Spring 5-18-2024

Embodied Co-Regulation: A Neuroregulatory-informed Dance/ Movement Therapy Transition Intervention Method for Arousal Regulation for Adolescents in a Partial Hospitalization Program

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Capstone Thesis

Lesley University

April 17th, 2024

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

Student's Name: Anamaría Guzmán Cárdenas

Type of Project: Thesis

Title: Embodied Co-Regulation: A Neuroregulatory-informed Dance/Movement Therapy Transition Intervention Method for Arousal Regulation for Adolescents in a Partial Hospitalization Program

Date of Graduation: May 18th 2024

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

Thesis Advisor: Wendy Allen

Abstract

This thesis introduces a novel Dance/Movement Therapy (DMT) approach, focusing on nervous system arousal regulation during transitions between therapy groups. The core of the method involves a brief 5-minute exercise designed to modulate arousal levels, encompassing alertness and energy, aiming to establish a baseline homeostasis. Rooted in Polyvagal Theory and Developmental Neurobiology, the approach assumes the co-regulation of nervous systems within a group therapeutic setting. Two primary outcomes are self-assessed: 1) somatic experiences documented through narratives and 2) nervous system biodata measured using the Flowtime headband monitoring of brainwaves, heart rate, and other biomarkers. Results indicated that all six sessions showed noticeable changes in embodied arousal before and after the DMT method. The author, in the role of facilitator for the DMT method, experienced a notable embodied and physiological transformation from lethargy and anxiety to a state of increased grounding and regulation. Both measured biomarkers and observed body/movement interoceptive cues were consistent, indicating regulation of arousal and attunement to the group, particularly evident in Session 5, which featured a larger group size. Consequently, the author proposes that the mind-body shifts observed during group engagement are not solely due to the accessible short bilateral movement game, but also to the number of participants receptive to the method. The ability of embodied co-regulation, as outlined in relevant literature, is contingent upon the individuals involved in the method. Participants who witnessed and actively engaged demonstrated a willingness to share space through movement, influencing the rhythm, attunement, and overall embodied and physiological experience of the facilitator. This method is specifically designed for group settings, and

as suggested in this study, the quantity and quality of participants present significantly shape the regulatory experience of everyone involved.

The method developed aims to gain a deeper understanding of individual nervous system responses when engaging in co-regulation, in this case as the leading therapist, to then provide a more phase-based tailored approach to assist clients in transitioning between groups and schedules especially those at sites like Partial Hospitalization Programs. This research contributes to the evolving landscape of DMT practices, highlighting the importance of phase/transition-based movement intervention as well as biodata measurement and personal narratives as valuable tools for refining therapeutic interventions.

Keywords: arousal regulation, adolescents, Dance/Movement Therapy, bilateral stimulation, co-regulation, neuroscience clinical application, transition-based intervention

Author Identity Statement: As a first-generation Colombian immigrant woman, I am driven to honor my family's generational effort that has enabled me to pursue higher education in the U.S. With a background in neuroscience and dance, I aspire to utilize movement in both functional and expressive capacities to integrate and process mind-body experiences. This approach fosters a somatic, client-centered, embodied, neurobiological-informed lens. I am deeply committed to learning and promoting representation and inclusivity, striving to advocate for and empower clients through psychoeducation and access to diverse mental health care resources.

Embodied Co-Regulation: A Neuroregulatory-informed Dance/Movement Therapy Transition Intervention Method for Arousal Regulation for Adolescents in a Partial Hospitalization Program

Introduction

The focus of this thesis revolves around the development and implementation of a Dance/Movement Therapy (DMT) approach, centering on the regulation of the nervous system during transitions between therapy groups at an adolescent Partial Hospitalization Program (PHP). In the realm of therapeutic group interventions, the importance of understanding and addressing nervous system arousal, which encompasses alertness and energy levels, cannot be overstated. This study aims to contribute to the growing body of knowledge in the merging field of DMT and neuro-informed therapeutic interventions by introducing a method that seeks to modulate arousal states, fostering a grounded and regulated mind-body state.

This topic is of vital importance for several reasons. Firstly, arousal regulation plays a pivotal role in shaping individual experiences, responses, and overall well-being in a therapeutic setting (Mayes, 2000; Corrigan et al., 2011; Siegel, 1999). Focusing on how DMT can regulate arousal, there is the potential to enhance the therapeutic process and contribute to a more conducive environment for therapeutic growth. Secondly, the integration of this method aligns with established theories such as Polyvagal Theory and Embodied and Developmental Neurobiology (Porges, 2022; Mahoney & Chapman, 2004; Sturman, 2011), offering a theoretical and evidence-based foundation for its application within a group therapeutic setting.

