is needed by their nervous system to respond to those impacts. Then the clinician can seek interventions that respond best to the needs of a traumatized client. That intervention could be child centered play therapy (CCPT) and other play therapy (PT) modalities.

Regardless of the modality or intervention used, the therapist must provide the child with the unconditional acceptance, attunement, and resonance that is the necessary foundation for creating a sense of safety. The glimmer of safety (Dana, 2018) that a child might experience eventually in therapy is the beginning of new neural connections. Those new connections will slowly bring traumatized children into a place where they can be held and supported in the process of healing, alter behaviors that were once adaptive but now hinder their ability to learn and have relationships. It is my intention to identify the underlying principles that justify my focus on creating safety and building relationship as the primary therapeutic and healing mechanisms for my clients. For my work, and the purposes of this paper, I will explore the following: use of developmental trauma disorder as a starting point and diagnosis rather than post-traumatic stress disorder as a diagnosis; How attachment styles and the experiences of trauma connect and the neurobiological effects of both; the possibility that NMT offers an effective way of assessing and treating traumatized children while; that play therapy can be considered a neurobiologically informed practice and, finally, if this can all be used effectively in a school-based setting.

Literature Review

The process of reviewing and digging into the effects of abuse, neglect, maltreatment and subsequent ruptures in caregiving during the course of a child's early years requires addressing a few areas of theory and practice. This exploration will first consider the current diagnoses given to many of these clients and if those diagnoses address the symptoms and needs of the population. I will then look at what is known about the effects of various attachment styles, review past and current thought on attachment theory. Also considered will be connections between attachment outcomes and the increasing information regarding what we know about the neurobiological and physiological effects of childhood trauma on later relational functioning. It is then important to consider how that knowledge informs therapeutic practices and, in particular, play therapy, especially what can be done to effect change for the children, teens, and adults who live with the effects of early childhood maltreatment. To that end, looking at the use of the neurosequential model of therapeutics (NMT), and how play therapy (PT) fits into NMT and, if these practices address the assessed needs of a child with complex trauma (particularly with in the school-based setting) when considered through the lens of NMT.

Reframing Post Traumatic Stress Disorder

Regarding terminology and language that is used for diagnosing childhood trauma, many clinicians in the field have found the diagnosis Post Traumatic Stress Disorder (PTSD) to be increasingly inadequate. PTSD, as a diagnosis, is generally accepted and useful for adults who have experienced trauma but does not take into consideration the overwhelming effects of early life stress (ELS), adverse childhood experiences (ACEs), and other identifying labels for repeated traumas that can occur during childhood (Van de Kolk, 2005, Lawson & Quinn, 2013). Perry (2009) discussed the idea that developmental adversity alters the developing brain which

can lead to a "complex and clinically confusing presentation" (p. 253). There are many alternative labels that have been proposed and are being used in academic literature that aim to address the complexity of these experiences. Most often seen are the terms Complex Trauma (CT) and Developmental Trauma Disorder (DTD) or just developmental trauma (DT). All are increasingly being used in literature and conversation related to the effects of trauma.

Lawson & Quinn (2013) discussed CT as having been proposed, though not adopted, for the DSM 5 and stated that CT results from:

> Exposure to severe stressors (e. g. emotional, physical, sexual, neglect and witnessing family violence) that most often begin in childhood or adolescence, occur repeatedly over time and are perpetrated within the caregiving system or by other adults who typically are expected to be the source of security, protection and stability...As a result, many of these children and adolescents experience lifelong difficulties related to self-regulation, relationships, psychological symptoms (depression, anxiety and dissociation), addiction, alterations in attention/consciousness, self-injury, identity, and cognitive distortions (p. 498).

The authors reviewed various therapeutic intervention modalities and their effectiveness in addressing CT. What stands out in their findings is that treatment length for CT often needs to be longer than the currently used short term treatment models and that caregiver involvement is important. They also pointed out that building self-regulation and anxiety tolerance are important. Significantly, the finding that trauma processing is not crucial to treatment, acknowledges that trauma processing has the potential to be counterproductive and retraumatizing if not handled thoughtfully. Also important was the finding that attention to length of treatment and caregiver involvement result in stronger positive outcomes for clients.

According to Bessel van der Kolk (2005) "neural development and social interaction are inextricably intertwined" (p. 402). Van der Kolk pointed out that PTSD is not the most common diagnosis for children. Made more often are diagnoses of separation anxiety disorder, oppositional defiant disorder, phobias, ADHD and other issues related to impulse control and self-regulation. This seems to indicate that clinicians struggle with diagnoses when significant instances of trauma are involved and that trauma symptoms can masquerade as many other diagnoses. Van der Kolk said that PTSD does not accurately and effectively speak to the developmental effects of childhood trauma. His proposal was that DTD results from multiple exposures to interpersonal trauma, such as abandonment, betrayal, physical and sexual abuse and witnessing domestic violence. Additionally, these experiences have predictable consequences such as:

> Complex disruptions of affect regulation, the disturbed attachment patterns; the rapid behavioral regressions and shifts in emotional states; the loss of autonomous strivings; the aggressive behavior against self and others; the failure to achieve developmental competencies; the loss of body regulation in areas of sleep, food and self-care; the altered schemas of the world; the anticipatory behavior and traumatic expectations; the multiple somatic problems, from gastrointestinal distress to headaches; the apparent lack of awareness of danger and resulting self-endangering behaviors; the self-hatred and self-blame; and the chronic feelings of ineffectiveness (p. 406).

These considerations and views on childhood trauma are important because with these early, chaotic, repeated stressors and traumas, the existing diagnoses fail to encompass and address traumatized individuals' greatest needs of consistency, safety, and attention to

neurological insults that are a result of their experiences. For the purposes of this paper, DT will be the term most used to refer to the mental health conditions of the population being considered.

Attachment theory: Why it matters

An in-depth review of attachment theory is beyond the scope of this paper. So, for the purposes of this inquiry, attachment:

> describes the interactions between children and their caregivers that have longstanding impact on the development of identity and personal agency, early working models of self and other, and the capacity to regulate emotions. Nurturing and consistent caregiving promotes skill development and a safety net for coping with difficult experiences" (Kinniburgh, Blaustein & Spinazzola, 2005, p. 424).

