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Teaching Through a Polyvagal Lens: Using the Science of Safety to Co-Regulate in the Classroom

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TEACHING THROUGH A POLYVAGAL LENS:

USING THE SCIENCE OF SAFETY TO CO-REGULATE IN THE CLASSROOM

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Abstract

According to Stephen Porges' Polyvagal Theory, social responses to environments are mediated by the limbic system either by vagal input or vagal withdrawal (Mulkey & Du Plessis, 2019). The nervous system preconsciously perceives threats through a process termed *neuroception*. The Polyvagal Theory provides insight about how the nervous system continuously assesses risk and safety cues that influence behavioral and physiological states (Porges, 2015). Co-regulation provides the neural state that supports the establishment of trusting relationships. Humans are always looking for safety cues and by design are motivated to develop relationships to co-regulate. Incorporating the science of safety in educational practices would support feelings of safety in the human experience and promote a more productive and healthier society (Porges, 2022).

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CHAPTER I: INTRODUCTION

The nervous system is constantly working behind the scenes of the human existence. The body is perpetually seeking out safety in an unsafe world. Exposure to danger cues, compromises children's development along with their health, quality of social relationships, and educational achievement. Children exposed to chronically dangerous environments have an increased likelihood of behavioral problems, mental health issues, and learning delays (Porges, 2015).

The Polyvagal Theory, as articulated by Stephen Porges, suggests humans are always searching for safety. This begins for a child in infancy with reliance on a caregiver to meet their need for soothing and continues throughout the lifespan with the need to form loving partnerships and trusting friendships. A mother nurturing an infant provides safety cues and strengthens the social bond, promoting the ability to co-regulate. Co-regulation involves creating a relationship to build trust to help each other through stressful situations and emotions (Kostol & Cameron 2020). Adequate neural pathway exercises result in optimal ability to co-regulate. When neural pathways are inadequately exercised, or the opportunities for mother and child to co-regulate are unreliable or disrupted, the ability to co-regulate with another is at risk as the child ages (Porges, 2015).

The nervous system preconsciously perceives threats through a process termed *neuroception*. Neural systems are informed by past experiences, so Polyvagal Theory offers insight into activation of fight or flight responses by reacting to seemingly safe environments and events (Ryland et al., 2021). Stephen Porges coined the term *neuroception* to emphasize the process the nervous system uses to continuously assess risk outside of consciousness; which differs from the term *perception*. Neuroception can decide if both visceral and environmental features are safe, dangerous, or life-threatening (Porges, 2015).

Polyvagal Theory connects the evolution of the autonomic nervous system to human affective experience and social behavior. The Polyvagal Theory describes how the autonomic subsystems are behaviorally linked to social communication. The theory provides insight about how the nervous system continuously assesses risk and safety cues that influence behavioral and physiological states. Humans are always looking for safety cues and by design are motivated to develop relationships to co-regulate (Porges, 2015).

This theory argues a hierarchy of three autonomic states assesses the threats in the environment, and then mediates our behavior (Ryland et al., 2021). When the nervous system deems an environment safe, the body regulates efficiently to promote restoration and growth by slowing the heart, which inhibits the fight-flight response. To protect during times of danger, the nervous system cycles through the neural defense circuits, using the newest circuit first (fight-flight). If the fight-flight circuit fails to provide safety, the older circuit (immobilization) activates (Porges, 2015).

Safety is crucial in optimizing humans' social behaviors that allow access to higher brain structures (Porges, 2015). When implemented in education or healthcare institutions, the science could improve sociality and health while enhancing creativity, productivity, and a sense of well-being (Porges, 2022).

I chose this research topic after I began seeing my therapist, Dara Denton, to support my mental health and well-being. We began working together in July of 2020 during the height of the COVID-19 pandemic. Dara introduced me to Polyvagal Theory and taught me so much about my nervous system, neuroception, co-regulation, strategies to use, and overall was an incredible support to me during some very challenging times. When I first learned about the theory and began exploring the work of Stephen Porges, Deb Dana and other experts I became slightly

obsessed and began to view life centering my nervous system and the nervous systems of those around me.

As I learned about Polyvagal Theory and how important safety and co-regulation is, I realized how much of a difference it could make in my classroom. By viewing my students' behaviors and interactions through this lens, I have become a much more intentional and empathetic educator. I strive to create a positive classroom environment that integrates cues of safety in everything I do. I am much more aware of my body language, facial expressions and prosody during teaching and all interactions. I am much more aware of my internal state during crises and do my best to utilize strategies to increase signs of safety for myself and my students.

The guiding question for this research is: How can educators' understanding of the Polyvagal Theory improve students' academic and social emotional outcomes in classrooms and school communities? Another question investigated was to determine how attachment styles impact the educational process for students and teachers.

Chapter II: Literature Review

To obtain literature for this thesis, searches of Academic Search Premier, EBSCO MegaFILE, ERIC, PUBMED, JSTOR, PsycINFO, and google scholar were conducted for the years 2000-2022. The search was narrowed by only reviewing published empirical studies from peer-reviewed journals that focused on Polyvagal Theory, attachment, self-regulation, mindfulness, and teaching/education. Keywords used in searches included but are not limited to "The Polyvagal Theory," "Polyvagal Theory in education," "Attachment in the classroom," "safe classroom climate," "Self-regulation for teachers," and more. This chapter reviews literature on Polyvagal Theory, Attachment Theory, classroom climate, and self-regulation for students and teachers.

The nervous system continuously monitors for cues of danger and safety. The Polyvagal Theory explains how these cues influence people both physiologically and behaviorally. People are perpetually inundated with news of tragedies, mass shootings, natural disasters, or otherwise. Many families also experience child or spousal abuse, bullying, or other traumatic experiences. Exposure to danger cues, compromises children's development along with their health, quality of social relationships, and educational achievement. Children exposed to chronically dangerous environments have an increased likelihood of behavioral problems, mental health issues, and learning delays. Later in life there is a greater incidence of substance abuse, incarceration, chronic illness, and shorter life expectancy (Porges, 2015).

Culture generally defines safety as the exclusion of risk from injury. We tend to focus more on those who threaten or hurt us instead of understanding the need for the nervous system to feel safe. Safety is crucial in optimizing humans' social behaviors that allow access to higher brain structures, increasing creativity. The advancement of technology has moved toward fewer

face-to-face interactions. Without visual communication safety cues, such as smiles or warm voices, the nervous system may move to a state of defense. This state triggers communication and self-regulation issues (Porges, 2015).

The Polyvagal Theory, as articulated by Stephen Porges, suggests humans are always looking to calm their neural defense systems by searching for safety. This begins for a child in infancy with reliance on a caregiver to meet their need for soothing and continues throughout the lifespan-extending to safety features with the need to form loving partnerships and trusting friendships. A mother nurturing an infant provides safety cues and strengthens the social bond, promoting the ability to co-regulate. As mothers nurture and soothe, they provide neural experiences that strengthen neural pathways. Adequate neural pathway exercise results in the optimal ability to co-regulate with others. When these neural pathways are inadequately exercised, or the opportunities for mother and child to co-regulate are unreliable or disrupted, as the child ages, the ability to co-regulate with one another is at risk (Porges, 2015).

Polyvagal Theory presumes that the evolution of the mammalian autonomic system provides the neurophysiological foundation for behavioral adaptive strategies. The theory connects the evolution of the autonomic nervous system to human affective experience and social behavior. The evolution of ancient reptiles to mammal changed the autonomic nervous system. Ancient reptiles had two subsystems, the sympathetic and the parasympathetic nervous systems. Most of the parasympathetic neural pathways travel through the vagus nerve. The vagal motor fibers change the function of visceral organs and sensory fibers to provide continuous information to the brain on the status of the organs (Porges, 2015).

During evolution from ancient reptiles to mammals a second vagal motor pathway emerged from the nucleus ambiguous. This change created mutual interactions connecting the

head and the heart. The vagal influences the heart and regulates the striated face and head muscles. This provides mammals with the ability to express physiological state through prosody and facial expressions, while also enabling voice and facial expression to calm one's physiological state. This face-heart connection creates an integrated Social Engagement System that provides and detects safety signals (Porges, 2015).

The Polyvagal Theory describes how the autonomic subsystems are behaviorally linked to social communication - through listening, vocalization, and facial expression; to mobilization - with fight-flight behaviors and immobilization; with behavioral shutdown, fainting, playing dead, and dissociation. The theory suggests that the autonomic response to challenges goes through a hierarchical sequence. When the nervous system deems the environment safe, the body regulates efficiently to promote restoration and growth by slowing the heart, which inhibits the fight-flight response. To protect during times of danger, the nervous system cycles through the neural defense circuits, using the newest circuit first (fight-flight). If the fight-flight circuit fails to provide safety, the older circuit (immobilization) activates (Porges, 2015).

Stephen Porges coined the term *neuroception* to emphasize that the process the nervous system uses to continuously assess risk outside of consciousness, is not the same as perception. Neuroception can decide if both visceral and environmental features are safe, dangerous, or life-threatening. When neuroception identifies safety cues, the autonomic system regulates and adapts to dampen the defense response. The unconscious risk evaluation in neuroception can create a disconnect between conscious perceptions and feelings. For example, a nonthreatening message delivered with less prosody and a lower tone, may be seen as a danger cue and trigger a neuroceptive defense response (Porges, 2015).

Some people, especially children who have experienced trauma, have a mismatch experience where the nervous system mistakenly judges a safe environment as dangerous. This triggers a fight-flight or immobilization response, inhibiting social engagement. Polyvagal Theory predicts that when in a state of mobilization, the ability to detect positive social cues is dampened. Even when the danger cues have been removed, one may still be unable to re-enter the Social Engagement System until appropriately stimulated by safety cues (Porges, 2015).

The Polyvagal Theory proposes to explain why some people with behavioral and psychiatric disorders have difficulty regulating emotional, social, and communicative responses and display atypical autonomic regulation. The theory provides insight about how the nervous system continuously assesses risk and safety cues that influence behavioral and physiological states. Humans are always looking for safety cues and by design, are motivated to develop relationships to co-regulate (Porges, 2015).

Hastings, Nuselovici, Utendale, Coutya, McShane, and Sullivan (2008) examined how vagal regulation was related to externalizing problems and parental socialization. The team also considered whether vagal regulation facilitated associations between parental socialization in preschool children and emotional regulation abilities in preschoolers. Researchers investigated cardiac respiratory sinus arrhythmia (RSA) in preschool-aged children when they interacted with an unfamiliar peer group, which was considered a natural social challenge.

The study was designed based on a Polyvagal theory framework that posits that the parasympathetic regulation of cardiac activity affects children's adaptive functioning. The researchers performed a short-term longitudinal study with 94 preschoolers and their parents. The research data was collected during two visits. First, the research team visited the families in their homes and recorded the children's basal RSA. They analyzed parent behaviors during

parent-child interactions via parent self-reports. Six to ten months later, the second visit took place at the lab. Children were grouped in triads, with same-sex, same-age, unfamiliar playmates. Following basal RSA data collection, the children transitioned into a large playroom where they had access to many toys for unstructured playtime. The children's RSA was measured during play. In an adjacent room, the mothers completed questionnaires about their child's self-regulation, internalizing problems, and externalizing problems (Hastings et al., 2008).

The data revealed that children with relatively high RSA during the social challenge compared to baseline, experienced fewer internalizing and externalizing problems and showed better behavioral self-regulation. Mothers who used more negative control in their parenting, had children with lower RSA who displayed more internalizing and externalizing problems while also demonstrating less self-regulation. The findings suggested that children's physiological processing of emotional regulation was shaped by parental socialization experiences (Hastings et al., 2008).

The research showed that preschool children who continued to have a relatively high RSA when transitioning from a quiet state with their mother to a social experience with unfamiliar peers had fewer emotional regulation challenges. Children with greater vagal suppression demonstrated more challenges. The findings supported Stephen Porges' Polyvagal Theory; the vagus nerve provides cardiac regulation that supports positive social engagement and supports the idea that decreased parasympathetic influence can lay the foundation for fight/flight response to perceived social threats (Hastings et al., 2008).

Hastings et al. (2008) is one of the first studies to support the connection between negative parenting and both behavioral and autonomic indicators of emotional regulation. Within a parent-child relationship, angry, critical, and punitive parenting puts a young child's sense of

safety at risk, including self-confidence. This creates a socializing environment that hinders typical successful emotional self-regulation development. Children who experienced parenting with mothers who may have undermined autonomy, efficacy, and security, showed a parasympathetic response in unfamiliar social situations. The children reacted with perceived danger or threat. The response was linked to the exhibited behavioral instability.