Through this exploration, the writer anticipates developing an effective method that is engaging and practical for both practitioners and clients, while also gaining valuable insights into the intricacies of nervous system regulation and its impact on personal somatic experiences. The utilization of innovative technology, such as the Flowtime headband, enables real-time measurement of biomarkers, adding an empirical dimension to the research. Furthermore, this study aims to illuminate how individual narratives, coupled with objective physiological data, can inform the development of a tailored therapeutic approach.

This study aims to bridge the gap between theoretical understanding and practical application, contributing to the enhancement of Dance Movement Therapy practices with adolescents in a Partial Hospitalization Program (PHP). By delving into the intricacies of nervous system responses and incorporating them into a transition/phase-based tool, the writer seeks to offer a simple yet valuable intervention for therapists, particularly those in PHPs. The goal is to facilitate better self-regulation for therapists, thus enabling clients to autonomously regulate themselves and consequently fostering a grounded and productive environment for the attainment of their treatment goals.

Literature Review

As humans, we possess the ability to move, communicate, work, and engage in activities, as well as rest, sleep, and recover. Our bodies achieve this by regulating and allocating metabolic and physical resources based on immediate requirements. This process is fundamentally arousal regulation (Mayes, 2000; Hegerl, et al., 2016). This literature review aims to examine the physiological and developmental implications of arousal regulation, the impact of trauma on arousal from childhood through adolescence, and the role of somatic-body-based interventions like Dance/Movement Therapy. Specifically, it will explore how such interventions facilitate arousal regulation in adolescents within short-term programs, such as Partial Hospitalization Programs, as chosen for this study.

The Physiology of Arousal Regulation

Physiologically, the concept of arousal regulation involves increased physiological activity reflecting activation in both the central and peripheral nervous systems (Mayes, 2000; Mahoney & Chapman, 2004). This heightened state influences attention, executive functions, information processing, learning, and socialization by balancing central nervous system inhibition and excitation, impacting the response to new or stressful situations (Mayes, 2000). More specifically, attention is an important concept when assessing arousal as it is the center point of neurobehavioral regulation systems.

Attention directs metabolic resources, showing interdependence with arousal levels in neuroimaging studies (Coull, 1998). Yerkes and Dodson's Arousal Theory (1908) notes that performance increases with physiological or mental arousal, reaching an optimum level beyond which performance declines. If an individual's arousal level is

either too low or too high, it leads to a deterioration in their performance and, thus their focus and attention (Yerkes & Dodson, 1908). Therefore, maintaining an optimum arousal level is crucial for cognitive performance, particularly attention, and overall functioning. Furthermore, a higher-level cognitive arousal system, which allows for smooth shifts between arousal states, is vital for optimal arousal, acting as a gate mechanism for stress responses and influencing reactions to trauma (Coull, 1998; Mayes, 2000).

Another integral aspect of arousal regulation involves the polyvagal system, as suggested by the Polyvagal Theory introduced by Stephen Porges in 1994. The autonomic nervous system (ANS) consists of two primary branches, the sympathetic (SNS) and parasympathetic nervous system (PNS). According to the polyvagal theory, there are two distinct vagal pathways within the PNS, giving rise to the dorsal vagal complex (DVC) and ventral vagal complex (VVC) (Porges, 2022). SNS precedes the VVC and, upon activation, triggers an increase in heart rate and other biomarkers, facilitating responses to immediate threats (Poli, et al., 2021). These pathways contribute to determining arousal states, influencing affect (any experience of feeling or emotion, in this context, displayed in physical cues i.e. facial expressions (APA, 2018), behaviors, and bodily responses, which are also tied to the development of attachment facilitated by co-regulation which is the reciprocal and coordinated control of one's own emotional and physiological states by another during social interactions (Porges, 2022). This neurobehavioral system’s development begins during childhood and serves as an important foundation for later social, physical, and emotional development.