Perry (2001) defines attachment more succinctly as the particular bond that takes place in the caregiver and infant relationship. Securely attached caregiver-infant relationships have 3 characteristics: They last over time with one person, the resulting effect for the child is safety, comfort, soothing and pleasure, and that the loss of the relationship causes significant distress to the child (Perry, 2002).

It is useful when discussing attachment to refer to the styles of attachment researched and established by Mary Ainsworth and John Bowlby (1989). The two primary styles are secure and insecure; insecure is then divided into avoidant, ambivalent and disorganized attachment (Hong & Mason, 2016; Kestly, 2014; Perry, 2001, 2009). Secure attachments with caregivers promote resilience in the face of challenging events (Kravits, 2008) and "securely attached children feel a consistent, responsive, and supportive relation to their mothers even during times of stress. Insecurely attached children feel inconsistent, punishing, unresponsive emotions from their caregivers and feel threatened during times of stress" (Perry, 2001, p. 4).

Attachment theorists Schore & Schore (2007) modernized attachment theory and proposed the idea of attachment theory as actually being a theory of regulation. They emphasize the idea of the attachment relationship occurring on a neurobiological level as stating that "the attachment relationship mediates the dyadic regulation of emotion wherein the mother (primary caregiver) co-regulates the infant's postnatally developing central (CNS) and autonomic (ANS) nervous systems" (p. 11). More simply, the attachment relationship is what fosters a child's eventual neurobiological ability to use self-control and be organized emotionally, mentally and physically. Schore's theory suggests that the attachment relationship is the beginning of a human's capacity to regulate the stress of both joy and distress. He states that "attachment is more than the reestablishment of security after a dysregulating experience and a stressful negative state, it is also the interactive amplification of positive affects" (2002, para. 26). Multiple other theorists and researchers also believe the infant's foundations for internal regulation occurs in the process of the child anticipating and eliciting the caregiver's responses (van der Kolk, 2005, Gaskill & Perry, 2016) and depends upon the caregiver reciprocating responses and being well-regulated and safe (Hong & Mason, 2016).

Also pertinent to Schore's theory is the proposal that attachment outcomes are also a relational process and a "product of the child's genetically encoded biological (temperamental) predisposition and the particular caregiver affective-relational environment" (2002, para. 7). Additionally, that:

> over the course of the first year these same attachment experiences directly influence the growth of the infant's brain, especially the higher areas of the right brain that are involved in reading the emotional faces, voices, and gestures of other humans, in appraising bodily

> responses to such social stimuli, in regulating resultant emotional states, and in coping with internal and external stress" (para. 43).

It is when primary caregiving relationships are the cause of distress and pain that a child's ability to regulate their arousal and stress breaks down (van der Kolk, 2005, Gaskill & Perry, 2016). It is when the distress and pain caused by an unpredictable caregiver are chronic or unrelenting that the roots and effects of trauma begin to occur and impact a child's ability to regulate (Lawson & Quinn, 2013, van der Kolk, 2005) and result in insecure attachment relationships (Perry, 2002). Cook, Spinazzola, Ford, Lanktree, Blaustein, Cloitre, & van der Kolk (2005) state that:

> early caregiving relationships provide the relational context in which children develop the earliest psychological representations of self, other and self in relation to other. These working models form the foundation of a child's developmental competencies, including, distress tolerance, curiosity, sense of competency and communication" (para. 5).

For the purposes of the paper and the population being considered, insecure attachment styles are considered to be the result of varying degrees of childhood trauma. Children from neglectful and abusive families contend with multiple challenges across multiple life domains. These children often struggle with emotional intimacy, are parentified (meaning they either treated like a playmate or expected to take responsibility beyond their capabilities), have developmental delays, poor impulse control, exhibit odd eating behaviors, use primitive or disruptive soothing behaviors, have deficits in emotional functioning and cognitive processing, and can exhibit aggressive and violent behaviors (Perry, 2001). These challenges can be attributed to, and understood by, the effect of significant deficits in caregiving, exposure to events that were terrifying and the neurological impact of those deficits.

Neurobiological Effects of Abuse, Neglect and Maltreatment

The original attachment theorists Mary Ainsworth and John Bowlby (1989) included neurological implications of attachment:

> Drawing on cognitive psychological concepts and research, he {Bowlby} pointed out that much sensory input normally is evaluated quickly and unconsciously in terms of stored knowledge, and then excluded from the highest conscious level of cognitive processing as a matter of sheer efficiency. Under other circumstances, when accessing stored experience to evaluate current input would occasion significant anxiety, there may be defensive exclusion of input before it can proceed to conscious processing. Attachment behavior and associated feelings are especially vulnerable to such exclusion. When the attachment system is intensely activated and is often [*sic*] or for an extended period [sic] not terminated, defensive exclusion is likely to occur. This results in the defence manifested by avoidant children and in the detachment attributable to severe separation experiences" (p. 339).

This description of "defensive exclusion" is very similar to definitions of dissociation. According to Perry (2001) "dissociation is a broad descriptive term that includes a variety of mental mechanism involved in disengaging from the external world" (para. 23). Perry proposed that children who have been maltreated most often acquire one of two physiological, and not mutually exclusive, coping responses; hypervigilance and dissociation. Younger children are more likely to use dissociation because "immobilization, inescapability or pain will increase the dissociative components of the stress response patterns at any age" (para.24). Dissociation can result in physical suppression of bodily functions such as extremely low heart rates and altering one's sense of time and place through alteration of neurotransmitters and hormones.

The other trauma response, hyperarousal, is a continuum of activation that begins in the central and peripheral nervous systems affecting multiple areas of the brain and its functioning These areas include the brain stem (which manages functions such as sleep, breathing, coordination and irritability), the hippocampus (which manages stress hormones and neurotransmitters which in turn impact memory), the amygdala (which manages and determines the emotional 'value' of simple sensory input and other complex perceptions, cognitive abstractions, and our responses to social stimuli (Perry, 2001).