The strongest association between RSA and adjustment was for young boys in the areas of externalizing problems and self-regulation. The study results showed that reduced parasympathetic regulation during social challenges predicted more externalizing behaviors in boys. The findings supported a strong link between vagal dysregulation and development of disruptive behaviors. Both young girls and boys with poor self-regulation may activate the "flight" response. However, young boys may be more prone to having their "fight" response activated. The findings echoed gender models of developmental psychopathology (Hastings et al., 2008).

Ryland, Johnson, and Bernards (2021) discussed reframing resistance using Polyvagal Theory. In a 2021 study they noted that when looking at resistant behaviors in therapy, the Polyvagal Theory normalizes and reframes them as preconscious and protective responses from the autonomic nervous system. The Polyvagal Theory explains how the nervous system reacts to the external world by activating social engagement or defensiveness. This theory can be relevant to therapeutic environments.

In Family therapy settings, Ryland et al. (2021) noted that when clients expressed vulnerable emotions and discussed memories, the remembered threats may preconsciously activate the sympathetic nervous system, producing protective behaviors that may look similar to how therapeutic resistance is often described. Alternatively, perceived positive regard and safety

cues, activated the parasympathetic nervous system fostering connection and engagement, both critical factors in a strong therapeutic relationship.

Researchers noted that if therapists incorporate the Polyvagal Theory into practice, they will be less likely to become resentful or place blame on clients for producing preconscious protective behaviors. This could enable therapists to recognize, explain, and normalize patterns of conflict for couple and family clients while facilitating connection and coregulation (Ryland et al., 2021).

A therapist can facilitate coregulation and create safety only if the parasympathetic nervous system supports the state of safety and connection for them. For successful therapy, a therapist must be one who is genuinely engaged, empathetic, and has positive regard for the client. This is critical due to being perceived subliminally. Safety and danger cues cannot be faked. Practicing mindfulness and selfcare can increase the therapists' 'window of tolerance' which describes the level of intensity an experience can be tolerated before the sympathetic nervous system is activated (Ryland et al., 2021).

Common behaviors viewed as resistance include: refusing correction of misinterpretation, arguing with the therapist, not complying with homework, silence, avoidance, and opposition. A therapist who reacts negatively to the resistant behaviors, can damage how safe the client perceives the therapeutic relationship. When therapists fail to recognize and process their own frustration and anxiety, they are likely to mistakenly project it onto clients who then will perceive danger and remain in a protective stance (Ryland et al., 2021).

The Polyvagal Theory describes how the nervous system reacts to perceived threats or downregulates these defensive strategies to allow connection. The theory argues a hierarchy of

three autonomic states, assesses the threats in the environment and then mediates our behavior (Ryland et al., 2021).

The tertiary state, the most recently evolved, is an activation of the parasympathetic nervous system. This state has also been referred to as the *connect state*, and *rest and digest* state and where relationship interaction and social engagement most likely occur. Ideally, humans should spend most time in the tertiary state and only activate the secondary protective state when in a genuinely threatening situation (Ryland et al., 2021).

The nervous system preconsciously perceives threats through a process termed *neuroception*. These systems are informed by past experiences, so the theory offers insight into activation of fight or flight responses in reaction to seemingly safe environments and events (Ryland et al., 2021).

Considering resistant behaviors through a Polyvagal Theory lens, it is understood that behaviors may stem from preconscious protective reactions from the sympathetic nervous system. One cannot hold clients accountable for their responses and must learn to honor the ways the autonomic nervous system functions to provide safety and survival. Practitioners must also be mindful of being present and cultivating positive regard for clients. Neuroception suggests that negative judgements, distractions, and defensiveness will be unconsciously perceived by the client as cues of danger (Ryland et al., 2021).

An attunement mismatch is when someone may perceive danger in a seemingly safe setting. This phenomenon may occur in the therapeutic setting or in other relationships creating a cycle of defensive behaviors and disengagement from others. A therapist who recognizes and validates these protective behaviors can respond to the client's need for safety, identify potential unintended effects, and model connection and regulation (Ryland et al., 2021).

Gerdes, Tegeler, and Lee (2015) proposed developing an educational practice that combined the mission of education as guided human development with the scientific understanding of the brain, known as allostasis, meaning stability through change. The theory laid the groundwork for allostatic neuro-education (GANE). The GANE perspective views learners as focused on the neurodevelopmental trajectories.

Allostatic neuro-education suggests that change is the norm, not constancy. It defines learner success within the context of changing and complex natural environments, versus controlled settings, and identifies the brain as the organ of central command. Instead of focus on standardized testing results, the learner's full neurodevelopmental trajectory is evaluated. This strategy involves guiding learning by paying attention to rhythms in ways that support real excitement. The specific focus is on rhythms of arousal (Gerdes et al., 2015)

The brain oversees the management of the change in rhythms across systems and aims to increase successful interactions with complex environments. Researchers suggest it would be valuable for teachers to tune into rhythms of arousal. In discussing GANE, arousal is considered activity patterns in the autonomic nervous system. People tend to function either in a low (parasympathetic activation) or high (sympathetic activation) state. Sympathetic activation has often been associated with states of disturbance, especially related to pain, mental health, and cardiovascular disease. Increased sympathetic activity has been connected to young women with school burnout (Gerdes et al., 2015)

Polyvagal Theory models the autonomic system functions in a way that moves beyond the opposing parasympathetic and sympathetic. It is recognized that two sub systems of the parasympathetic system come from different phases of the evolution of vertebrates. The myelinated branch of the vagus nerve is the most evolutionary advanced part of the autonomic

nervous system. It functions as a fine-tuned brake on high arousal of the sympathetic system. It allows self-calming and emotional communication (Gerdes et al., 2015)

The three systems work together in a hierarchal way, based on evolutionary phylogeny. The myelinated vagus works to prevent wasteful or unnecessary high arousal. If the environment is dangerous, it gives way to the sympathetic function to mobilize, however if this fight/flight response is inadequate, the unmyelinated vagus activates to produce a freeze or shutdown mode (Gerdes et al., 2015)

Allostatic neuro-education strives for an educational practice that is mindful of the changes between autonomic state and provides periods of excitement along with periods of calm reflection and to help students identify and understand the functionality of the vagus nerve, to support self-awareness of emotional regulation (Gerdes et al., 2015)

During the fine-tuning or myelinated parasympathetic state, the bidirectional body-brain communication enables feeling calm and should facilitate information appraisal and increase learners' cognitive engagement. It is likely that physical movement, complex games, music, and exposure to natural environments engage the learner's autonomic arousal. There is significant qualitative difference between an individual with low arousal who has developed strong myelinated vagal fine-tuning by self-calming in stressful environments verses the unmyelinated vagal freeze responses for someone who hasn't recovered from past trauma. Students may have difficulty learning in an unmyelinated vagal freeze mode and be emotionally disengaged to the degree that it increases maladaptive behaviors including anti-socialness (Gerdes et al., 2015)

The GANE strategy suggests reconsidering technology use and refraining from use until middle or high school because technology may produce risk of negative effects for learners. Researchers suggested to substitute with rhythm sensitive activities such as learning with crafts,

music, physical movement, art, or spending time in nature and learning a foreign language. They suggested that including of these as elements of core curriculum would enhance academic achievements. They argued that educators are in a good position to collaborate, or lead hypothesis-driven studies intended to mitigate and prevent toxic stress. It is proposed that allostatic interventions may restore the responsiveness of the neural system to the full range (Gerdes et al., 2015)

In the mature human brain, the autonomic nervous system (ANS) functions in the background and maintains connections to limbic processes involved in memories, mood, and emotional regulation. Differences in adult and child anxiety, depression, and stress resilience might be due to differences in ANS functioning. Genetic factors begin to influence ANS development in early preconception and intrauterine periods. Early disruption of this process may alter the developmental course of the ANS which could limit the system's capacity to respond to physiologic environmental changes. The ANS is also associated with neuropsychiatric disorders later in life (Mulkey & Du Plessis, 2019).

The onset of many neuropsychiatric disorders such as anxiety, depression, autism spectrum disorder (ASD) and attention-deficit hyperactivity disorder (ADHD) is in childhood. There is increased risk for children with a history of prematurity and other neonatal conditions such as congenital heart disease or maternal stress/neuropsychiatric illness. The functioning between the limbic system and the autonomic nervous system during physical and emotional experiences, shapes behavior and emotional/neuropsychiatric health beginning during the prenatal period and continuing into adulthood (Mulkey & Du Plessis, 2019).

The ANS has two components, the sympathetic, which activates the fight or flight response when someone senses stress or danger, and the parasympathetic, which moderates

sympathetic activation and vegetative functions. The limbic system develops multiple connections and interconnections to ANS centers in the brainstem. Through life, the limbic system connections strengthen or weaken depending on the environment and stress, along with other exposures and experiences. When experiencing a stressor or negative memory, the sympathetic centers are activated, increasing blood pressure, heart rate, and muscle responsiveness. Working like a "vagal brake", the parasympathetic centers may dampen this response. Increased amygdala volume is associated with chronic stress and may result in aggression and mood disorders. However, chronic stress may cause volume reduction in the hippocampus or prefrontal cortex. Excessive cortisol stimulation of the amygdala may cause hypothalamic activation and inhibit hippocampal activity which is associated with depression. Anxiety disorders can manifest from abnormalities in amygdala and limbic system function (Mulkey & Du Plessis, 2019).

According to the Polyvagal Theory, social responses to environments are mediated by the limbic system either by vagal input or vagal withdrawal. From age six months and on, vagal development starts to influence mood and behavioral regulation. Infants develop a "face-heart" connection also known as the Social Engagement System and engage facial muscles to communicate feelings connected to brainstem responses in cardiovascular function. The preschool years are a critical time for neurotransmitter systems development (serotonergic, dopaminergic, noradrenergic), which are critical for behavior control (Mulkey & Du Plessis, 2019).

Throughout the fetal period and infancy, the autonomic nervous system matures. Typically, vagal tone experiences a steep increase around 37-38 weeks, which may be at a time when premature newborns may have entered the ex-utero environment. Autonomic imbalance

especially decreased parasympathetic tone, is associated with depression, anxiety, schizophrenia, and post-traumatic stress disorder. Premature infants, may have lower vagal activity, causing the Social Engagement System to be less mature resulting in limited social skills that foster co-regulation with a caregiver (Mulkey & Du Plessis, 2019).

Generally, the body maintains stable functioning to establish homeostasis. Within ever-changing environments, the body may have to adapt to allow optimal function. This process is known as allostasis. Through differing environmental and physiologic demands, allostasis works to keep the body optimally functioning (Mulkey & Du Plessis, 2019).

Measuring physiologic signals such as blood pressure, respiratory rate, and heart rate provide us information on the autonomic function. Measuring heart rate variability (HRV) (changes in length of time between heart beats) highlights the maturation of the ANS function. The function of the myelinated vagal pathways can most accurately be quantified by measuring respiratory sinus arrhythmia (RSA) (Mulkey & Du Plessis, 2019).

Mulkey and Du Plessis (2019) studied 30 premature newborns found that HRV and cardiac vagal tone were positively related to improved neurologic outcomes at age three in social skills, mental processing, and motor development. The children also had fewer behavioral problems. While prematurity may be the cause of autonomic nervous system developmental issues, there are other neonatal, fetal, and maternal conditions that may disrupt nervous system development. These conditions include maternal stress or nutrition deficiency.

Neuropsychiatric disorders in children are multifactorial and complex, so there is not a universal intervention that can significantly reduce these disorders. However intimate mother-infant connect is crucial for the development of an infant's nervous system. Increased support for

mother targeting nutrition, stress reduction, and improvements in environment, can improve an infant's ANS and improve their future mental health (Mulkey & Du Plessis, 2019).

Mulkey and Du Plessis (2019) looked at the functioning of premature newborns. Infants whose mothers smoked during pregnancy had lower parasympathetic function, higher sympathetic function, and less cardiac adaptability compared to those with nonsmoking mothers. A meta-analysis of adults born very prematurely showed increased incidence of mental health disorders including depression and anxiety.

To study whether regulatory abilities related to how children functioned in school, Miller, Seifer, Stroud, Sheinkopf, and Dickstein (2006) performed a study to examined early classroom adjustment, psychophysiological stress regulation and reactivity, and classroom emotional regulation and expression. Researchers investigated how reactivity (change in cortisol and heart rate) and regulation (respiratory sinus arrhythmia) in a lab were related to observed behavioral regulation and emotional expression in the classroom setting. Using teaching questionnaires, researchers assessed how this information was associated with ratings of school attitudes, behavior problems, and motivation.

This study sampled of 62 four-year-old, low-income preschool children who attended Head Start. Male participants comprised 45% of the sample and 67% were Caucasian, 13% African American and 19% biracial/other (Miller et al., 2006).