Neurobehavioral Development and Attachment

In the early stages of human neurobehavioral development, Dahl (2009) suggests that experiences during the establishment of neural connections lay the foundation for later connection patterns. The growth of arousal regulation systems is integral to this developmental process, with childhood beholding the early formation of connections between higher cognitive processes and affective regulation, potentially influencing lasting links between cognition and emotion (Turpyn et al., 2017). Attaining self-regulation and self-control requires achieving a harmonious balance between cognitive and affective processes that thrive when parents convey the affective cues as they exert a marked influence on how the child learns and regulates (Dahl, 2009).

Childhood attachment, aimed at providing safety, security, and protection (Benoit D., 2004), significantly shapes self-regulation (Movahed, et al., 2017), impacting one's ability to handle stress effectively. This influence is encapsulated in the concept known as the Window of Tolerance (WOT). Coined by Dan Siegel in 1999, the WOT represents the optimal arousal states between sympathetic hyperarousal and parasympathetic hypo arousal, facilitating tolerable emotions and integrated experiences (Siegel, 1999, as cited in Corrigan et al., 2011). Within the WOT, the sympathetic (SNS) and parasympathetic (PNS) nervous systems collaborate for homeostasis. However, exceeding stress capacity forces individuals out of this window, leading to dysregulation and either sympathetic dominance (hyperarousal) or parasympathetic dominance (hypo arousal). These concepts will be reintroduced later relating their role after trauma occurs.

The absence of secure childhood attachment can impact children's transition into adolescence, a period characterized by internal and external changes, leading to further

rewiring in arousal states. During adolescence, the balance of sleep and arousal regulation often tilts strongly towards heightened arousal and away from sleep due to various factors. As Dahl (2009) notes, “With multiple sources of elevated arousal and decreasing opportunities for sleep, many adolescents end up with profound imbalances in sleep-arousal regulation, which returns the discussion to the consequences of sleep deprivation” (p. 280). Adolescents require additional external support, and the involvement of support systems such as caregivers, counselors, and the community becomes crucial for engaging in co-regulation, thereby aiding the further development of arousal regulation and affect management (Sturman, 2009; Montgomery, 2013). Consequently, it is unsurprising that trauma during the formative stages of arousal system development results in enduring consequences, intricately affecting both the mind and body.

Childhood Trauma’s Impact on Adolescent Arousal

Childhood trauma is described in alignment with the criteria outlined in the Diagnostic and Statistical Manual of Mental Disorders V (DSM-V). It encompasses instances of actual or threatened death, serious injury, or sexual violence. This incorporates firsthand exposure to trauma, observing traumatic events, or being informed about trauma affecting a close friend or family member (American Psychiatric Association, 2013). If children transition into adolescence experiencing continuous trauma, young individuals experience Complex post-traumatic stress disorder (CPTSD, C-PTSD or cPTSD) which can develop if there is continued experience of long-term trauma (Cleveland Clinic, 2023). Common symptoms following trauma may involve hypervigilance and heightened arousal, often coupled with impulsive behavioral issues and a diminished capacity to verbally articulate emotional experiences (Dixius, 2021).

Furthermore, adolescent trauma (whether presented as CPTSD, PTSD MMD, or other diagnoses) may manifest as various behavioral expressions, including depression, social withdrawal, rebellion, risky behaviors like sexual acting out, a desire for revenge, action-oriented trauma responses, and disruptions in sleep and eating patterns (Hamblen J., 2001). These behaviors, functioning as defense mechanisms tied to negative affect arousal, paradoxically contribute to the exacerbation of unbalanced arousal neurobehavioral pathways. Trauma, especially in early years where attachment is essential, can lead to an autonomic nervous system (ANS) imbalance, resulting in either hypo arousal through PNS overuse or hyperarousal through SNS overuse, meaning there is a narrower WOT which leads to easier dysregulation (Shirtcliff, 2009; Montgomery, 2013). Defensive mechanisms, as mentioned earlier, are activated to avoid straining the less well-developed branch, resulting in adolescents being consistently in either hypo arousal or hyperarousal state.

Hypo arousal is associated with emotions including flat affect, numbness, feeling "empty" or "dead," cognitively dissociated, and inability to think (Corrigan, et al., 2011). This happens due to greater use of PNS leading to inhibited emotions/affect which leads to a compromised ability to tolerate arousing effects (Montgomery, 2013). Due to the constant low physiological arousal, adolescents tend to actively pursue stimulation as a means of alleviating the discomfort associated with a state of low arousal (Raine, 2002). In moments of stress, young individuals may seek to shift their low arousal state by resorting to self-injurious thoughts or behaviors (Aldrich, J. T., et al, 2018). Research also suggests that adolescents who exhibit reduced responsiveness to their surroundings

are less inclined to cultivate empathy when there is a lack of existing physiological arousal (Gostisha, 2014; Shirtcliff, 2009).