The idea is that the symptoms (dissociative/hypervigilance) a child exhibits as a result of traumatic events will be in response to the intensity and duration of the maltreatment. If the response is activated long enough or consistently enough there will be molecular, structural and functional changes in the brain (Perry, 2001). Perry stated the direct link to attachment styles, "in the absence of an appropriate caregiver reaction to {the child's} initial alarm outcry, the child will abandon the early alarm response" (p. 7) thus eliminating the use of emotional distress to elicit caregiver attention. This behavior is very similar in description to the insecure and disorganized attachment styles discussed above in that the child learns to stop seeking comfort from the caregiver in the face of persistent inattention, neglect, or abuse.

The neurosequential model of therapeutics (NMT). Perry and Dobson (2013), defined NMT as a "developmentally sensitive and neurobiologically informed approach to clinical problem solving" (p. 249). NMT is not a therapeutic technique or intervention. Rather, it is an approach that "structures assessment and identification of primary problems and strengths, and it sequences the application of interventions (educational, enrichment and therapeutic) in a way that reflects the child's specific developmental needs in a variety of key domains" (pp. 248-249). The NMT process also involves "quantifying the nature, timing, and severity of adverse

experiences as well as relational health factors" (2013, p. 253). The three central elements of NMT are taking a developmental history, assessing current functioning, and creating a set of recommendations for intervention. The developmental history (see Appendix B) includes gathering (when possible) genetic and epigenetic information and the nature, timing, and severity of ACEs. In addition, information is taken regarding relational health measures such as information on bonding and attachment, family supports and community supports. Current function (see Appendix C) refers specifically to neurological and central nervous system functioning by considering the current capacities exhibited or missing that relate to the brainstem, cerebellum, limbic area, the cortex and the frontal cortex. Recommendations made will take into consideration all of this information and produce a set of treatment modalities and recommendations that directly address the assessed developmental and current functioning needs of the client.

Perry (2001, 2002, 2009) and his associates (Hambrick et al., 2018, 2019) have conducted extensive research and discuss in multiple writings the effects of maltreatment, violence and neglect on children's developing brains and how these children are required to develop and perform academically under conditions of constant threat and deprivation. The primary concern is the vulnerability of the brain's development to these stressors. It is generally understood that the brain develops rapidly in the first few years of a child's life. During that time the neurological systems for emotional regulation, behavior, social connection and physiological functioning are being laid in place. Perry (2001) stated that "a growing body of evidence suggests that the growing brain organizes in response to the pattern, intensity and nature of sensory perceptual and affective experience of events during childhood" (p. 4). Hambrick et al. (2019) also remind us that the human brain organizes most rapidly in the earliest days of an

infant's life and does so best in a co-regulated relationship. Also, of importance, as discussed above, is a child's ability to manage states of both hypo- and hyperarousal. Simply stated, chronic threat results in permanent changes in the brain (Hong & Mason, 2016).

Why consider the timing of trauma in NMT? The development of the human brain is an organized and hierarchical process with neural networks and major areas of the brain developing from the bottom up (Hong & Mason, 2016, Perry 2009). In other words, the most basic systems develop first and more complex functions develop later (see Appendix C).

The first to develop, often referred to as the lower brain area, is the brain stem, where our principal physiological functions such as breathing, heartbeat, temperature regulation and more, are managed. The brainstem develops first in-utero and then during infancy. Next to develop are the diencephalon and cerebellum (or midbrain) which are responsible for functions such sleep, coordination, feeding and appetite. The limbic system is next and is responsible for functions such as affect regulation, short-term memory, empathy and internal reward systems. Last to develop fully is the cortex and frontal cortex where our more complex and mature functions are developed and integrated. Some of these functions are self-awareness, complex communications, academic skills, abstract thinking and other complex functions. Starting in adolescence these later developing cortical areas, are the seat of one's ability to make decisions, think logically and manage our impulses (Perry, 2001, 2009, 2013).

Perry contends that "the very same traumatic experience will impact an 18-month old differently than a 5-year old" (2009, p. 242) and discusses how "exposure to violence activates a set of threat-responses in the child's developing brain; in turn, excess activation of the neural systems involved in the threat responses can alter the developing brain; finally, these alterations may manifest as functional changes in emotional, behavioral and cognitive functioning" (2001,

p. 5). Perry & Gaskill (2014) remind us that "when these networks are impacted by intrauterine insults (e. g. prenatal alcohol or drug exposure), early life attachment disruptions, or traumatic stress, these networks will be dysregulated, resulting in compromise in all the functions impacted by their wide distribution" and that "predictable, moderate activity leads to flexible and capable stress response capacity (with potential for demonstrating resilience), whereas extreme, unpredictable, or uncontrollable activation leads to a sensitized, overly reactive set of stress response networks" (p. 182) or, based on attachment theory, secure or insecure attachment.

Also pertinent is the idea that the brain develops in a use dependent fashion (Perry, 2009). In the therapeutic fields one often hears the terms 'use it or lose it' or 'states become traits.' This means that neural connections for brain states, abilities and functioning that are used most often will be created and neural connections for unused functions will be eliminated. Perry (2001) states that "evidence suggests that the developing brain organizes in response to the pattern, intensity and nature of sensory, perceptual and affective experience of events during childhood" (p.4) and that:

> exposure to violence activates a set of threat-responses in the child's developing brain; in turn, excess activation of the neural systems involved in the threat response can alter the developing brain; finally, these alterations may manifest as functional changes in emotional, behavioral and cognitive functioning. The roots of violence-related problem, therefore, can be found in the adaptive responses to threat present during the violent experience (p. 5).

For example, if dissociation is the coping mechanism a child uses consistently and repetitively, then over time dissociation will become the default coping mechanism. The same can be said for

aggression, anger, lack of empathy or many of the other traits of concern related to the needs of maltreated children.