The brief video clips presented were designed to elicit positive and negative reactions and various arousal states. Researchers continuously recorded heart rate during the sessions. Salivary cortisol samples were collected at initial baseline, post soothing video, post arousing video, and during recovery. The children's teachers completed questionnaires that assessed behavior

problems and school attitudes. Independent observers observed children during "center time" to assess behavior during structured play periods (Miller et al., 2006).

Miller et al. (2006) found that increased heart rate in response to positive stimuli was marginally related to positive emotion displays in class, and decreased heart rate in response to negative stimuli was marginally related to sadness. Increased heart rate and less cortisol reactivity in response to negative stimuli was related to emotionally negative dysregulation. Considering relationships between regulation and reactivity, and the teacher-rated school adjustment, researchers found increased heart rate in response to positive stimuli marginally related to motivation. They found decreased heart rate in response to a negative stimulus marginally related to persistence. Overall, teacher motivation and general learning behavior ratings correlated with greater cortisol reactivity. They also found that negative emotional expression, particularly anger, was related to persistence, motivation, learning attitudes, and behavior problems (Miller et al., 2006).

Researchers observed the relationship between stress reactivity and emotions displayed in the classroom setting although the associations were modest. They did not find a relationship between classroom emotional displays and regulation. Cortisol reactivity was strongly related to motivation and overall positive school/learning attitudes, as determined by teacher ratings. This could possibly suggest that higher levels of reactivity may be beneficial for engaging in school-based activities. Miller et al. (2006) suggested that regulation and emotional reactivity related more with the teacher perspective of the child's functioning than the regulatory abilities assessed in the lab (Miller et al., 2006).

As a part of a larger study of new science teachers in Queensland, Australia, Tobin, Ritchie, Oakley, Mergard, and Hudson (2013) examined the emotional climate relative to

teaching and learning in a 7th grade science class. They used a multi-method multi-theoretic approach to analyze conversations, prosody, and nonverbal behaviors.

An emotional climate is formed by emotions expressed between people within a collective, such as a class or school, that describes the actions, feelings, and social identities of the members, differing from that of non-members. When in a collective state of emotional communion, members sense of individualism may decrease as the collective identity is enhanced. Emotions, emotional energy, and emotional climate are all able to be categorized as positive or negative. A positive emotional climate is manifested by expressions of joy and happiness and a sense of belonging. A negative emotional climate radiates fear, sadness, or anger within a group. It is important to note that both negative and positive emotional climates can produce solidarity within the group (Tobin et al., 2013).

The study targeted Victoria, a researcher and co-author of this paper, also a teacher at an independent, suburban school in Queensland. Observations of 11 lessons conducted with Victoria's 2009 7th grade science class were analyzed through seven selected video recordings. Data included in the report was drawn from intensive analyses of one lesson, a double-period where students learned about density and floatation by participating in a lab activity. Emotional climate was measured in three-minute segments throughout the class period (Tobin et al., 2013).

The lesson on flotation began with reviewing a boat building activity. Victoria selected a previous boat building winner, Trent, to role play a news interview about the experience. The student used humor, accented speech, and expressive gestures as "Professor Wiley". As Vicky and Trent participated in this theatrical dialogue, the class clapped and laughed together. Victoria attempted to stifle her laughter numerous times throughout. She waved her hand in front of her face and said "Sorry. Sh Sh serious face" and transitioned the class into a more serious science

focused discussion. Trent resumed his normal voice. When teammates tried to chime in, Trent did not let them. He seemed frustrated (Tobin et al., 2013).

The theatrical activity allowed for high levels of positive emotional energy but restricted participation to that of a collective audience. The most successful and emotionally positive interactions during this activity happened when Victoria and her students collaborated to produce collective dialogue vs. teacher questioning and student responses. A great deal of collective effervescence was noted in the form of clapping, laughing, and choral responses. To make sure Trent's team members weren't left out, Victoria gave them both high fives (Tobin et al., 2013).

During small group activities, Victoria often interacted with students to illicit positive emotions. The interactions weren't always focused on science, but on building and maintaining a positive emotional climate. Class experienced synchronicity contributed to collective engagement and excitement, positive moods, and higher emotional climate (Tobin et al., 2013).

Following the activity Victoria lead a class discussion to elicit positive and negative feedback. Emotional climate during this was relatively low and the verbal interactions fell into a pattern of Victoria asking a question and students answering, not a dialogue. As the lesson progressed, signs of crankiness increased. As Victoria attempted to obtain class focus, negative emotional energy increased. When she resisted the class's collective excitement and attempted to control the students, they displayed negative emotions (Tobin et al., 2013).

Throughout the lesson, emotional climate continuously varied. Dialogue allowing learning opportunities happened when interactions between teacher and students were fluent and included humor and collective enthusiasm. When the teacher and/or students tried to gain and maintain power by limiting participation from others, forcing them into a spectator role, the

result was a negative emotional climate. Teacher establishment and maintenance of control over the students, was detrimental to teaching and learning (Tobin et al., 2013).

Teacher education programs stress the importance of establishing and maintaining student control. This study highlighted a positive emotional climate during the student and teacher collaboration. The study suggested that collective effervescence allowed for cultural fluency, high quality content and learning, and lessons filled with positive emotional energy. (Tobin et al., 2013).

Children who have experienced trauma characterized by disorganized attachment relationships are at an increased risk for multiple behavioral and academic challenges, as often seen in elementary and special education classrooms. Teachers and school counselors can learn strategies from trauma research to support students in the schools and classrooms (O'Neill et al., 2010).

Children who have experienced long-term interpersonal victimization from multiple events for extended periods, may have complex trauma. Child abuse and neglect tend to happen during a vulnerable period of development, when the nervous system undergoes immense organizational and maturational changes. Early exposure to stress can affect brain development resulting in long-term functioning and behavior effects. Understanding the implications of complex trauma and attachment can be critical in developing appropriate interventions for school and home (O'Neill et al., 2010).

Neurobiological research states that from the age of six months to age four, the brain increases neuron myelination and decreases the proportion of cerebral white matter to grey matter, which suggests that during this developmental period, infants are more vulnerable to stress. Activated cortisol triggers a fight or flight response, which provides protection during an

emergency and or threat. If a child continuously experiences perceived or real danger, physiological changes begin to affect the developing system with slow brain cell and physical growth, and immune system suppression (O'Neill et al., 2010).

Emotional regulation is at the core of attachment. Children who have experienced abuse, may have chronic emotional arousal and are unable to self-soothe. In addition to challenges in self-regulation, children may have difficulty developing and maintaining social relationships. Emotional and sensory deprivation significantly impacts cognitive development, causing delays in communication, lower IQ scores, and less flexibility and creativity in problem-solving. Supporting students emotional and behavioral growth and learning about other people's emotions will develop emotional intelligence and interpersonal competence (O'Neill et al., 2010).

Attachment to teachers affects academic motivation. Children with low attachment scores felt their teachers did not like them and treated them unfairly. Children with insecure attachment or attachment disruptions felt they would be unsuccessful with teachers and peers based on past relational experiences. When teachers were viewed as caring, the dropout rate decreased. Students with early attachment issues often have a difficult time learning to read and write. Reading is a social experience. Due to difficulties forming social bonds, children with complex trauma miss out on opportunities for direct and indirect literacy modeling. Learning to read is also based on trust that the teacher will help and believe in the students. A child who lacks trust, may not be willing to believe the teacher will model appropriate strategies and reading habits (O'Neill et al., 2010).

To address the needs of students with complex trauma, a teacher must provide a safe environment where students can engage in appropriate and stimulating activities, enjoy

relationships, and are given tasks they can successfully accomplish. Forming a trusting relationship and attachment with a caring person, such as a teacher or teachers' aide, is also critical. Students also require structure and guidance, as well as information given in shorter step-by-step instructions (O'Neill et al., 2010).

Teachers must realize that children with trauma may have issues with self-regulation. The behaviors are due to the body in an activated state of arousal and unrelated to effort or defiance. The behaviors must be handled appropriately by teaching the student self-regulation. Teaching students about emotions, self-regulation, problem solving, and relationship building will manage trauma and support academic experiences. Teachers can create a safe classroom environment by approaching students with playfulness, acceptance, curiosity, and empathy (O'Neill et al., 2010).

The quality of the teacher-student relationship influences student development and academic achievement. Higher levels of emotional support in classrooms support better self-regulation, more pro social behaviors, and increased academic skills (Sher-Censor et al., 2019).

The teacher's attachment style is one factor that may influence the level of emotional support provided. Attachment style, the pattern of relational behaviors, emotions, and expectations, is a result of the adult's attachment history. It is measured along two dimensions. The first, avoidance, refers to discomfort in dependency and closeness along with negative perceptions of others. The second is anxiety, which refers to a fear of rejection by others, strong desire for closeness, and negative self-appraisal (Sher-Censor et al., 2019).

Sher-Censor, Nahamias-Zlotolov, and Dolev (2019) studied 40 teachers in special education classrooms in northern Israel. All 27 female and one male teacher had bachelor's degrees and teaching certificates, 11 had master's degrees and teaching certificates and 2 had teaching certificates. The teachers averaged 11.97 years of experience.

Sher-Censor et al. (2019) examined how teacher avoidance and anxiety attachments were associated with classroom emotional support. They investigated the complexity and valence of teacher narratives about teaching experiences related to interactions in the special education classrooms.

Data was collected in schools, first by observing the teacher-children interactions using the Class Assessment Scoring System (CLASS) for 20 minutes during two lessons. CLASS, an observational measure, evaluates four aspects of classroom climate: positive climate, lack of negative environment, teacher sensitivity, and teacher regard for student perspectives (Sher-Censor et al., 2019).

Immediately after the lesson, teachers completed questionnaires and were interviewed using the Five-Minute Speech Sample (FMSS). During the FMSS, teachers were given an uninterrupted five-minute period to speak about their experiences teaching. The interview was audiotaped, transcribed, and coded using two scales. The first rated the narrative complexity and the second examined the negative valence through the affective narrative tone. A brief symptom inventory was also included to measure teacher general psychological distress (Sher-Censor et al., 2019).

Sher-Censor et al. (2019) found that a more complex teacher narrative was associated with teachers having advanced degrees. The level of teaching experience was associated with greater negative climate observations, but less negative narrative valence. Researchers found that teachers with high anxiety and avoidance taught younger students. Avoidance was not associated with negative climate or with regard to student perspectives. Anxiety was not associated with teacher sensitivity, regard for student perspective, or negative climate.

The most prominent discovery in this study was that teacher avoidance attachment and the complexity and negative valence of the narratives was associated with a less positive classroom climate. These factors also related to reduced teacher sensitivity and less regard for student perspectives. The study found that teachers with high avoidance tended to be less responsive to children's moods, interests, needs and academic and emotional abilities. They also showed less of warmth and physical affection towards students (Sher-Censor et al., 2019).

The study suggested that a negative classroom climate was impacted primarily by how many years of experience a teacher had vs. other factors such as positive climate, sensitivity, or regard for student perspectives. This may be due to burnout and should be researched further. They found that when mostly negative emotions were expressed in the narrative, it was also difficult for the teacher to understand the children's academic and emotional needs accurately and respond to them appropriately (Sher-Censor et al., 2019).

This research indicates the value in assessing both teacher attachment style and the level of teaching experience, to better understand classroom climate and how to form and maintain emotionally supportive classroom interactions. Emotional support contributes to student's well-being and academic achievement. It is critical to provide support to children, especially in the special education classroom which can be a very challenging task (Sher-Censor et al., 2019).

Beauchaine, Gatzke-Kopp, and Mead, (2007) conducted three studies examining autonomic nervous system (ANS) functioning of children aged 4-18 with conduct problems. They described the importance of the Polyvagal Theory. When combined with social reinforcement and motivation the Polyvagal Theory helps explain specific patterns of psychopathology. Polyvagal Theory further explains how the nervous system regulates emotions, how emotions change, and suggests possible interventions for externalizing behaviors.

The Polyvagal Theory discusses two branches of the vagus nerve. The dorsal motor nucleus (DMX), (the phylogenetically older branch) and the newer branch, originating in the nucleus ambiguous (NA). Both branches provide inhibitory input to the heart through the parasympathetic nervous system (PNS), but they serve distinct evolutionary functions. The DMX's primary function is survival for primitive vertebrates, reptiles, and amphibians by activating a freeze response when threatened. The DMX suppresses metabolic demands under dangerous conditions. The NA branch on the other hand, is referred to as the *smart vagus* and is uniquely mammalian and evolved to regulate increased metabolic output, including modulating the fight or flight response (Beauchaine et al., 2007).