On the other hand, hyperarousal is associated with feelings/symptoms like anger, anxiety, insomnia, and aggression (Corrigan et al., 2010; Fernandez-Mendoz et al., 2016). The usual coping mechanisms that arise from these are acting out, mania, externalization, and impulsiveness (Montgomery, 2013). This means the SNS branch is heavily relied on and compromises the ability to tolerate low arousal effects. Young individuals who undergo hyperarousal might be prone to reacting impulsively or responsively to both threatening and non-threatening or unclear situations (Phan, J., et al 2020). While hyperarousal, hypervigilance, and aggression are commonly viewed as pathological or maladaptive, adaptive calibration models suggest that historically perceived pathological behaviors may serve as purposeful, predictable, and effective responses to navigating challenging environments (Gaylord-Harden et al., 2018, as cited in Phan, et al., 2020). A study analyzing the role of hyperarousal in African American males who have experienced community violence found that hypervigilance and hyperarousal, which are symptoms of C-PTSD, may be adaptive in contexts of traumatic and unpredictable stressors (Phan, J et al., 2020). This demonstrates that arousal is more complex than it may appear in terms of its functionality.

Given the above considerations, it can be assumed that hypo arousal is associated with more depressive profiles, while hyperarousal is linked to profiles prone to anxiety. This concept is primarily encapsulated in the tripartite model, introduced by Clark and Watson in 1991, aiming to clarify the taxonomy of anxiety versus depression. This model, still widely used in both children and adults, suggests that anxiety and depression

share negative affect (NA) as a common factor, with anxiety being mainly characterized by physiological hyperarousal. However, research by Greaves-Lord et al. in 2007 indicated elevated arousal levels in both anxiety and depression, contrary to the model's expectations. The findings suggest that hyperarousal cannot reliably distinguish between anxiety and depression. As Greaves-Lord (2007) notes, "The idea that hyperarousal is specific to anxiety and not depression is too simplistic and does not reflect the more complex reality." This highlights the intricate function and mechanism of arousal. Regarding traumatized youth who may showcase depressive either/or anxious profiles, it is the significant fluctuations in arousal levels that appear to reinforce self-injurious thoughts and behaviors as a regulatory method, increasing the likelihood of their recurrence in the future (Aldrich et al., 2018, p. 58).

Transitions and Changes: Shifts in Arousal Regulation

When do shifts in arousal regulation occur? Transitions and changes disrupt predictability for young individuals who are neurodivergent or have a history of trauma, leading to potential dysregulation (Martinelli, K., 2016). The ARC framework (Attachment, Regulation, and Competency), designed for children and adolescents with complex trauma, recognizes this as crucial in their healing (Kinniburgh and Blaustine, 2005). Trauma often brings chaos, and establishing consistency during transitions builds trust. Authors Green and Myrick (2015) identify from the literature three important steps in phase-based treatment when working with complex trauma in adolescents: (a) stabilization and safety, (b) trauma processing, and (c) reconnection.

Short-term treatment's initial focus on stabilization and safety is key (Green & Myrick, 2015; Johnson, 2009) as the goal is to enhance symptom control and for clients

to find stability in treatment. Once stabilization occurs, young clients can start processing and developing a more coherent narrative, which then enables them to reconnect with themselves and others. In terms of arousal regulation, stabilization involves widening the Window of Tolerance (WOT) through simple, short interventions, that attune to the self (body and mind) and others via co-regulation (Siegel, D. J., 2010; Green & Myrick, 2015), with somatic-based interventions being particularly relevant.

Somatic and Body-Based Interventions for Adolescents

The existing literature on somatic and body-based interventions showcases that incorporating somatic regulation into the treatment of complex trauma in adolescents can play a significant role in promoting stabilization and skill development (Warner et al., 2014; 2013). Somatic interventions such as mindfulness-focused Yoga have been shown to have positive effects on emotional regulation and affect the improvement of high school students (Daly, L. A., 2015; Noggle et al. 2012). More importantly, Dance/Movement Therapy (DMT) distinguishes itself in the literature by offering a comprehensive approach that integrates both body and mind, serving as the primary approach utilized in the development of the methodology in this study.