Hambrick, Brawner, Perry, Brandt, Hoffmeister and Collins (2019) consider the association between ACEs and a child's social, emotional and cognitive functioning, particularly as these relate to the developmental timing of the adversities experienced. The authors caution that "public awareness about the potential impact of adversity and trauma is important, yet knowing that these matter is only the first step in the informed creation of programs, practice, and policy to address the physical, social and emotional morbidity associated with developmental adversity" and contend that the "type, timing, severity, frequency, chronicity and the child's developmental status when adversity occurs are interrelated and uniquely meaningful for developmental outcomes" (p. 244). The authors used data collected by clinicians using NMT and hypothesized that perinatal Adverse Experiences (AE) occurring between 0-12 months would account for more profound impacts on the functioning of children from ages 6 to 13 years, than if the ACEs had occurred between 13 months and 11 years of age. It was found that deficits in attachment relationships were a predictor of later emotional and behavioral challenges even more so than perinatal adversity. This means that attachment relationships in early life can have more of an impact on later functioning than other adverse experiences that occur in the early years.

Hambrick, Brawner and Perry (2019) conducted subsequent research that provides further evidence for the idea that timing of trauma has particular outcomes. In this case they looked at Early Life Stress (ELS) which "is defined as severe adversity (domestic violence, caregiver drug use) and severe relational poverty (e. g. caregiver neglect, lack of caregiver attunement) occurring during the first 2 months of life" (p. 1) thus narrowing even more one

window of timing. It was found that ELS, and specifically severe lack of perinatal (0-2 months) positive relational experiences, were associated with later challenges in sensory integration and self-regulation. Negative experiences that persisted throughout childhood were found to have more impact on cognitive and relational functioning. Interestingly, it was theorized that the function of dissociation in ELS might protect cognitive functioning. Thus, if maltreatment or neglect discontinues early on later challenges will not necessarily affect academic functioning. Based on this research, there are connections between ELS and lower brain functions such as: self-regulation, an ability to maintain relationships, sensory integration, sleep, arousal, impulsivity, and empathy. These are challenges many clinicians working with children see their clients grappling with and are the deficits make it seemingly impossible to engage academically, relationally and with self-awareness and self-control.

To provide a quick review of this section: hypervigilance and dissociation serve as adaptive coping mechanisms in early life and the duration, intensity and repetition of adverse life experiences (ACEs) cause lasting neurological changes. The brain develops from the bottom up with basic human functions developing first and more complex functions later in life which then means that the timing of trauma can have particular long-term impacts. Additionally, NMT is a possible framework with which to approach formulating treatment of developmental trauma.

Using Play Therapy to Treat Children with Trauma

Hambrick et al. (2019) caution that "one size fits all interventions do not reliably work for this subset of children who present with a diverse set of problems that can include severe sensory sensitivities, impulsivity and regulatory problems, relational impairments and cognitive deficits" (p. 2). Hong and Mason (2016) seem to agree stating that "a neurobiologically informed understanding of work with a child allows a clinician to select interventions most likely to

impact the areas of the brain in which overall functioning suggests a deficit while recruiting those areas with relative strengths to promote positive development" (p. 41). NMT identifies play therapy as one therapeutic intervention that is supported as an effective and compatible treatment to use once NMT assessments and goals have been completed (Perry & Gaskill as cited in Malchiodi & Crenshaw, 2015). In an interview, Eliana Gil (well known play therapist, author, clinician and presenter) states that:

> When we do therapy, most clinicians are trained to engage the cortex, that is, have verbal dialogues. The problem is that if the brain stem is activated, and children are not breathing properly, and their motor functioning is not in control, their cortex is not 'online'. It is such a simple concept that you really have to address: What is really happening in the moment you are with the child? Being able to get the cortex online usually happens when the children feel comfortable, safe and they have a relationship with you. They are much more able to engage with you cognitively when their regulatory system is calmed down, or regulated, and happens in the context of a relationship (Sori & Schnur, 2014, p. 252)

This is the essence of play therapy, creating the safety that allows a child's neurology and physiology to be in a relationship with a caring attentive adult. Perry (2014) reminds us that:

> Developmental theorists generally have viewed play as an essential experiential element of social, emotional, physical, intellectual, and psychological development. The somatosensory experiences in some play activities have been viewed as the neurological foundations for later advanced mental skills such as creativity, abstract thought, prosocial behavior and expressive language (p. 180).

Both the research reviewed in this paper and the experience of many play therapists show that play heals and play therapy is effective. Play is a stimulant for curiosity, organizing, joy, creation and explanations (Kravits, 2008) and those experiences and sensations are what make play and play therapy a potentially healing process for children living with the effects of traumatic experiences. As Gary Landreth (2012) says "therapists must turn loose of their world of reality and verbal expression and move into the conceptual-expressive world of children" (p. 7). Schore (2017) states that neurobiologically informed play therapy stresses the importance of "the therapeutic relationship and regulation of affective states…the role of the therapist is not to interpret children's play, but to cocreate play contexts that can form an attachment, a bond of emotional communication and interactive regulation. We understand a child's defenses as strategies that minimize or avoid intolerable affects and so we pay attention not only to conscious but also unconscious affects (p. 129). In other words, play and play therapy, provide a process through which children (and adolescents and even adults) can express non-verbally what they are unable to express verbally.

Play therapy theory and practice. Again, a full discussion of the depth of theory and evidence supporting play therapy as a practice is beyond the scope of this paper except for the basics. Garry L. Landreth (2012) defines play therapy as:

> A dynamic interpersonal relationship between a child (or person of any age) and a therapist trained in play therapy procedures who provides selected play materials and facilitates the development of a safe relationship for the child (or person of any age) to fully express and explore self (feelings, thoughts, experiences, and behaviors) through play, the child's natural medium of communication (p. 11)

Landreth also shares his theory that Child Centered Play therapy (CCPT) is a "complete therapeutic system, not just the application of a few rapport-building techniques, and is based on a deep and abiding belief in the capacity and resiliency of children to be constructively self-directing" (p. 53). Kottman (2011) identifies the following mechanisms, or therapeutic powers of play, in PT as; self-expression, access to the unconscious, use of direct and indirect teaching, abreaction, stress inoculation and mastering fears, counter conditioning of negative affect, catharsis, positive emotion, competence and self-control, sublimation, attachment formation, power and control, sense of self, creative problem solving, reality testing and fantasy compensation.