Deployment of the newer vagal system suppresses significant fight or flight emotional reactions, needed for complex social behavior. When dysregulated emotion occurs, reduced cardiac vagal tone is observed. Data showed that excessive vagal reactivity to a variety of challenges was found in children who were temperamentally angry, reactive, and shy, and in patients with panic disorder. High vagal tone appeared to protect children (who witnessed marital hostility and conflict) from the risk of developing internalizing and externalizing behaviors (Beauchaine et al., 2007).

The Polyvagal Theory provides context to understanding emotional dysregulation and explains that failure of the newer vagal system results in activating the sympathetic nervous system (SNS), causing a fight or flight response in situations where it isn't needed. Questions remain around why some people respond more often with aggressive (fight) externalizing behaviors, while others tend to respond with aversive (flight) internalizing behaviors (Beauchaine et al., 2007).

Beauchaine et al. (2007) argued that an under responsive central reward system causing chronically irritable mood paired with deficient vagal modulation of emotions leads to aggressive behaviors seen in delinquency and conduct disorders. A central inhibition system that is over-responsive, causes anxiety, paired with deficient vagal modulation of emotions and leads to withdrawal behaviors seen in anxiety and panic disorders.

Each of the three studies conducted by Beauchaine et al. (2007), used respiratory sinus arrhythmia (RSA) and cardiac pre-ejection period (PEP) to measure vagal activity. The first study monitored male adolescents, 20 with conduct disorder (CD), 17 with ADHD, and 22 in a control group. They found that for the aggressive CD group, the baseline RSA was significantly lower than that of the control group. All groups decreased RSA when watching the videotape of escalating conflict. The CD group exhibited lengthened PEPs during baseline with less PEP reactivity during the incentive task, suggesting SNS-insensitivity to the reward (Beauchaine et al., 2007).

The second study targeted male children aged 8-12. The sample included 23 with oppositional defiant disorder (ODD) and or CD, compared to 17 with no psychiatric disorder. The results from this study were consistent with the first study, showing baseline RSA in the aggressive ODD/CD group was significantly lower than the control group and all groups had decreased RSA during the film clip used to elicit feelings of empathy and sadness. No differences in PEP were observed at baseline, but like the previous study, the ODD/CD showed less PEP reactivity to the incentive task (Beauchaine et al., 2007).

The third study examined preschoolers aged 4-6. The participants included the control group with 20 children (9 girls, 11 boys) and the ADHD/ODD group of 18 children (7 girls, 11 boys). No observed differences were noted in RSA between groups, which could be explained by

the girls included. Girls have exhibited higher baseline RSA in some studies. Consistent with the first two studies, lower PEPs were observed in the ADHD/ODD preschoolers at baseline and during the reward (Beauchaine et al., 2007).

Researchers found that preschool children at risk for CD due to concurrent diagnoses of ADHD and ODD did not show excessive vagal reactivity or reduced vagal tone. This suggests that the reductions in vagal tone observed in the older children with ODD/CD developed sometime between preschool and middle school years. The findings proposed that vagal tone and emotional regulation were largely socialized within families and buffer children from developing externalizing and internalizing behaviors when in adverse situations (Beauchaine et al., 2007).

Findings showed that aggression is shaped during the first five years of life by coercive exchanges with parents, where parent and child escalate conflict by matching and exceeding arousal levels. Escalation often terminates the aversive interactions which negatively reinforces emotional lability and heightened autonomic arousal. Research found that ADHD led to CD only when coercive parenting was present, which indicate that the comorbidity of CD and ADHD comorbidity was primarily due to environmental factors. Due to preschool years being such important years for developing executive control and emotional regulation, early intervention is needed. Parenting training to change coercive parenting reinforcement has been found to be the most effective intervention for CD (Beauchaine et al., 2007).

In a study that investigated the importance of teacher-student relationships, Murray, Kosty, and Hauser-McLean (2016) conducted two studies focused on the perspectives of low-income children and youth in a large urban environment. Significant research has demonstrated that teacher-student relationships are associated with emotional, behavioral, and cognitive developmental outcomes. These relationships appear to be important for all students, but they

may be particularly beneficial to young students experiencing poverty or other socio-demographic risk.

Most of the research in this area comes from two perspectives, social support, and attachment. Social support focuses on teacher guidance and behavioral supports, while attachment focuses on affective security in relationships. Murray et al. (2016) explore the importance of both teacher social support and teacher-student attachment amid students of color from low-income backgrounds (Murray et al., 2016).

Social support, defined by emotional, informational, instrumental, and appraisal support dimensions, was associated with psychological and health outcomes. Emotional support is the perception of belonging. Informational support is receiving support to understand specific events and was also sometimes referred to as appraisal support. Instrumental support refers to supplying material, financial, or needed services. Experiencing high levels of social support provides people with regular positive experiences and helps avoid negative experiences. It may help someone reacting to or processing a stressful event. A consistent finding in this area of research more strongly associated with adjustment than support received (Murray et al., 2016).

Attachment theory suggests that early relationship experiences with caregivers afford children the ability to regulate emotions, learn new skills, and explore new environments. Security is described as accessibility, trust, and open communication in relationships, and is predictive of behavioral, emotional, and school functioning. An insecure attachment characterized by alienation, predicts of higher levels of anxiety, depression, poor self-esteem, and antisocial behavior. As children age, attachment relationships evolve into internal working attachment models and influence expectations and emotional regulation in relationships (Murray et al., 2016).

Murray et al. (2016) conducted two studies. The first study focused on 157 primarily African American or Latinx kindergartners from five public schools in a large metropolitan area in the U.S. There were 12 teachers, 9 with a master's degree or higher. One teacher was Asian, 2 Latina, 1 African American and 8 were White. Each teacher completed a questionnaire for 13 students with three components that rated students on items pertaining to emotional, informational, and instrumental support. The second component assessed attachment-base qualities in student-teacher relationships, mainly focused on closeness and conflict. The last component of the questionnaire required teachers to rate students on "school liking" and "school avoidance" (Murray et al., 2016).

The second study included 284 African American students from three large urban schools. The mean age was 13 and 60% of participants were female. Of 16 teachers, 15 were African American and one was White. Teaching experience ranged from 1-38 years and 69% of the teachers held master's degrees. Students completed six surveys and teacher completed four (Murray et al., 2016).

Findings from the two studies stated that overall, teacher-student relationships were associated with the behavioral and emotional adjustment of early adolescents and with school-related adjustment. Teacher-student conflict and teacher emotional support among young children showed unique contributions to children's school adjustment. Teacher-student alimentation was a predictor of student ratings of behavioral, emotional, and school adjustment. Student ratings of trust in teacher-student relationships were consistently associated with how teachers rated student school adjustment. The researchers suggest that trust, conflict, and alienation, based in attachment constructs, were more strongly and consistently associated with teacher and student adjustment ratings than the social support constructs (Murray et al., 2016).

Research shows that urban living is associated with stress as seen in increased amygdala activity. Urban green space among people living in urban areas was associated with impaired amygdala integrity, a sign of coping with stress. Living close to natural landscapes has been shown to enhance well-being, cognition, mental health, amygdala integrity, and increase life longevity. An altered stress response from living in urban environments indirectly impact development and maintenance of mental health issues (Mygind et al., 2018).

In a study that investigated how student stress levels and cognitive performance were affected by exposure to natural environments, Mygind, Stevenson, Liebst, Konvalinka and Bentsen (2018) studied 47 children aged 10-12 in schools located north of Copenhagen.

Mygind et al. (2018) studied children in natural and classroom environments using the same mental load to isolate the environmental effects on psychosocial stress and measured tonic and phasic vagal tones. Tonic cardiac vagal tone indicates the modulation of the vagus nerve on heart rate during supine or sitting rest. Phasic vagal tone measures the vagal withdrawal that occurs during the transition from resting to an event. Higher tonic vagal tone levels suggest more adaptability to external events and has been associated with improved emotion recognition, lower levels are linked with depression, anxiety, alcohol dependence and behaviors showing poor self-regulation. Studies have shown association between cognitive performance and tonic vagal tone.

Chest-strapped heart rate monitors were used to test heart rate variability. Data was recorded during the task and for five minutes of supine rest. The d2 test, a paper and pencil letter cancellation test measured cognitive performance. Children were given 20 seconds to identify the letter d with two apostrophes arranged among distractor letters arranged in 14 rows. (Mygind et al., 2018).

Higher levels of tonic vagal tone were observed in the natural environment, supporting previous research that documented improved cortisol levels during teaching in natural environments compared to in the classroom. Researchers did not find evidence of environmental-related differences for phasic vagal tone during the task. This indicated that the effects natural environments had on the autonomic systems used for stress processing depended on the situation. The natural environment was significant during mental pauses, break time, and periods of rest (Mygind et al., 2018).

Wheeler and Dillman Taylor (2016) combined theories from the interpersonal neurobiology model with play therapy practices. Focusing on the nine levels of integration to connect play therapy and neuroscience concepts, to inform interventions and advocate for play therapy.

Capacity for neuroplasticity continues through the lifespan, but significant brain development happens at astounding rates during ages 0-6. This development lays the foundation for future neural pathways and functioning. Neuroscience highlights the importance of social relationship and play to healthy brain development. Wheeler and Dillman Taylor (2016) found connections between neuroscience findings and play therapy interventions. Dan Siegel and Allan Schore's interpersonal neurobiology (IPNB) model, when used in education and intervention, addresses nine domains of neural integration that influence functioning and relationships. IPND explains the interconnection between the brain, mind, and relationships, illustrating the flow of energy and information within an individual and between the nervous systems of others in their environment (Wheeler & Dillman Taylor, 2016).

IPNB integrates several neuroscience theories that support the importance of play therapy. Polyvagal Theory, encoding of implicit and explicit memory, neuroplasticity and

affective emotional-motivational systems of the midbrain all inform IPNB. Implicit memory is formed prenatally, and post-birth, the caregiver attachment shapes the child's sense of self. Implicit memory consists of unconsciously recalled images, behaviors, and emotions that guide planning and reactions. Explicit memory develops around age 2 and is consciously encoded with focused attention and adds a sense of time. Neuroplasticity is the resulting development of new connections within the brain from exposure to new stimuli and experiences. Seven basic emotional processes identified in mammals that inform higher order thinking and motivate behaviors are seeking, rage, fear, lust, care, grief, and play. Play therapy is founded on the idea that play is natural and the first way for children to communicate their thoughts, needs and emotions (Wheeler & Dillman Taylor, 2016).

Play is considered the foundational element of social connection and has been described as the glue for developing secure relationships because a child is free to learn, grow, and respond to their environment when in a safe and secure relationship. Polyvagal Theory asserts that for play therapy to happen, the child's sympathetic nervous system (SNS) must be in a calm state, suggesting that a play sanctuary of a calm, inviting, and safe space is created. The play space not only should be inviting, but it should be organized in a predictable way, have flexible boundaries, and have a variety of toys (Wheeler & Dillman Taylor, 2016).

IPNB suggests relationships share information and energy, to shape the embodied brain and nervous system, and regulate the mind. When the mind is healthy and functional, energy and information flow are linked through the process of integration. Every relationship has the potential to contribute to or inhibit integration. The nine domains of integration include consciousness, bilateral, vertical, memory, narrative, state, interpersonal, temporal and transpirational or identity integration (Wheeler & Dillman Taylor, 2016).

Consciousness integration is about awareness of the here and now with mindful acceptance of experiences in the moment. Bilateral integration focuses on connecting the left and right brain hemispheres. The right hemisphere is more creative and symbolic and contains our autobiographical memory and the left hemisphere is more linear, literal, and logical and provides words to understand experiences. Vertical integration uses information from the entire body to inform the conscious experience, allowing an individual to transition from reactivity of a stressful or triggering experience, to being receptive to the internal experience and use higher order thinking. Memory integration is the developing the ability to differentiate implicit memories from explicit, allowing one to experience the past as the past. Narrative integration is an individual's ability to understand and resolve experiences and move traumatic or negative experiences from the present to the past. State integration is the process of resolving internal conflicts within parts of the personality and noticing the difference between states of feelings being different than an identity and recognizing that a state is temporary. Interpersonal integration is where the integrated and disintegrated self meets another system, transitioning from an *me* to a *we,* allowing connection and higher levels of meaning and intimacy. Temporal integration gives the ability to accept the dissonance occurring between the humans' natural desire for permanence, certainty, and immortality with the equally natural reality of transience, uncertainty, and mortality. Transpirational or identity integration, which isn't developed until adolescence, is when a larger sense of belonging and purpose arises and drives behaviors through social, community or planetary connection (Wheeler & Dillman Taylor, 2016).

Play therapists can use all nine domains of integration in their practice depending on the age of the child and the skill/issue they are working through. Some examples of strategies to incorporate are using storytelling, letting the clouds of emotion roll by, name it and tame it,

focusing on the breath, and many more. With the connection of neuroscience and the power of play, play therapists will have increased ability to attune and connect with clients, and have the scientific rationale to explain and advocate for their services and techniques (Wheeler & Dillman Taylor, 2016).