Dance/Movement Therapy and Adolescent Regulation

Dance/movement therapy (DMT) is defined by the American Dance Therapy Association (ADTA) as utilizing movement for psychotherapeutic purposes to promote the emotional, social, cognitive, and physical integration of individuals, thereby enhancing their overall health and well-being (ADTA, 2023). The theories underpinning DMT are grounded in embodied neurobiology, which suggests that "responding to the body through movement can effectively regulate or contain emotion" (Homman, 2007 as

cited in Homman 2010). Drawing from concepts such as the mirror neuron system and right-left brain integration, DMT provides a dynamic framework for exploring the interplay between the body and emotions, fostering awareness, facilitating choice exploration, and improving responsiveness to complex situations (Homann, 2010).

In the context of DMT and regulation with adolescents using trauma-informed methods, research has identified touch (Seoane, K. J., 2016), interoception (Dieterich-Hartwell, R., 2017), and movement expression (Anderson et al., 2014) as effective tools for promoting self-regulation and emotional processing. These findings emphasize the significance of integrating various sensory and movement-based modalities in therapeutic interventions. The development of the transition-based Dance/Movement Therapy method is informed by several foundational concepts and theories, which contribute to its theoretical underpinnings.

In the context of the specified population and methodology developed, the DMT approach designed for this study incorporates four key elements: 1) embodiment, 2) rhythm, 3) attunement, and 4) bilateral stimulation applied within the framework of DMT. As the population consists of adolescents who have been referred to a Partial Hospitalization Program (PHP) due to heightened Suicidal Ideation (SI), Self-injurious Behavior (SIB), and increased depressive and anxious symptoms, the primary objective of the methodology is to provide these clients with safe access to their bodies through simple and concise movement exercises conducted in between group therapy sessions. This approach aims to regulate the nervous system in real-time, assisting clients to 1) stabilize and reach moderate arousal for better function and attention as well as 2) aid in the smooth transition between groups, which, as previously mentioned, can cause

dysregulation. The additional aspects of the PHP and the necessity for the devised DMT approach will be further explained later, as well as detailed in the methodology section.

Firstly, embodiment involves theories and research where the body and movement play a fundamental and central role in our cognition, emotions, perception, and behavior (Van Geest, J., et al, 2021). During the feedback loop of bidirectionality between subjective experience and the body's sensations and movements, the body exchanges interoceptive and proprioceptive information (sensory data) with the brain through the central nervous system, leading to the creation of neural patterns (Damasio, 2005, Van Geest, J., et al, 2021). The developed DMT method utilizes embodiment via the pre- and post-movement experiential, in this method, called “body check-in” where individuals are offered the chance to express current affect and emotional state through the body via any non-verbal expression and/or identify specific bodily sensations. The author suggests, based on the literature, that by embodying both the current state of the body and mind, individuals can direct their attention to the internal and physical sensations, facilitating needed physical shifts i.e. stretching, adjusting clothing, self-touch, etc. (Koch, S., 2014). These actions enable individuals to acknowledge both present and absent qualities within their current state. In the context of the methodology employed in this study, the objective is to help invigorate the body, enhancing alertness and readiness to engage and learn during the final therapeutic group session of the day.

Secondly, rhythm is “a strong, regular, repeated pattern of movement or sound” (Oxford Languages, 2024). In DMT, rhythm is understood to be inherent to human physiology, as engaging in rhythmic movement stimulates various brain regions including the motor cortex, somatosensory cortex, basal ganglia, and cerebellum (Cruz,

2018; Korn, 2012). An illustration of rhythm's specific application in dance/movement therapy is demonstrated through a polyvagal-informed dance/movement therapy case study of a client who initially presented with overwhelming terror and bodily shutdown (Gray, 2018). In this case study, the client was able to engage and shift through movement using rhythm, which the author emphasizes as a key ingredient in fostering social engagement and reciprocity. This case highlights the importance of leveraging movement, rhythm, and dance to cultivate a deeper, more profound connection among individuals who have experienced trauma (Gray, 2017, 2018).