Landreth, like Eliana Gil, reminds us that children do not have the cognitive capacity to express their hurts verbally and that play therapy allows a child the sense of being in control of their world, at least with in the therapy space. For most maltreated children, control is what they have not had: control over the adults in their worlds, the violence in their neighborhoods, poverty or racism. Landreth states "A major function of play therapy experiences is the changing of what may be an unmanageable experience in reality to a manageable experience through symbolic representation" (p. 16). Van der Kolk (2005) states "Safety predictability and 'fun' are essential for the establishment of the capacity to observe what is going on, put it into larger context and initiate physiological and motoric self-regulation" (p. 407).

For the purposes of this paper it is useful to keep in mind that play has therapeutic powers such as providing non-verbal outlets for managing trauma, offering children a sense of control and providing a safe space and experience.

Play therapy as neurobiologically informed. Hudspeth (2016), in a review of articles related to neuroscience in the *International Journal of Play Therapy*, found that "over the course

of 24 years, there have been more than 50 articles that mention, explore, or integrate neuroscience aspects with play therapy. The further back one looks, the fewer articles one will find" (p.1). He goes on to remind readers that "authors have used neuroscience to help explain what we as play therapists do and believe. This research confirms our belief in the therapeutic powers of play" and "supports the notion that what we do is developmentally sensitive and beneficial" (p. 1). Schore (2017) states that "Play, in fact, is a fundamental expression of the attachment regulatory dynamic. Attachment is not just the re-establishment of security after a dysregulating experience and a stressful negative state. It is also the interactive amplification of positive affects, as in play states. Play calms and soothes infants, and it modulates their stressful states of negative arousal, replacing stress with intense joy and excitement" (p. 117). Similarly, in a discussion of interpersonal neurobiology and play, Wheeler and Taylor (2016) state that "Play therapy techniques compliment discoveries in neuroscience for the power of relationships to influence neuronal growth" (p. 32).

Hong and Mason (2016) connect neurobiological information, as discussed above, to many elements of PT practice. Implicit memory is an interesting example. Implicit memories are those outside of consciousness, are primarily non-verbal, is the only type of memory process available during infancy and is involved in the creation of associations between sensory information and traumatic events that can lead to trauma responses later in childhood and throughout the lifespan. It is proposed that one way to access those non-verbal, early life sensory experiences is by activating those same neural connections that encoded those memories. Play therapy offers non-verbal, sensory based, experiential learning that can create new neural connections to balance the neural connections that result in suffering. Or, as Perry (2013) said, can provide "patterned, repetitive and rewarding experiences sensitive to developmental status"

(p. 257). In other words, a child might be 10, but developmentally functioning in some, or all areas of, in ways that are more like a 3-year old. Play therapy can meet the non-verbal needs of a such a client.

Rick Gaskill (2019) discusses six components of positive neurodevelopmental experience, based on the NMT theories of Bruce Perry, that occur within play therapy. PT is relevant, repetitive, relational, rhythm, rewarding and respectful. He considers play therapy to be *relevant* because it can address those lower brain functions effectively through sensory play; *repetitive* because memories and learning occur with repetition and lower brains needs can be met through repetition to foster regulation, *relational* because "positive relational interactions regulate the brains stress response systems and help create positive and healing neuropsychological states" (p. 9), *rhythmic* is in the process of creating an attuned relationship with a client through patterns of eye contact, face to face interactions and unconditional positive regard, *rewarding* in that play therapy can provide positive relational experiences to balance the traumatic relational experiences (Gaskill (2019) points out that the neurotransmitter dopamine is released in positive play interactions), and lastly, play therapy is *respectful* in that play therapists are trained to honor the child's background whatever socioeconomic status, race, ethnicity, gender, sexuality religion or culture they may come from.

Stewart, Field and Echterling (2016) state, "Gradually, one playful response at a time, a secure attachment pattern is created, an artifact of the neural connections" and base this on Bruce Perry's research and approach. They discuss the importance of non-verbal communication and stress that as humans we communicate nonverbally even more than we do verbally, supporting the use of play therapy (or for that matter expressive therapies) in approaching developmental and complex trauma.

School based play therapy. The clients being considered throughout this paper are all being seen in a school-based setting (SBS). Research supports the use of play therapy (PT), particularly child centered play therapy (CCPT), with school-based populations.

Blanco, Holliman, Ceballos & Farnam (2019) found that two, 30-minute PT sessions over 6 weeks significantly improved at risk kindergarten student's academic achievement compared to a control group. In this study the children progressed academically from a below-average range to average range in just 6 weeks. For schools and families seeking support and change for struggling students this seems to provide an effective response. The researchers noted the relational aspects of play therapy as being a possible factor in the academic improvements observed.

Pester, Lenz & Dell'Aquila (2019) conducted a meta-analysis of single case studies using CCPT to treat children's mental health symptoms and found a moderate effect for "decreasing internalizing symptoms, externalizing symptoms, and social skill deficits" (p. 144).

Less recent but still pertinent: Baggerly and Parker (2005) found that child centered group play therapy (CCGPT) with African American boys "is a culturally sensitive and developmentally appropriate approach" (p. 394) to working with young African American boys of elementary age. Parham, White and Ajamu (as cited by Baggerly and Parker, 2005) identified common elements of African American worldview such as; emotional vitality, interdependence, collective survival and harmonious blending. Baggerly et.al. found that CCGPT supported these worldviews as well as facilitating elements of self-confidence such as; seeing self as capable, sense of belonging, optimism, coping with failure and access to role models. This research supports that the use of CCGPT in schools can provide culturally sustaining support to with marginalized students.

Schottelkorb, Doumas, & Garcia (2012) found that CCPT is supported and effective in reducing symptoms of trauma with refugee children in a school-based setting. Of interest in this research is that the therapists were not all originally play therapists and were trained with only a 10-hour introductory CCPT course and subsequently provided supervision in CCPT. In this study, the sessions were 30 minutes, twice weekly, for twelve weeks. The study intended to provide 6, fifteen-minute consultations that provided feedback on their children as well as information on play therapy, child development and trauma. The results of parent consultations were not included in final results due to the difficulties presented by scheduling, access and need for interpreters. The results of this study did not achieve statistical significance (a common issue with small play therapy studies) but there was still an observed reduction in PTSD symptoms. Especially of interest for the purposes of this exploration, is that the reduction in symptoms was achieved without significant parental involvement.