School classroom environments impact children's mental health. Differences in children's physiological reactivity may cause a student to be susceptible in varying degrees to the classroom environment. Three hundred and thirty-eight children from 19 kindergarten classrooms were in a longitudinal study to find if parasympathetic reactivity in children moderated the association between classroom climate and changes in externalizing behaviors throughout the school year. This study focused on use of teacher-directed and child-centered practices across classroom management and social domains (Roubinov et al., 2020).

Climate encompasses both instructional and social-emotional features of the classroom environment. A child-centered approach involves the teachers viewing children as active participants in their learning and use instructional practices that support children to become more self-directed and autonomous in their learning. The teacher-directed approach promotes the teacher's managerial role and students learn in more of a passive role. In most classrooms both practices coexist and are used in varying amounts (Roubinov et al., 2020).

Researchers gathered data on externalizing symptoms in the fall and spring of the kindergarten year. They collected children's RSA reactivity and examined teachers use of teacher-directed and child centered instructional styles. The study found that when teachers utilized more child-centered methods, children with high levels of RSA reactivity, showed decreased externalizing behaviors over the course of the school year. An increase in

externalizing issues were seen when more teacher-directed methods were used (Roubinov et al., 2020).

While both child-centered and teacher-directed methods have good qualities, there is not one type of instructional method that will be effective for every student. Some students demonstrate a greater need for rules and routine while others respond better to teacher warmth. The findings of this study align with previous research that children with heightened reactivity are more susceptible to characteristics of the environment while children with moderate to lower levels of reactivity are less vulnerable to environmental effects on development and health. Low-reactive children may benefit from more structure and routine (Roubinov et al., 2020).

The study states that attending to and understanding differences in student stress physiology will help identify children at risk and support the diverse instructional needs students have. Providing teachers with training on stress biology will help teachers understand how students respond to classroom climate and how to support students that need intervention. Integrating biologically informed theory into education and classroom teaching is a critical next step for the future of education and human development (Roubinov et al., 2020).

Disruptions in attachment and intellectual disabilities can both lead to disordered or atypical attachment patterns. Schuengel, Sterkenburg, Jeczynski, Janssen, and Jongbloed (2009) designed a multiple case design study to investigate whether secure attachment behavior could be stimulated with specific emotional regulation. The researchers sought to examine the role of therapeutic relationship in affect regulation for six teenage children with severe intellectual disabilities, challenging behaviors, visual disabilities, and prolonged social deprivation.

It has been theorized that children are born with the innate tendency to find a familiar caretaker in times of danger or stress. With continued proximity-seeking behaviors, patterns

develop and organize attachment behaviors to maintain feelings of safety. During moments of high arousal or distress, a caregiver helps children learn emotional regulation skills that they can use when the caregiver isn't there to help soothe them. When a child is unable to develop attachment relationships, a caregiver's role in emotional regulation may be impacted (Schuengel et al., 2009).

Children with intellectual disabilities struggle to develop both emotional regulation and adaptive coping skills as well as increasing the likelihood of attachment disruptions due to hospitalizations, residential care, maltreatment, and parental disabilities. Close to half of children with intellectual disabilities experience significant behavior and mental health problems often related to maladaptive emotional regulation including self-injurious behaviors. An integrative psychotherapy protocol was developed for clients with a visual and severe intellectual disability who have severely challenging behavior and a history of disrupted attachment. The protocol includes steps to build a therapeutic attachment relationship with a client, and once that has been established, conduct behavior modification (Schuengel et al., 2009).

The study examined which method stimulated more secure attachment behaviors, the integrative intervention which included building the attachment relationship, followed by behavior modification or the control intervention which included only positive attention before behavior modification. Researchers also investigated if the therapeutic attachment relationship elicited lower arousal during behavior modification than the control therapist. Client behavior was videotaped, and arousal was recorded by measuring respiratory sinus arrhythmia (RSA) and pre-ejection period (PEP) (Schuengel et al., 2009).

Schuengel et al. (2009) conducted the study in three phases. During the first phase children attended sessions alternating between the experimental therapist who stimulated

therapeutic attachment and the control therapist that only provided positive attention only. Both therapists applied behavior therapy during phase two, and during phase three, the frequency of sessions was slowly reduced, and they began to include the daily caregivers to promote forming relationships between client and their daily care givers. Once the client continuously sought proximity to the daily caregivers and received appropriate responses, the sessions were terminated (Schuengel et al., 2009).

The results of this study posit that secure attachment behavior can be stimulated for children with multiple disabilities and atypical or disordered attachment. Researchers found that fostering a therapeutic attachment relationship supported emotional regulation under stressful teaching conditions. During the behavior modification sessions, the therapeutic relationship buffered against the arousal, elicited by the activities, in four of the 6 clients. The effects of the therapeutic relationship on emotional regulation were seen in 4 of the 6 children when measuring the activation of the sympathetic nervous system (PEP) but the effects on the parasympathetic nervous system response (RSA) was only seen for two children. The Polyvagal Theory argues that early caregiving experiences are integral to the development of the nervous system and vagal regulation, suggesting that the significant disruptions in attachment the children experienced could explain the lack response seen in RSA (Schuengel et al., 2009).

This study showed that a secure relationship can dampen arousal in stressful situations and suggests that when approaching behavior, integrating ideas of attachment may benefit people with multiple disabilities that are socially deprived (Schuengel et al., 2009).

Advancements in developmental neuroscience have provided unprecedented opportunities to apply research findings to better the academic and social-emotional outcomes for young people. Focused on risk behaviors, Bradshaw, Goldweber, Fishbein, and Greenberg

(2012) bring to light the implications of behavioral problems for school-based prevention programming.

Bradshaw et al. (2012) desired to translate, promote, and disseminate developmental neuroscience research to enhance the experience for youth with educational and prevention curricula, while identifying the specific procedures that facilitate improved experiences. Researchers first investigated the role of stress in the development of mental health and behavioral problems. Substantial research focuses on early childhood; however, neurobiological systems continue to develop and form connections through adolescence and into early adulthood (Bradshaw et al., 2012).

Brain plasticity in early adolescence, changes in functional and structural connectivity and increased dopaminergic activity have been associated with changes in reward-directed neural activity. Focusing on differences during neurodevelopmentally sensitive periods through childhood and into adolescence will result in achieving the greatest preventative impact. Improvement in a child's social environment, while supporting coping abilities and emotional regulation, and implementing empirically informed interventions, could prevent a range of negative outcomes (Bradshaw et al., 2012).

School-based prevention interventions often involve goals to mitigate the impacts of stress, regulate stress reactivity, and support coping skills. Prevention researchers have grown more interested in the specific physiological mechanisms used during the stress response. Research indicates that youth who show more aggression tend to show a hostile attribution bias, are hypersensitive to cues of threat, and overlook situational factors while inferring hostility in the behavior of others. Many preventative interventions try to reduce aggressive behavior by targeting social information processing. Research suggests that high autonomic reactivity is

associated with reactive aggression, while low autonomic arousal is associated with proactive aggression (Bradshaw et al., 2012).

Recent research suggests that executive functions have an important role in aggressive behavior problems. Given the comorbidities, preventative interventions that target executive functioning may have a positive impact on behavior problems. More responsive and nurturing environments including calm and organized classrooms and a positive school climate may affect executive function. Neuroscience informed school-based programs are likely to lead to evidence-based practices that reduce risk behaviors and improve academic achievement (Bradshaw et al., 2012).

Neuroscience literature posits that engaging the brain's reward and motivational systems can enhance the intrinsic reward of learning. Adolescence is characterized by increased reward sensitivity, anticipation, and novelty or sensation seeking. With these findings, interventions during this pubertal period may be particularly useful. Promotion of executive functioning, verbal processing and emotional awareness may improve outcomes for students especially during adolescence (Bradshaw et al., 2012).

Growing evidence indicates effectiveness of neuroscience-informed preventative interventions. The PATHS social-emotional learning curriculum was based on neuroscience models with goals to develop vertical and horizontal neurocognitive control. Studies have found PATHS partially mediated inhibitory control and fostered self-regulation skills. Mindfulness is another approach to promote regulation. Yoga has been indicated as a promising intervention for urban youth to reduce problematic stress reactivity that may lead to depression and anxiety (Bradshaw et al., 2012).

Neuroscience perspectives and methodologies can be utilized to optimize and evaluate programs designed for behavioral self-regulation, cognitive development, and academic success. Neuroscience has the potential to legitimize behavioral and social-emotional based prevention programs. Incorporating neuroscience research could enhance the development and effectiveness of prevention programs (Bradshaw et al., 2012).

Sullivan, Erb, Schmalzl, Moonaz, Taylor and Porges (2018) used yoga-based practice frameworks to propose a model of yoga therapy that converges with the Polyvagal Theory. Sullivan et al. (2018) use Polyvagal Theory to inform a model that connects the neurophysiological insights to the yonic concept of *gunas*. Gunas can be thought of as qualities of nature, and provide the foundation from which emotional, behavioral, and physical attributes emerge. The gunas are believed to shape and support everything that is of material nature.

Yoga therapy and other mind-body therapies are argued to benefit well-being and health. Integration of top-down and bottom-up processes facilitate brain and body communication. Top-down processes involve setting of intentions and regulation of attention and have been associated with decreased stress, hypothalamic-pituitary axis, and sympathetic nervous system activity, which impacts inflammation and immune function. Bottom-up processes involve movement and breathing techniques that influence the cardiovascular, musculoskeletal, and nervous system influencing emotional well-being and immune function (Sullivan et al., 2018).

The three Polyvagal neural platforms, ventral vagal complex (VVC), sympathetic nervous system (SNS), and dorsal vagal complex (DVC) are linked to behaviors of social communication, defensive mobilization, and defensive immobilization. There are times when these three circuits co-exist and produce two additional states. The fourth state occurs when the VVC and SNS co-arise. The VVC provides the experience for safety and connection and the

SNS promotes the mobilization of the body for movement, play, and creative thinking. The fifth state occurs when both the VVC and DVC are activated creating the state of safe immobilization. Immobilization without fear allows for social bonds to form through activities such as childbirth and nursing. Polyvagal Theory gives insight into the ability to recognize and shift the underlying neural platform of a psychophysiological state, and how they could directly affect physiology, behavior, and emotion providing the individual with strategies for resilience and regulation (Sullivan et al., 2018).

Modern yoga practice focuses primarily on physical postures and movement sequences. However, the tradition is centered on a philosophical path to understand the causes and alleviation of suffering. Yoga suggests that suffering comes from one's reaction to, relationship, and misidentification with various phenomena of the body, mind, or environment (BME). One model believes suffering can be alleviated by transforming the individual's relationship to the BME phenomena to promote eudaimonic well-being. Eudaimonia is a state of well-being or human flourishing that is often connected to feelings of purpose, meaning, and self-realization and is linked to many health benefits (Sullivan et al., 2018).

Sattva is the quality of calmness, pleasure, and tranquility and serves the function of illumination. *Rajas* is the quality of turbulence, energy, and pain and serves the function to activate. Tamas is the quality of delusion, inertia, and indifference and serves the function to limit or restrain. These three gunas co-exist and co-mingle in constant movement to create manifestations of BME phenomena. Polyvagal theory and yoga describe three neural platforms or qualities to explain psychological, physical, and behavioral attributes. Activation of the VVC and/or sattva promotes interoception and connection and may lead to eudaimonia. Activation of SNS and/or rajas provide mobilization to respond to psychophysiological demands when real or

perceived threat emerges. Activation of the DVC and/or tamas provides a spectrum of experiences ranging from stability to immobilization. Both the gunas and Polyvagal Theory have a critical role in understanding how yoga can be utilized to help patients with diverse conditions (Sullivan et al., 2018).

The yoga practices of Asana, Pranayama, Yama and meditation could enhance specific vagal pathway function, optimizing the VVC and or strengthen the quality of sattva. Polyvagal Theory provides a neuroscientific explanation of the techniques and methods used in yoga. Development of interoceptive sensitivity and awareness encourages resilience and regulation of the shifting neural platforms and gunas as they respond to BME phenomena. Yoga practice can promote the ability to return to VVC or sattva when in a maladaptive state of rajas and SNS or tamas and DVC and help build resilience and self-regulation (Sullivan et al., 2018).

The model developed by Sullivan et al. (2018) supports the creation of yoga therapy tools for assessment to identify guna predominance. While the neural platforms of Polyvagal Theory and the gunas are not the same, they are reflected in one another. Resilience and self-regulation come when one changes the relationship between the gunas and neural platform counterparts, teaching the individual to bounce back to the states of restoration (Sullivan et al., 2018).