Thirdly, attunement is “the sense of being fully aware of the other person's sensations, needs, or feelings and the communication of that awareness to the other person” (Erskine & Trautmann, 1997, p. 90, as cited in Jerak, T., et al., 2018). This is possible via mirroring, kinesthetic empathy (the ability to understand somebody else's inner experience through body movement sensing), and the ability to feel safe via co-regulation (Jerak, T., et al, 2018; Montgomery, 2013; Porges, 2022). Co-regulation is a particularly important concept here as it allows for nervous systems to help regulate each other, and this is evidenced by increased eye contact (mutual gaze), shifts and matching affects (flat to brighter), and arousal regulation, which is measured by heart rate, coherence, and shifts in alpha, theta, and beta brainwaves (Steffen, P. R., et al, 2017; Marzbani, H., et al, 2016). In DMT, non-verbal attunement enables clients to convey their feelings and facilitates the emergence of novel responses, resulting in the encouragement of richer experiences and thereby facilitating the regulation of neurobehavioral systems.

Fourth and last, bilateral stimulation (BLS) refers to the use of a stimulus that is presented to both sides of the body; it utilizes bilateral visual (eye movement), auditory, or sensory stimulation (e.g. tactile stimulation) (Amano, T., & Toichi, M., 2016). Over the last ten years, empirical research has demonstrated that the thalamus plays a crucial role in the integration of memory, somatosensory, perceptual, and cognitive functions. This integration process is also known as thalamo-cortical temporal binding (Llinás & Ribary, 2001; Llinas et al., 2002) Additionally, it is supported by neuroimaging studies that consistently find decreases in thalamic activity in PTSD (Lanius et al., 2001, 2003).

Various theories, based on neurobiological research, including studies by Bergmann (2008, 2012), suggest alterations in neuronal mechanisms in PTSD. Bergmann proposes that activating the lateral cerebellum through BLS facilitates the activation of specific thalamic nuclei, promoting the integration of somatosensory, memory, cognitive, affective, and coordinated hemisphere activities impaired in PTSD. Similarly, Corrigan (2002) suggests that BLS, such as auditory, visual, or tactile stimulation, could deactivate certain brain regions, leading to increased cognitive control and reduced emotional distress. When it comes to arousal, physiological studies have found that BLS used in Eye Movement Desensitization and Reprocessing (EMDR) is associated with a de-arousal response driven by increased parasympathetic relative to sympathetic changes (Kapoula et al., 2010). However, the literature agrees that more research is needed to determine BLS's mechanism of action and how and what is improving regarding treatment outcomes when used. All in all, BLS in EMDR involves stimuli presented to both sides of the body, such as tapping (rhythm), eye movements, sounds, or bilateral

movement (Lilienfeld, 2021; Shapiro, 2014). Consequently, the link between movement and stimuli suggests a potential role for BLS in Dance Movement Therapy (DMT).

After reviewing the literature on DMT and EMDR, this writer did not find a lot of available research on its integration. However, available resources and educational webinars guide trained therapists proficient in both EMDR and expressive therapies to integrate these modalities. This integration aims to expand the safety and accessibility of healing opportunities for clients struggling with complex trauma (Davis et al., 2022; McNeil, E., & Platt, J., ADTA, 2018). Bilateral stimulation, a feature shared by both EMDR and DMT, has the potential to foster positive neurodevelopment in individuals who have undergone trauma (McNeil, E., & Platt, J., ADTA, 2018). These holds promise for integrating DMT into short-term treatment settings, particularly for individuals with trauma histories who may not be ready to delve deeply into trauma due to the brief nature of the setting, which may not provide a secure environment for processing trauma. Neuroregulatory BLS-informed DMT offers a practical skill to help individuals stabilize, regulate their emotions, and actively participate in short-term treatment.

Partial Hospitalization Programs and DMT

Partial hospitalization programs (PHPs) serve as a transitional treatment option within the spectrum of psychiatric care for patients necessitating greater clinical support than what weekly outpatient care offers yet requiring fewer intensive services and a less confining environment than inpatient hospitalization (Mee-Lee & Shulman, 2003). PHP's focus is on finding short-term stabilization and space where clients can learn coping skills and reintegrate into social settings via group therapy. When it comes to DMT, among a few, a study focused on short-term treatment verified that a brief DMT group intervention

yielded beneficial outcomes for patients with depression and anxiety (Punkanen et al., 2014). Considering the literature and research, this writer believes that in short-term programs like PHP, implementing brief movement-based transitions that are simple and allow for safe access to the body can facilitate clients in: 1) developing awareness of their current state, 2) engaging in co-regulation/stabilization with others, 3) establishing a unified sense of space via rhythm, 4) forming connections with peers via eye-contact, and 4) increasing alertness and energy levels, thereby enhancing client engagement (e.g., learning, participating, processing).