Finally, Shen (2017) conducted a qualitative study and found that use of play therapy techniques with teenagers in a school setting allowed clients to relax, open up, offer alternative ways to build rapport and provided a useful supplement to talk therapy. Examples of play activities used were sand play, drawing, and role play. Aggressive play was observed to help a teen with challenging anger and aggression behaviors to channel those energies into aggression with soft toys and one student drew a picture of her father which elicited information about her father's incarceration. It was even reported by one counselor participant that allowing a client's attention to be divided between her presence and video games permitted a student to feel less pressure and less in the spotlight. This study also considered obstacles within the school setting that are challenging such as: inconsistent and insufficient understanding of play therapy, lack of funding and system support and time constraints with in the school system (e.g. competing needs

of academics). These are all similar challenges that I experience in the school setting, but, like the researchers, also found approaching these constraints with flexibility and patience is essential.

In summary, for the purposes of this paper, PTSD is insufficient as a diagnosis for the effects of childhood trauma. Complex trauma (CT) provides a deeper understanding of the symptoms seen in children who have experiences abuse, neglect and ruptures in caregiving during childhood. Attachment theory provides a strong initial understanding of what happens within many caregiving relationships that are impacted by abuse neglect and caregiving ruptures. There are known and understood neurobiological impacts as a result of insecure and disorganized attachment. For the purposes of this paper the neurosequential model of therapeutics (NMT) is explored and found to be a useful framework from which to assess and create neurobiologically informed treatment plans for the population being considered. Finally, I review the evidence behind play therapy (PT) as effective and neurobiologically informed treatment and, in particular, evidence for use of PT in a school-based setting.

Discussion

When I began researching neurobiology and play therapy there was an abundance of materials, information and paths of inquiry to dive into. As I learned more and continued to work at my internship it became clearer that I needed to know, and be able to explain to others, why play therapy is an effective tool with a fairly broad age range and that it can be be effective in the school-based setting. Many practicing play therapists with whom I interact, expressive therapists with whom I am in classes and other play therapists and clinicians with whom I work, talk about the therapeutic relationship as being the core healing agent in play therapy. What does that really

mean and is this true enough to justify some of the important therapeutic elements missing in the SBC relationship such as family involvement?

In assimilating the research and theories, elements of practice and areas of focus have consistently emerged that I believe can support how I have chosen to work therapeutically. It seems helpful to begin with a clearer description of the kind of client I see. I will then lay out the elements of practice that I believe the literature supports. It seems important to say that the conclusions I have made are particular to my perspectives and personality but, I believe that they do emerge as neurobiologically informed. They are approaches, not black and white techniques. Also important to state is that while I am taking an NMT informed perspective, I am not NMT trained or accredited. I have found the ideas useful when creating formulations and treatment plans for my clients.

Composite Client Profile.

Bruce Perry (2001) describes the population that makes up the majority of my clients saying that they are:

> Safe nowhere; their home is chaotic and episodically abusive, their community is fragmented and plagued by gang violence and the schools are barely capable of providing structure and safety from intimidation and threat, let alone education. These children must learn and grow despite a pervasive sense of threat. These children must adapt to this atmosphere of fear. Persisting fear and the neurophysiological adaptations to this fear can alter the development of the child's brain, resulting in changes in physiological, emotional, behavioral, cognitive and social functioning. (p. 4).

The students I see for therapy could be 5, 12 or 21 years of age. I have clients of all those ages and in between. I see them in a school-based setting for individual therapy once a week. I

maintain contact with families and caregivers when possible and work collaboratively with the guidance team and teachers in these schools to create the best supports we can under the circumstances of student's trauma histories and continuing challenges.

These challenges may include multiple historical and current occurrences of the following adverse experiences (see also Appendix A): single or multiple separations or removals from families or caregivers, abuse and neglect (both in families of origin or in alternative caregiving placements), witnessing of domestic violence, exposure to community violence, death of a loved one due to community violence, history of family mental illness, history of family physical health issues, incarceration of one or more family members, single or multiple psychiatric evaluations and hospitalizations of client or family member, single or multiple placements outside the home, involvement of state agencies (Department of Children and Families, Department of Mental Health, Department of Youth Services), multiple, confusing and contradictory mental health diagnoses, aggression towards family and peers, aggression in the community, academic challenges and absences, multiple therapeutic relationships that are interrupted.

As a result, the students I see usually struggle with two categories of behavioral, cognitive, and mental health challenges. One is hyperarousal which results in behaviors such as aggression, hyper-alertness, impulsivity, anxiety and an inability to sit still. The other is hypo arousal which often results in depression, dissociation, detachment from one's experiences and relationships. As a result, these students struggle engage in learning, peer and family relationships and community effectively.

Also observed are abilities that display great resilience and strengths such as the student who: misses the bus and still gets himself to school because it is the one place he possibly feels

safe; keeps herself employed despite having no consistent loving home base; maintains curiosity and continues to ask questions despite his anxiety; eventually begins to spend more than 5 minutes in the therapy space after months of being unable to; suddenly takes a risk and decides to share feelings and challenges despite having a history of not trusting helpers. It is also helpful to remember (as previously discussed) many of these clients challenging behaviors also serve as survival mechanisms.

Application of Neurobiologically Informed Principles

I had thought that trauma informed therapy for different ages would require different approaches but, the essence of therapy is the same and I use play with all of my clients, whether in the form of hide and seek, art, role play, music, or games. The following are some of the neurobiologically informed elements in this review of the literature that provides theoretical and clinical support for my practice.

Establishing relational safety as neurobiologically informed. Perry (2009) points out that having loving relationships later in life is not usually enough without planned therapeutic intervention. On the other hand, Hambrick et al. (2018) contend that, "even if a child's early experiences are poor, improving future relational contexts will likely improve outcomes" (p. 246).