Educators encounter many unique occupational stressors such as managing the classroom environment, teaching challenging students, responding to student crises, and dealing with pressures from parents. These stressors come along in addition to typical work stressors such as overload in work responsibilities, interpersonal relationships with administrators and colleagues and many more. The level of emotional engagement, stress and demands that is required of educators impacts their professional effectiveness and can result in burnout. Sharp and Jennings (2015), investigated how teachers who learned mindfulness strategies in the Cultivating

Awareness and Resilience in Education (CARE) intervention program, utilized the knowledge and how the skills were applied in teaching practices (Sharp & Jennings, 2015).

Current research discusses burnout having three components: emotional exhaustion, depersonalization, and diminished personal accomplishment. Emotional exhaustion is defined as when emotional or physical symptoms that manifest from draining work situations. Depersonalization refers to a decreased level of empathy for students or people served while simultaneously becoming increasingly detached. Personal accomplishment describes how an individual feels about their efficacy in relation to their work. School personnel report that burnout leads to dissatisfaction and exits from the profession (Sharp & Jennings, 2015).

Mindfulness- based interventions (MBIs) are programs that teach mindfulness practices and support the practice of present-centered attention and awareness. CARE is an MBI developed to address burnout in teachers, by giving school personnel strategies and tools to support teachers in managing emotional responses and stress. The CARE training program includes 30 hours of training, over four days, distributed over a 6-week period. Instruction is delivered through small group discussions, lecture, experiential activities and working with partners. Phone consultations are also provided between trainings (Sharp & Jennings, 2015).

The researchers sought to answer two questions. The first was “How do educators report integrating and applying mindfulness techniques taught in CARE?” and the second “How do CARE participants describe and reflect upon their involvement in the program?” They used eight participants for this study who had previously participated in CARE and reported positive outcomes from utilizing what they had learned (Sharp & Jennings, 2015).

Interviews and focus groups were audio recorded and transcribed. Several patterns were discovered across the narratives. Researchers identified three themes present in how the

educators applied mindfulness. They noted themes of integration of CARE metaphors, present-centered awareness of emotions, and the ability to shift perspective and reappraise situations. Many educators used metaphors they had learned in the training, such as “flipping my lid” and “elevator going up”. Two participants also discussed events in which they were able to recognize their emotion, label it with a metaphor and responded with an appropriate CARE strategy. Participants also reported increased present-centered awareness of emotions by being able to pause and assess a situation before reacting. Examples of perspective taking were also noted among many participants (Sharp & Jennings, 2015).

Polyvagal Theory shows how our biology influences the interactions that help form our attachment style. When feeling safe, bodies use the social engagement system to help navigate relationships. When the relationship between an infant and their primary caregiver does not provide the needed sense of safety, a therapeutic relationship can provide a reparative experience. As seen in the game of peek-a-boo, loss of connection and attempts to reconnect can reveal attachment dysfunction. A therapist can attune to the client needs and the peek-a-boo can provide a playful and interactive repair. As clients play, they transition from a defensive state to being available to find connection and belonging (Wagner, 2015).

Attachment styles can indicate a person’s pattern of defense. When in situations with a potential threat, people have a tendency to move into fight or flight response, shut-down, or social engagement. When looking through a polyvagal lens at two of the main insecure attachment styles, anxious and avoidant, one notes that the frantic behavior seen in anxious attachment relates to sympathetic fight or flight response and the distancing avoidant behavior relates to the parasympathetic collapse response. If a person tends to use the social engagement system, they likely have secure attachment (Wagner, 2015).

Peek-a-boo- resulting in a brief loss of the caregiver can cause an infant to experience a "life-threatening response. The quick playful return with a smile and cooing voice shows the child that all is well. This game can help an infant develop social engagement. To establish a connection, the therapist must attend and respond to many of the clients' cues such as eye movements, posture, breath patterns, vocal tone and rhythm and words. The goal is for the therapist to join in the vocal and physical qualities without joining in the distress. When a loss of connection is noted, the therapist can seek reconnection with curiousness about the disconnection (Wagner, 2015).

When connection with a client is difficult, it can cause life-threatening cues to the therapist. When the connection cannot be established after a long time, this may cause therapists and parents to experience the shut-down response, also called burn-out. To operate in this state can be harmful for children and clients. Therefore, therapists and parents must have other sources for connection (Wagner, 2015).

Ideally with a therapist's use of the social engagement system a client can find enough of a sense of safety to be able to engage. When a person's early life did not provide enough sense of safety to develop social engagement biology, a therapeutic relationship can provide a reparative experience. Polyvagal Theory provides a conceptualism of defense mechanisms as a three-part hierarchy. With this knowledge one can understand the biology behind Attachment Theory to aid the journey towards connectedness (Wagner, 2015).

Adverse Childhood Experiences (ACEs) are defined as childhood events often chronic and varying in severity, that occur in a child's family or environment that cause harm or distress and disrupts the child's psychological or physical health and development. ACEs are correlated with an increased likelihood of health issues in adulthood. Some examples include alcoholism,

depression, suicide, diabetes, heart disease, and cancer. Children with higher ACE scores also have more behavior-related problems and fewer social emotional competencies (Conroy & Perryman, 2022).

When the body senses threat, it releases a flood of hormones to promote an adaptive response to the stress. This process is facilitated by the hypothalamic-pituitary-adrenal (HPA) axis. Dysfunction within the HPA axis has a positive correlation with childhood trauma. After repeated activation, the body's threat response system becomes prone to upregulation or downregulation. Upregulation is when the body remains alert and vigilant even when there is a lack of threat. This can lead to panic and anxiety disorders. Downregulation is when the body is less responsive to prominent emotional stimuli which can lead to depressive symptoms. Both responses can be very disruptive and inhibiting to typical functioning. The body prioritizes blood and energy flow during the stress response, to maximize adaptability, causing a shortage within the brain (Conroy & Perryman, 2022).

Due to lack of soothing from the social engagement system, individuals with higher ACE scores are more likely to have their sympathetic nervous system activated than those with lower ACE scores. Polyvagal theory proports that by stimulating the ventral vagal complex through safe social engagement, people who have experienced trauma will become less reactive over time (Conroy & Perryman, 2022).

Child-Centered Play Therapy (CCPT) is an evidence-based approach for treating trauma - related behaviors. CCPT has been found to be effective in increasing child-caregiver relationships, academic performance, and child self-efficacy, while also decreasing problem behaviors. The play-therapist-and-child-relationship promotes change by creating a safe experience where the child can feel empowered as they foster autonomy and learn to control the

process. Looking at CCPT through a polyvagal informed lens could provide clarity for therapists on the impact of therapy (Conroy & Perryman, 2022).

SECURE is an acronym to represent the construct of the lens. The S stands for safety, E for engagement, C for co-regulate, U for understanding of self, R for regulation expansion and another E for exploration. The SECURE lens does not change the goals of CCPT but helps explain the process of change. As the therapist co-regulates with the child, they provide a more regulated experience and foster a new understanding of self. When exposed to these experiences repeatedly, the child will begin to improve their own regulatory capacities and show more exploratory behaviors (Conroy & Perryman, 2022).

Trauma that happens at early stages of development is labeled “low brain trauma” which manifests nonverbally and should be addressed through movement or sensory activities that aren’t usually used in CCPT. It is important to apply neuro-informed counseling to CCPT to understand the impact of the process. Use of the SECURE lens in CCPT will provide clarity to ground the therapist and offer a clear picture of the change process for therapists and provide a common language to explain the change to guardians (Conroy & Perryman, 2022).

Polyvagal Theory studies feelings of safety while incorporating neuroanatomy and neurophysiology. Acknowledging that feeling safe has a measurable and underlying neurophysiological substrate shifts the research feelings about safety from a subjective to objective science. When humans feel safe, their nervous system supports homeostatic functions of health, restoration, and growth while supporting a connection with others. The phylogeny and neural development study support understanding the underlying mechanisms of the autonomic nervous systems. When implemented in education or healthcare institutions, the science could

improve sociality and health while enhancing creativity, productivity, and a sense of well-being (Porges, 2022).

Through the study of phylogeny and neural development, foundational principles can be extracted. Porges suggested seven principles regarding the science of safety:

1. Feelings of safety are a subjective interpretation of a calm autonomic state regulated by the ventral vagal pathway that supports homeostatic functions (i.e., health, growth, and restoration.)
2. Feelings of threat, stress, or anxiety are subjective interpretations of a shared defensive autonomic state that disrupts homeostatic function.
3. Feelings of safety provide access to the social engagement system.
4. When recruited, the social engagement system sends safety signals (e.g., intonation of voice, facial expressions) to others that functionally downregulate (via neuroception) autonomic defense states to states of calmness and accessibility mitigating the metabolically costly threat reactions via co-regulation.
5. Co-regulation provides the neural state that supports the establishment of trusting relationships.
6. Autonomic calmness states (e.g., feelings of safety) enable efficient access to higher brain structures involved in problem solving and creativity.
7. The reciprocal benefits of co-regulation form the basis of sociality and support the neural systems in optimizing health and performance (p. 12).

Porges (2022) noted that acknowledging and incorporating of these principles in societal institutions and daily interactions would support feelings of safety in the human experience and promote a more productive and healthier society.

Extensive research is prevalent regarding self-regulation with various methods and theoretical approaches on the subject. Kostol and Cameron (2020) stated that humans develop the ability to control emotions from an early age. Much research is focused on forms of interaction between parents and other significant caregivers with the developing child. Competent self-regulation develops through these interactions as part of a multi-faceted term known as co-regulation. Supportive co-regulation creates a safe and secure adult-child relationship, in which the child learns to trust that caregivers will support them through stressful emotions and situations (Kostol & Cameron 2020).

Research on mother-child relationships has clarified many elements of co-regulation. To support this study, Kostol and Cameron (2020) prefaced by stating the following: Mothers use movement, voice, imitation, and reaction to support and calm the infant. This helps them develop emotional regulation. Starting at almost complete reliance on parental co-regulation, children gradually develop self-regulation. Research has also been done (e.g. Silkenbeumer et al., 2016) focused on co-regulation of teachers and students. Findings suggested that preschool teachers tended to use activity related co-regulation as opposed to approaches that specifically addressed the child's emotions. Activity-based co-regulation may not be as effective for improving self-regulation in the long run and did not provide children with a greater awareness of their own emotions (Kostol & Cameron 2020).

Kostol and Cameron (2020) explored how first-grade teachers responded to students in emotional distress within the framework of co-regulation. Researchers used four focus groups with 13 educational professionals from four primary schools in Southern Norway. The focus groups had between two and five participants aged 20-40, all women, with one exception. The

goal was not to explore variation across individuals but rather to identify prevalent themes across all groups and schools (Kostol & Cameron 2020).

The subjects were shown two different video sequences followed by participating in interviews with broad questions that involved immediate responses or feelings, reflections on student emotional states, how participants would approach the situation and conceptualizing co-regulation. The interviews were audio recorded and transcribed with field notes also collected. Findings included three main themes, that included teacher emotional self-awareness, acknowledging students and their emotions, and pragmatic approaches to the problem.

The first theme was that teachers regulated their own emotions as the initial step in co-regulation. This is seldomly a conscious effort because the risks of emotional reactions can be automatic at times. The subjects highlighted the importance of "holding back" their emotions. They mentioned strategies such as taking deep breaths or counting to 10. The findings underscored the importance of adults practicing self-regulation and emotional awareness to support positive co-regulation with children (Kostol & Cameron 2020).

The second theme was teachers' efforts to acknowledge student emotions. Approaching a child with a calm voice and demonstrating empathy supported feelings of safety that helped the student regain control of their feelings. All four groups reported that having close relationships with the students was critical. Knowledge about individual students affected teacher actions and influenced the development of co-regulation. This illustrates the relational component of co-regulation. Co-regulation involves creating relationships to build student-teacher trust that help students through stressful situations and emotions. Another common finding was that teachers viewed sadness a more relatable emotion than anger. More challenges occur when addressing a child's anger than their sadness. This also aligns with evidence that students with externalizing

behavior issues are more often rejected by teachers than those who withdraw (Kostol & Cameron 2020).

The third theme included using pragmatic approaches to solve the problem. Participant responses revealed a two-step process involving a brief assessment of the situation followed by quickly moving to solve the problem. In all but one of the schools, participants pointed out that removing the student from the situation may support calmness and regain control. However, the issue of staff availability to allow for student breaks was addressed. Time limits also related to staff shortages and other resources. There was often not enough time to allow students to process their emotions, however teachers said they wished they had more time to devote to attending to the emotional states of students (Kostol & Cameron 2020).

Kostol and Cameron (2020) proposed that important opportunities for co-regulation may be lost when teachers focus too much on reducing the impact of the situation and resolve situations too quickly. Despite indications that positive co-regulation exists, the findings suggested a need for greater attention to the process of co-regulation and the impact on students in early primary years (Kostol & Cameron 2020).

Flores and Porges (2017) discussed how Polyvagal Theory could explain the biobehavioral intricacies of social experiences during child development, later expressed as adult attachment. Polyvagal Theory describes the neural mechanism involved in attachment and offers a clinical model to support more effective treatment. Informing strategies for intervention that exercise the neural circuits used in the social engagement system can help work towards secure attachment. When safety is repeatedly detected, using the idea of neuroception to understand attachment, reinforces a bias toward social engagement behaviors. Consistent absence of safety cues primes a bias toward activating defensive mobilization (fight or flight) or defensive

immobilization (shutdown). Polyvagal Theory supports understanding the neural basis of affect regulation, attachment, and emotional disorders (Flores & Porges, 2017).

Flores and Porges (2017) noted that using Polyvagal Theory to approach group therapy created a neural exercise regimen that provided opportunities to strengthen the social engagement system. While exercising neural circuits that dampened fight/flight responses, group therapy also enhanced members' ability to detect safety cues in voices and faces of others. Group leaders should incorporate three main Polyvagal principals when designing groups. First, a group leader must become familiar with environmental and social features that can bias neuroception and understand the impact it causes in discerning safety and threat. Therapists must help members recognize and identify their emotions and assist in developing awareness of visceral signals. This will help discourage avoidance via numbing or dissociating (Flores & Porges, 2017).

Next, a group leader must construct a group environment that promotes feelings of safety to decrease defensiveness and offer opportunities to exercise the social engagement system. Positioning chairs in a group that allows all members to have face-to-face contact with each other encourages social bonds. Group leaders must provide safety and predictability to create community and a secure space for members. A leader must be constantly checking to see if the space is safe enough for people to disagree, challenge authority, and to self-advocate when feeling misunderstood (Flores & Porges, 2017).

Finally, a group leader should provide repeated opportunities for group members to exercise the vagal brake by navigating through a sequence of states from calm, vigilant, startle and back to calm. Good cardiac vagal tone is similar to good muscle tone. Just as going to the gym regularly builds muscle, working the social engagement system in group strengthens the

vagal brake. This improves one's ability to engage and disengage with others in the service of fostering self-soothing behaviors (Flores & Porges, 2017).

Polyvagal Theory provides convincing evidence that supports crucial, recurring, authentic face-to-face interactions. Social interactions strengthen the vagal pathways and improve the accuracy of neuroception, emotional communication, and the dampening of sympathetic defensive reactions. Polyvagal Theory offers a model to guide more effective treatment in group therapy by outlining strategies that exercise neural circuits that promote secure attachment. (Flores & Porges, 2017).

Research has shown that communicating validation improves the recipients physiological and psychological well-being as opposed to receiving invalidating feedback. Studies have yet to establish if the positive impact comes from validation itself or the absence of invalidation. Greville et al. (2016) sought to find the answer (Greville et al., 2016).

Research established that higher levels of well-being were associated with being part of a social group, giving and receiving social support, and having predominantly positive interactions with others. Being rejected, excluded, ignored, or overly criticized during social interactions has a detrimental effect on well-being. For this study researchers examined the validation/invalidation effects on psychophysiology and perceptions of social safety through the lens of Polyvagal Theory. Greville et al. (2016) proposed that validation was a signal of safety and engaged the parasympathetic nervous system and increased social engagement. Conversely, invalidation was a sign of threat and activated the sympathetic nervous system thereby decreasing social engagement. (Greville et al., 2016).

Using a control group, the study had 90 healthy volunteers (25 males and 65 females) randomly assigned to a group that received validating, invalidating, or no feedback during a

series of stressor tasks. Researchers recorded social engagement behaviors, psychophysiological measures and self-reported ratings. First, participants completed the Difficulties in Emotion Regulation Scale and an online demographics survey. Then electrodes we placed on participants for psychophysiological measures and a five-minute baseline was recorded. Next, participants filled out the Positive and Negative Affect Schedule (PANAS) before completing a mental math stressor task that was designed to be impossible to solve within the time allowed (Greville et al., 2016).

The control group completed an online feedback form; and the validating or invalidating group participants described their feelings about the task to the experimenter. The experimenter then responded for about two minutes providing either validating or invalidating feedback. Participants completed the PANAS again. Researchers coded and examined the nonverbal social engagement behaviors of 42 participants (Greville et al., 2016).

There were no significant differences between the control and validated participants. Invalidated participants showed reduced social engagement behaviors and increased psychological and physiological arousal on several measures compared to the other groups. Invalidated participants had many adverse effects including significantly lower perceived safety ratings, significantly higher negative affect, significantly less social engagement behavior and decreased willingness to repeat the experiment. The findings suggested that lack of invalidating feedback rather than the presence of validating feedback influenced a reduction in negative physiological and emotional arousal during stressful tasks. Reducing invalidation in social interactions is important and these findings have potential for application in many clinical interactions (Greville et al., 2016).

Attention during class is a critical element for student learning and success. Lack of attention causes incoming information to quickly fade and results in impaired learning. Focused attention is comprised of two related but separable processes, which include sustained attention and selective attention. Sustained attention is maintained attention on a task over time and selective attention is selecting task-relevant stimuli among other objects. This study focused on attention while also exploring the presence of inattentive behaviors within the classroom. The main goal was to investigate how classroom climate influenced self-regulation skills (Scrimin et al., 2018).

Classroom climate is defined as the physical environment and the harmonious microsystem students and teachers form through high-quality emotional and social interactions. This study examined 62 first graders from mid-sized primary public schools in northeastern Italy. All teachers were women with 10-27 years of teaching experience (Scrimin et al., 2018).

The researchers initially spent three months participating with students in classroom activities to build relationships and obtain trust. The first session required students to sit individually in a quiet room and watch a short relaxing cartoon. Electrocardiogram (ECG) were recorded at rest. The student was then administered an inhibitory control task and debriefed before returning to class. The following week students participated in a second session during a regular classroom activity where the researcher observed and completed a classroom climate checklist. The third and final session took place the following week where the researcher administered a selective attention task in class (Scrimin et al., 2018).

Among the first graders, focused attention was better for girls compared to boys. Greater cardiac vagal tone at rest was associated with a higher focused attention score. Findings showed a significant interaction effect between cardiac vagal tone and classroom climate with focused

attention. More importantly, researchers discovered a three-way interaction between cardiac vagal tone, classroom climate, and inhibitory control that explained student focused attention. In classrooms with a positive climate, the first graders with higher cardiac vagal tone at rest also had higher focused attention. Those with lower vagal tone had lower focused attention. In classrooms with a negative climate, having high cardiac vagal tone at rest was not enough to improve focused attention. Students with deficits in physiological self-regulation might show decreased inhibitory control in negative classroom environments representing a protective factor (Scrimin et al., 2018).

The findings are significant for developing targeted interventions to focus on both individual and environmental factors. Effort should be focused on improving classroom climate as well on increasing student inhibitory control skills. This study supports how emotional regulation plays an important role in classroom activities and learning (Scrimin et al., 2018).

School provides an environment where children have the opportunity to observe interactions between teachers and peers from various social groups. Treatment from teachers often differs between social groups. Research has shown that adult nonverbal behaviors influence how children evaluate individuals and increase biases children develop toward members of low-status groups (Brey & Pauker, 2019).

Brey and Pauker (2019) sought to determine if children acquired group-level stereotypes and biases after witnessing teachers treat some students differently from others. They also tested how the emergence of stereotypic beliefs and intergroup preferences were influenced by children's group membership and teacher treatment (Brey & Pauker, 2019).

The study involved 96 five to eight-year-old children living in Hawaii. Most were in kindergarten, with 26% in preschool and 4% in first grade. To start the session, participants were

shown a picture of three groups of 12 children. The children in the photo matched the gender of the participant with a variety of racial groups common in Hawaii were represented. The novel groups were distinguished by the color of t-shirt the children wore (orange, green, or blue). Participants were assigned one of the groups and given a corresponding t-shirt. Next, they were shown four 17-second videos of a teacher and two students of the same gender as the participant. In each of the videos, the teacher wore a black shirt, one student wore a green shirt and the other wore an orange shirt. In the videos, the teacher directed positive nonverbal behaviors towards students in one color shirt and negative nonverbal behaviors towards students in the other (Brey & Pauker, 2019).

Brey and Pauker (2019) found that children's group membership and teacher behaviors differentially influenced the development of stereotypes and intergroup preferences. When choosing who to be friends with, children tended to pick members of the same group regardless of whether the group received positive or negative behaviors from the teacher. The participants assigned to the positive group showed the strongest in-group preferences. When asked to pick the "smarter kid" children picked students from the group that received positive behaviors. Participants formed beliefs about the intelligence of the groups based on observations of teacher behavior. They generalized their beliefs to the new students from those groups. The results suggested that exposure to patterns of teacher differential behavior towards students from different groups maybe influence how children develop stereotypes about group members but not group bias (Brey & Pauker, 2019).

Christina Devereaux (2017) focused on the intersections between autism and the social engagement system through regulated mobilization in dance/movement therapy. Deveraux (2017) relates neuroception to "finely attuned antennae". The goal of dance/movement therapy

(DMT) is to help clients increase the accuracy of neuroception through building body awareness and utilizing neural exercises to experience physiological shifts from playful, active and alert. Mobilization without fear allows an individual's experience to be reframed and the nervous system is no longer expecting danger and chaos (Devereaux, 2017).

Many people, including those with autism, can pick up inaccurate environmental cues. Polyvagal Theory suggests that those with autism may struggle to voluntarily engage in social behaviors because through neuroception, threats in the environment are felt, even when people or situations are safe. When the nervous system communicates the movement away from social engagement, dance/movement therapists can notice this and work through it using movement in a dance of relationship (Devereaux, 2017).

To begin using Polyvagal Theory in DMT, therapists must begin to pay careful attention to the "finely attuned antennae" and notice emotional activations and physical sensations in oneself. When the therapist does this, it supports co-regulation in the therapeutic relationship. These principles clarify what happens during dysregulation for those with autism and provides strategies to increase calm and stability. Engaging breath with deep exhalations reactivates the vagal break. Stephen Porges: The Listening Project suggests incorporating ventral vagus activating music assists with modulation and triggers the social engagement system (Devereaux, 2017).

DMT therapists must notice qualities of movement and accept motor distortions and repetitive actions as forms of communication. Individual needs can be determined by observing how a person with autism responds with their body. Therapists must address the client where they are both emotionally and physically through movement, gesture, and sensorial communication to offer different channels to social engagement. This work suggests that through

carefully attuned movement and dance, the social engagement system can be activated and allow for mobilization without fear. Polyvagal Theory proports that through attuned mobilization, closeness, social engagement, and bonding can happen. Polyvagal Theory via DMT is a positive strategy for working with clients with autism (Devereaux, 2017).

It is estimated that two-thirds of middle-class Americans have experienced at least one adverse childhood event (ACE) and one in six report experiences four or more. Effects of ACEs can be mitigated with early interventions that boost resiliency. Theraplay® created Sunshine Circles (SC) by a psychologist working in a Chicago Head Start program. An individualized intervention program was developed utilizing principles from attachment theory, good-enough-parenting, developmental play and social skills training for autistic children to be delivered in Head Start programs. Over time, the model evolved into what is now thought of as SC or Theraplay. SC was designed to align with neuroscience research on children's brain development, and emotional regulation, attachment, and social learning (Tucker et al., 2017).

The SC program emphasized adult-led play, eye contact, gentle touch, and movement. Sessions were delivered at least once a week for 20-30 minutes long. This study compared students who received the SC program with students who received education as usual. Across the school year, students were compared on standardized measures of social-emotional functioning. There were 12 teachers and 206 preschool students from a midwestern U.S. state with 107 students in the SC intervention classes and 99 in the control classes. Data was collected at each site three times a year (October, February, and May) using the Teaching Strategies GOLD, ASQ-third edition, and the ASQ-3 Social Emotional section which are all commonly used to measure student growth during the school year. In the spring, the teachers were visited by

a trained observer who used the Teaching Pyramid Observation Tool for Preschool Classrooms. Teachers were interviewed near the end of the school year (Tucker et al., 2017).