One of the basic principles of NMT is that "any efforts to change the brain or systems on the brain must provide experiences that can create patterned, repetitive activation in the neural systems that mediate the function/dysfunction that is the target of therapy" (Perry, 2009, p. 244). As a reminder, according to Perry's research as previously discussed, it is important to understand that, since the brain develops from the bottom up, it is necessary to conduct therapy from the bottom up. Approaching clients with words and logic is pointless until we have

addressed the limbic, rhythmic and human attachment seeking part of the client's brain that will then lead to greater integration in the frontal lobe and ability to process feelings with words. For many of my clients this means focusing on repetitive play and relational safety which can potentially calm the brainstem and establish new and more regulated neural connections. Schore (2017) reminds us that "Play calms and soothes infants and it modulates their stressful states of negative arousal, replacing stress with intense joy and excitement" (p. 117). Creating relational and safe experiences that can provide soothing and calming experiences can also impact neuronal growth.

Establishing relational safety resulted in a behavioral shift for a 14-year old boy, mentioned above, who was unable to stay in the therapy space for more than 5-10 minutes. The approach I took was to show up consistently and without judgment or expectation, to attune to his needs and interests and offer multiple opportunities to meet. After 6 months he stayed for 15 minutes, back tracked to 5 and then one day stayed for a full 45 minutes. Being repetitive, consistent and patient seemed to allow this boy to depart from his CT response of hyperarousal and be able to experience the therapy space and being in relationship as safe.

According to Moul, Hawes & Dadds (2018) "attachment theorists have argued that conditions that foster a secure attachment, sensitive and contingent on caregiving, frees a child from self-preoccupation and allows them to fully engage in empathic exchanges (p. 39). I take this to mean that if I can foster an environment and relationship that is sensitive, accepting and non-judgmental then there is some purpose in what I do towards supporting change and possibly new neural connections that reflect security and safety.

Consistency as neurobiologically calming. Perry identifies that, as therapists, we "rarely provide the repetitions necessary to modify organized neural networks" (2009, p. 244)

which indicates that doing something over and over again is what is often needed for this population to shift away from maladaptive behaviors. This is why I begin many sessions the same way each week, find running jokes and repeat them, show up over and over again or am willing to play the same, safe, predictable game for weeks on end. I strive to be predictable and consistent to create what Malchiodi & Crenshaw (2015) call "brief reparative enactments of secure attachment experiences" that are "fundamental to positive change" (p. 9).

Play as neurologically regulating. Winnicott (1971) said that "psychotherapy takes place in the overlap of two areas of playing, that of the patient and that of the therapist. Psychotherapy has to do with two people playing together. The corollary of this that where playing is not possible, the work done by the therapist is directed towards the bringing of a patient from a state of not being able to play into a state of being able to play" (p. 44). Schore (2002) proposes that "attachment is more than the reestablishment of security after a dysregulating experience and a stressful negative state, it is also the interactive amplification of positive effects, as in play states. Regulated affective interactions with a familiar, predictable primary caregiver create not only a sense of safety, but also a positively charged curiosity that fuels the burgeoning self's exploration of novel socioemotional and physical environments. (para 26). Based on the research and personal observation, play can bring a child from a state of either hypo- or hyper-arousal into a state of calm that can allow them to engage and learn. Play therapy can access the lower, non-verbal regions of the brain and regulate the dysregulated physiology.

The school-based setting as therapeutically appropriate. When providing therapy in the school-based setting I have observed that there are particular qualities of the students that can be consistent. Perry (2001) says "that hypervigilant children from chronic violence settings frequently develop remarkable non-verbal skills in proportion to their verbal skills (street

smarts)" (p. 10) and they are often considered to be smart but unable to engage in learning. Often these children are labeled as learning disabled. Difficulties with cognitive organization often contribute to a more primitive, less mature style of problem solving. Aggression is often employed as a coping skill that serves to keep the demands of the world at bay. These ideas are critically important in understanding why a traumatized child cannot usually sit in a classroom and learn. Perry states that "the capacity to internalize new verbal cognitive information depends upon having portions of the frontal and related cortical areas being activated. This, in turn, requires a state of attentive calm. A state the traumatized child rarely achieves" (p. 11).

The research I found supports the use of play therapy in schools and suggests that it has the potential to support long term change (sometimes even in short periods of time).The SBC setting in which I work has many elements that create a good therapeutic environment. I work in a light filled space with many art supplies, a sand tray and other toys and games. I work for an agency that contracts with the school system rather than being employed directly by the public school which allows for more autonomy and independence. The agency I work for strives to be trauma informed, to address issues of power, privilege and oppression and provides thorough supervision and training. Within the school setting, I collaborate with guidance staff and teachers which allows for the possibility of a child's therapeutic needs entering into any discussion of educational needs. Individually as a clinician, I try to be consistent and predictable (I show up every week even when a student is refusing therapy, I check on them in class and they see me within the school collaborating and working with others to meet the needs of our students). I instinctively try to interact in ways that are non-threatening and create a sense of felt-safety in the therapeutic space.

Missing therapeutic elements in school-based services. One element not present that can be essential to a child's healing and progress towards better mental health is the inclusion of family in the therapeutic process. I do not see parents of my clients regularly and most information on best practices in child therapy strongly recommend including caregivers in the therapy and the frequency of sessions. I see my students once a week, and sometimes less for the older students who can often be absent.

Also, some of the research included in this paper recommends more than once a week (Hambrick et al., 2018) and reminds us that many repetitions over time of positive experiences are needed to balance the neurobiology of the traumatic experiences. While I cannot offer therapy twice a week, I do interact consistently with my clients in many other ways. I am in the classroom, I greet them in the halls and try to show up for meaningful school events. This is a form of consistency and availability. I keep in mind what Perry (2009) offers as a reminder "that healthy relational interactions with safe and familiar individuals can buffer and heal trauma related problems" (p.248).

Is it All Enough?

So, is the relationship building enough? Is being consistent enough? Is creating felt-safety within the relationship enough? Is play enough?