The SC group was always signaled by playing a song used for SC that indicated the special activity was about to begin. Children sat in a circle, and when everyone joined, they sang a song using large motoric motions. Then participants used words and motions to review the three SC rules: Stick together, no hurts, and have fun. The first activity was titled "check-ups" where the children were divided into groups of three to four plus a teacher. The adults asked the children to show them any "boo-boos" or "hurts". This activity supported neuroception of safety, promoted empathy among the students, and improved child-teacher relationships. A new, fun, large motor activity followed the check-up. Depending on the class's tolerance, the teacher chose three-five games for the intervention. The group always ended with a snack and finished with a song. The snack provided an essential support to establishing emotional bonds between child and teacher. The end of group was signaled by a song and followed by the students transitioning to their next activity (Tucker et al., 2017).

The quantitative results suggested that regular use of SC in the classroom increased the overall amount of student learning over the course of the year and increased the use of prosocial behaviors. There were significant differences between the intervention group and the control group on all areas in the Preschool Behavior Questionnaire. In SC interventions, gains were seen for problem solving, management of emotions, and fine motor skills. SC also decreased problematic behaviors in the classroom. The qualitative data reinforced the quantitative findings by showing the improvement of teacher-student relationships and reduction of teacher stress related to challenging student behaviors. These findings indicated that the use of SC in early-

childhood classrooms was a simple, relatively low-cost, and highly effective intervention (Tucker et al., 2017).

Childhood is a time when emotions are intense and capacity for emotional regulation is low. Because primary education is a time when emotional self-regulation is developing, it provides important opportunities to implement interventions to improve these abilities. Interventions based on focused breathing and biofeedback of heart rate variability (HRV) have proven effective in improving the emotional self-regulation abilities in children (Aritzata et al., 2022).

Biofeedback is a method that trains people to voluntarily control physiological functions like breathing, while providing users instant information about changes in physiological activity. Using these method, one can learn to breathe to increase HRV by breathing at a frequency of approximately six breaths per minute. Children with lower HRV display behavior problems and children with greater HRV show better psychosocial adjustment. To offer a comprehensive theory on self-regulation capacity in children through biofeedback programs, researchers used Polyvagal Theory to support the research. The main goal of the study was to examine how the effectiveness of a breath pace training biofeedback program for primary school-aged children influenced HRV. Aritzata et al. (2022) hypothesized that the experimental group would show higher HRV values compared to the control group post intervention (Aritzata et al., 2022).

Participants were students from two different primary public schools. The control and experimental groups were divided into three cycles. The first cycle included 2nd grade students who compromised 29.2% of participants. The second cycle of 57.7% included 3rd and 4th grade students. The remaining 13.1% were in the third cycle and included 5th and 6th grade students. The program involved two phases: A pre-intervention phase and the intervention phase that

included five sessions. When the intervention was finished, the five HRV scores were processed and analyzed (Aritzata et al., 2022).

The results of the study affirmed that students who participated in the program learned to increase HRV through the practice of long, steady breathing. This suggests that HRV biofeedback is and effective strategy to teach self-regulation. Self-regulation during Primary Education is critical due to the increased social and academic demands that can cause emotional distress. The results showed the relevance and need for HRV biofeedback interventions to be applied in schools, especially for children aged eight years and older (Aritzata et al., 2022).

Pei-Ling Hsu (2019) conducted a study that investigated how cogenerative dialogues (cogens) could be used as a pedagogical tool to address emotional issues during a project-based learning (PBL) science internship. PBL is a teaching method that uses extended inquiry to engage students in learning knowledge and skills through authentic, complex questions and carefully designed tasks and projects. PBL has three key features, situated learning, active construction, and social interaction. Without scaffolding from teachers, students may experience anxiety and confusion during inquiry due to lack of knowledge or tools to help them address the problems (Hsu, 2019).

Cogens has great potential in supporting the emotional climate during PBL. Cogens are conversations between stakeholders for these purposes: to reflect the collective experience and to assist in developing and deciding rules, roles, and responsibilities for activities. Hsu used the Polyvagal Theory to explore participant emotional responses during PBL. The study was part of a four-year research project supporting high school students in an intensive seven-month science internship. One scientist, assisted by two teaching assistants guided nine high school students in learning scientific practices. Cogens were used throughout the seven months to identify issues

and find solutions. For each Cogen, the sandwich method was used beginning by discussing the implementation of ideas from the previous Cogen, next they discussed topics, issues, and positives from the week and finished by discussing the quality of the Cogen that day. The purpose of the third part was to help distinguish the Cogen from everyday conversation, because cogens emphasized and valued the respect and equity of different voices which were not always present in daily conversations (Hsu, 2019).

The researchers collected real-time interactions through video. Analysis of the data showed a transformative trajectory of emotional climate among the participants. The results suggested that cogens could be an effective pedagogical tool to address challenges in the complex PBL environments and improve emotional climate. By using cogens, educators can increase synchronicity and reciprocity among teachers and students. The Polyvagal Theory asks whether society provides people opportunities to experience trusting relationships and safe environments. Feeling safe is a prerequisite for the ability to perform socially or engage higher levels of creative practices. This study supports embedding the practice of cogens in schools and demonstrates the great potential to foster safe learning environments (Hsu, 2019).

Chapter III: DISCUSSION AND SUMMARY

Summary

The nervous system continuously monitors for cues of danger and safety. The Polyvagal Theory explains how these cues influence people both physiologically and behaviorally. Exposure to danger cues, compromises children's development along with their health, quality of social relationships, and educational achievement (Porges, 2015).

Polyvagal Theory provides convincing evidence that supports crucial, recurring, authentic face-to-face interactions. Social interactions strengthen the vagal pathways and improve communication, neuroception accuracy and the dampening of fight-flight or immobilization responses (Flores & Porges, 2017).

Measuring physiologic signals such as blood pressure, respiratory rate, and heart rate provide information about the autonomic function of the body. Measuring heart rate variability (HRV) (changes in length of time between heart beats) highlights the maturation of the Autonomic Nervous System function. The function of the myelinated vagal pathways can most accurately be quantified by measuring respiratory sinus arrhythmia (RSA) (Mulkey & Du Plessis, 2019).

Research involving Polyvagal Theory show significant promise for developing targeted interventions to focus on both individual and environmental factors. Effort should be focused on improving classroom climate as well on increasing student inhibitory control skills. Emotional regulation plays an important role in classroom activities and learning (Scrimin et al., 2018).

Professional Application

The level of positive impact possible if the political leaders in the United States operated through the lens of The Polyvagal Theory is unimaginable. Considering the benefits of the

principles the theory asserts, leaders would promote universal healthcare, housing for all, extended paid parental leave, free early-child education, in addition to other supportive social services. If the human experience is to seek safety, no one should live without having their basic human needs met. Implementing these changes could save the educational system and our society. How can a child learn at school if they are worried about whether there is dinner at home, or if they will have a bed to sleep in later that night? How do students feel safe in classrooms without a trusting relationship with their teacher and classmates? These questions continue to be asked. If all educators had the basic understanding of this theory and taught using this understanding as one aspect of their approach, our society would flourish.

Providing teachers with training on stress biology will help them understand how students respond to classroom climate and how to support students who need intervention (Roubinov et al., 2020). Teacher education programs highlight the importance of establishing and maintaining student control. Tobin et al. (2012) suggested that a positive emotional climate during student and teacher collaboration allowed for cultural fluency, high-quality content and learning, and lessons filled with positive emotional energy.

A child-centered approach occurs when teachers view children as active participants in their learning and using instructional practices that support students becoming self-directed and independent in their learning. The teacher-directed approach promotes the teacher's managerial role and students learn passively. In most classrooms, practices coexist and are used in varying amounts (Roubinov et al., 2020).

Research indicated the value in assessing both teacher attachment style and the level of teaching experience to better understand classroom climate and how to form and maintain emotionally supportive classroom interactions (Sher-Censor et al., 2019). Significant research

demonstrated that teacher-student relationships are associated with emotional, behavioral, and cognitive developmental outcomes (Murray et al., 2016). Attachment to teachers affected student academic motivation. Students with early attachment issues often had difficulty learning to read and write. When teachers were viewed as caring, the dropout rate decreased (O'Neill et al., 2010).

Efforts should be focused on improving classroom climate as well on increasing student inhibitory control skills. Emotional regulation plays an important role in classroom activities and learning (Scrimin et al. 2018) and teachers can create a safe classroom environment by approaching students with playfulness, acceptance, curiosity, and empathy (O'Neill et al., 2010).

More responsive and nurturing environments including calm and organized classrooms and a positive school climate affect executive function. Neuroscience-informed school-based programs are likely to lead to evidence-based practices that reduce risk behaviors and improve academic achievement (Bradshaw et al., 2012). Behaviors must be handled appropriately by teaching students self-regulation skills. Teaching students about emotions, self-regulation, problem-solving, and relationship-building will manage trauma and support academic success.

Educator well-being is crucial when considering ways to promote positive outcomes in education. Based on Ryland's suggestions for therapists, a successful educator must be one who is genuinely engaged, empathetic, and has positive regard for the student. This is critical because teachers are perceived subliminally. Safety and danger cues cannot be faked. Practicing mindfulness and self-care can increase the educator's 'window of tolerance' which describes how intense an experience can be tolerated before the sympathetic nervous system is activated (Ryland et al., 2021).

Kostol and Cameron (2020) proposed that important opportunities for co-regulation may be lost when teachers focus too much on reducing the impact of the situation and resolve situations too quickly. Despite indications that positive co-regulation exists, the findings suggested a need for greater attention to the co-regulation process and the impact on students in early primary years (Kostol & Cameron 2020). When educators work outside their 'window of tolerance' opportunities for co-regulation may be rushed or missed all together.

Polyvagal Theory provides convincing evidence that supports crucial, recurring, authentic face-to-face interactions. Social interactions strengthen the vagal pathways and improve the accuracy of neuroception, emotional communication, and the dampening of sympathetic defensive reactions (Flores & Porges, 2017). Neuroscience links the importance of social relationships and play to healthy brain development. Play is considered the foundational element of social connection and has been described as the glue for developing secure relationships. When a child is in a safe and secure relationship, a child is free to learn, grow, and respond to the environment. When designing areas in classrooms, the play space should not only be inviting, but should be predictably organized, have flexible boundaries, and a variety of toys (Wheeler & Dillman Taylor, 2016).

Gerdes et al. (2015) suggested that physical movement, complex games, music, and exposure to natural environments engage autonomic arousal in learners. Some examples of ways to implement Polyvagal Theory and teach emotional regulation and play in classrooms include incorporating the use of storytelling, letting the clouds of emotion roll by, name it and tame it, focus on breathing, and many more. When connecting neuroscience and the power of play, play therapists will have increased ability to attune and connect with clients (Wheeler & Dillman Taylor, 2016).

Mindfulness and being surrounded in nature are other approaches to promote regulation. Yoga has been indicated as a promising intervention for urban youth to reduce problematic stress reactivity that may lead to depression and anxiety (Bradshaw et al., 2012). Enjoyment of natural landscapes enhances well-being, cognition, mental health, amygdala integrity, and increase life longevity (Mygind et al., 2018).

Creating a classroom climate through the lens of The Polyvagal Theory could be a game changer in our schools. When educators and humans approach behaviors and learning from a neuroscience perspective they may begin to understand students better and teach them in ways to connect safely and support healthy emotional and academic development.

Limitations of the Research

In my research I focused on gathering information to build my overall understanding of The Polyvagal Theory and how the Autonomic Nervous System operates. I then sought to find research investigating use of the theory in education and therapeutic environments. At that point, I decided to also include some research on Attachment Theory because both are important when looking at building relationships in the classroom and community at large.

Limitations in the research across most of the literature review was small sample sizes. There was not a large amount of research on Polyvagal Theory in education, especially for classrooms in the United States, or for older elementary and middle school students.

Implications for Future Research

This theory appears to be increasing in many more areas of application. There was quite a bit of information to support the benefits of understanding Polyvagal Theory, however, its application in the educational system seems to be an area where more research is needed. Since beginning this research, I have seen more and more information emerge about The Polyvagal

Theory including more on the application in the classroom, however much of it is still inaccessible to many educators due to cost including workshops or publications. I look forward to learning more strategies and ways to incorporate The Polyvagal Theory to improve my own well-being and to create classrooms and learning environments based on promoting safety and a healthy nervous system.

Conclusion

The research addressed by this thesis focused on how educators could use Polyvagal Theory in classrooms and school communities to improve academic and social emotional outcomes for students? I also investigated how attachment styles impact the educational process for students and teachers. To answer these questions, a comprehensive review and synthesis has been conducted. The synthesis produced several applicable strategies including creating a classroom climate where students and teachers collaborate (Roubinov et al., 2020). Research suggests positive effects from incorporating play into academics via games, art or movement (Wheeler & Dillman Taylor, 2016). Incorporating the natural world as much as possible was another important strategy (Gerdes et al., 2015). Educators must also take care of their own well-being so that they can show up authentically for students and engage in co-regulation and safety in classrooms.

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