I have concluded that they are enough. Frankly, they have to be enough as I have to work within the constraints of the system and in which I am employed. I can focus on co-creating the glimmers of safety, providing consistency, predictability and relational safety with my clients. I can continue to focus on the neurobiological principles, and their connection to play therapy, and work in an NMT informed manner and continue to consider the timing of trauma over the child's lifetime as a way to assess how to approach them therapeutically

It seems likely that more evidence and research will emerge in coming years that support the use of neurobiological principles in therapy and in particular in play therapy. Most of what I have explored in this paper has been considered and researched with in the past 2-3 decades and has changed approaches to therapy significantly. I do think there needs to be some caution in exclusively focusing on the neurological aspects of therapy. As an individual clinician and within the greater professional community, continuing to connect to the human in need that sits in (or plays in) my therapeutic space and presence, is still the most important aspect of what I do. I find it important to remember that the brain and the person are not separate but intertwined and incredibly complex. The brain, and neurological development, is part of each human and who they become. It is part of their humanity, pain, joy and struggles. In so many ways, our neurobiology and the interaction of our neurobiology with others and the world, makes us who we are. Supporting possible neurological change and growth in the traumatized brain creates the possibility that we can all engage in the world without fear and anger but with hope and expectation of safety.

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Appendix A

ACEs Definitions

All ACE questions refer to the respondent's first 18 years of life.

- Abuse
  - **Emotional abuse:** A parent, stepparent, or adult living in your home swore at you, insulted you, put you down, or acted in a way that made you afraid that you might be physically hurt.
  - **Physical abuse:** A parent, stepparent, or adult living in your home pushed, grabbed, slapped, threw something at you, or hit you so hard that you had marks or were injured.
  - **Sexual abuse:** An adult, relative, family friend, or stranger who was at least 5 years older than you ever touched or fondled your body in a sexual way, made you touch his/her body in a sexual way, attempted to have any type of sexual intercourse with you.
- Household Challenges
  - **Mother treated violently:** Your mother or stepmother was pushed, grabbed, slapped, had something thrown at her, kicked, bitten, hit with a fist, hit with something hard, repeatedly hit for over at least a few minutes, or ever threatened or hurt by a knife or gun by your father (or stepfather) or mother's boyfriend.
  - **Substance abuse in the household:** A household member was a problem drinker or alcoholic or a household member used street drugs.
  - **Mental illness in the household:** A household member was depressed or mentally ill or a household member attempted suicide.
  - **Parental separation or divorce:** Your parents were ever separated or divorced.
  - **Incarcerated household member:** A household member went to prison.
- Neglect[1]
  - **Emotional neglect:** Someone in your family helped you feel important or special, you felt loved, people in your family looked out for each other and felt close to each other, and your family was a source of strength and support.[2]
  - **Physical neglect:** There was someone to take care of you, protect you, and take you to the doctor if you needed it[2], you didn't have enough to eat, your parents were too drunk or too high to take care of you, and you had to wear dirty clothes.

ACEs definitions. Retrieved on April, 17, 2020 from https://www.cdc.gov/violenceprevention/childabuseandneglect/acestudy/about.html

Appendix B

TABLE 13.1. Elements of the Web-Based NMT Metrics

1. Demographics
2. History—Developmental
   a. Genetic
   b. Epigenetic
   c. Part A. Adverse events measure
      i. Developmental timing
         1. Nature, severity, pattern
   d. Part B. Relational health measure
      i. Developmental timing
         1. Bonding and attachment
         2. Family supports
         3. Community supports
3. Current status
   a. Part C. Central nervous system (CNS) functional status measure
      i. Brainstem
      ii. Diencephalon/cerebellum
      iii. Limbic
      iv. Cortex/frontal cortex
   b. Part D. Relational health measure
      i. Family
      ii. Peers
      iii. School
      iv. Community
4. Recommendations
   a. Therapeutic web
   b. Family
   c. Client
      i. Sensory integration
      ii. Self-regulation
      iii. Relational
      iv. Cognitive

From: Perry, B. D. & Dobson, C. L. (2013)

Appendix C

CURRENT CNS FUNCTIONALITY

	Time	1-Year	Typical
Brainstem			
1 Cardiovascular/ANS	8	10	12
2 Autonomic Regulation	6	9	12
3 Temperature regulation/Metabolism	9	10	12
4 Extraocular Eye Movements	9	10	12
5 Suck/Swallow/Gag	5	8	12
6 Attention/Tracking	3	6	12
DE/Cerebellum			
7 Feeding/Appetite	7	9	11
8 Sleep	4	8	11
9 Fine Motor Skills	6	8	10
10 Coordination/Large Motor Functioning	6	8	9
11 Dissociative Continuum	4	6	10
12 Arousal Continuum	2	7	10
13 Neuroendocrine/Hypothalamic	8	8	10
14 Primary Sensory Integration	6	8	11
Limbic			
15 Reward	4	6	11
16 Affect Regulation/Mood	4	6	10
17 Attunement/Empathy	4	6	10
18 Psychosexual	4	6	9
19 Relational/Attachment	4	7	9
20 Short-term memory/Learning	7	9	11
Cortex			
21 Somato/Motorsensory Integration	5	7	10
22 Sense Time/Delay Gratification	3	6	8
23 Communication Expressive/Receptive	8	9	11
24 Self-Awareness/Self-Image	4	6	8
25 Speech/Articulation	8	9	10
26 Concrete Cognition	7	8	9
Frontal Cortex			
27 Nonverbal Cognition	6	7	8
28 Modulate Reactivity/Impulsivity	2	4	8
29 Math/Symbolic Cognition	4	5	8
30 Reading/Verbal	4	5	8
31 Abstract/Reflective Cognition	3	5	8
32 Values/Beliefs/Morality	4	5	8
Total	**168**	**231**	**317**

FIGURE 13.1. Change in James's brain-mediated functioning over time.

Perry, B. D. & Dobson, C. L. (2013)

THESIS APPROVAL FORM

Lesley University
Graduate School of Arts & Social Sciences
Expressive Therapies Division
Master of Arts in Clinical Mental Health Counseling: Expressive Arts Therapy, MA

Student's Name: Laurie M. Smith

Type of Project: Thesis

Title: Neurobiological Effects of Trauma and The Efficacy of Play Therapy in a School-Based Setting

Date of Graduation: Saturday, May 16, 2020

In the judgment of the following signatory this thesis meets the academic standards that have been established for the above degree.

Thesis Advisor: E. Kellogg, PhD