Given that DMT is a field that is still evolving and finding its place in medical and clinical environments, there is an ongoing need for simple movement interventions that reacquaint the clients with their bodies. These interventions should facilitate adolescents who are struggling with trauma, and increased depressive or anxious symptoms in learning how to manage and regulate their arousal states during transitional phases. While the existing literature predominantly features methods and sessions lasting 30 to 60 minutes in more extended care settings, there is a pressing need to devise more concise DMT approaches suitable for short, high-level-of-care facilities such as PHPs.

Methods

The neuro-informed DMT transition method was approved and implemented at a PHP program in Boston, where this writer is currently interning and working with adolescent clients (16 to 18 years old) who present with SI, SIB, history of trauma, and diagnoses ranging from Major Depressive Disorder (MDD), Generalized Anxiety Disorder (GAD), Post-Traumatic Stress Disorder (PTSD) and/or Complex-PTSD. This writer implemented this method for two weeks, three times a week (Tuesday, Thursday,

and Friday), during the same transition period between Expressive Therapy and Psychotherapy, the last two groups of the day.

The Method: “Energy Flow Game”

The core of the method centered around a 5-minute transition activity where the facilitator invited present clients to participate in a movement game called the "Energy Flow Game" (EFG), while also wearing a headband to collect self-data on brainwaves. Those who verbally consented to participate stood up in a circle. The facilitator then explained the beginning (1 min), middle (3 min), and end of the activity/game (1 min).

During the beginning phase, participants engaged in a "body check-in," expressing how they felt pre-activity through non-verbal cues. The middle phase involved bilateral stimulation movement through snapping fingers or tapping the body left and right respectively, followed by clapping (to integrate left-right movements) and passing on the "energy" to the next person either to their left or right side. Participants were encouraged to be intentional with their body posture and eye contact when passing the energy to another peer. When clients felt prepared, the facilitator or another peer initiated the movement chain.

At the 3-minute mark, the facilitator paused the game and explained that to conclude, they would start a chain of energy moving in one direction only, ending when it returned to the facilitator. Upon the energy's return, the facilitator signaled by clapping their hands and holding the energy with both hands, expressing gratitude for the shared experience before releasing it into the space. Finally, participants engaged in a final "body check-in," and were invited to share if they wished. The facilitator expressed gratitude for their participation and for those who observed.

The Goal and Measured Outcomes

The goal of the method was to facilitate arousal regulation and establish baseline homeostasis via co-regulation. This as a result would aid clients in achieving a sense of "groundedness" and alertness for smoother transitions between the last two group sessions of the program. This supported a healthy, regulated group dynamic, enhancing conditions for therapeutic learning and engagement. The method aligns with existing treatment goals and established interventions supported by the program. Results were shared with staff during clinical rounds and with participating clients during psychoeducation sessions with a handout (See Appendix B). Empowering clients to practice and independently apply the method, both at PHP and elsewhere, aligns with the primary intention of assisting them with treatment goals and providing the method as an additional practical coping skill.

The two outcomes assessed this writer's 1) Embodied experiences and 2) Biodata which were measured via journal in narrative form in addition to a tracking sheet (see Appendix A) and the Flowtime headband, respectively. The Flowtime headband (Bakarat, 2022) is connected to a phone application for real-time monitoring of brainwaves (defined in Table 1), heart rate, relaxation, attention, and coherence since these markers have been previously used to measure physiological arousal (Wang et al., 2018; Pino, O., & Romano, G. 2022; Bakarat, 2022). The headband was utilized before the data collection to improve validity and calibrate the sensors for this writer's arousal baseline. The different biomarkers are measured and defined from exported data from the Flowtime application.

The journal tracked the pre- and post- method of the following: 1) Eye Contact, 2) Facial Expression, 3) Use of Space (Approach and Spatial Pathways), 4) Tension and softness, and 5) Rhythm and Tempo. The data will be plotted and graphed to account for trends and overall change throughout time. In addition to this, the tracking sheet covered general scales of levels of stress before the method and how many participants were present.

Table 1. Specific brainwaves with their characteristics.

Common brainwave frequency	**Frequency range (Hz)**	**General characteristics**
Delta	1–4	Sleep, repair, complex problem solving, unawareness, deep-unconsciousness
Theta	4–8	Creativity, insight, deep states, unconsciousness, optimal meditative state, depression, anxiety, distractibility
Alpha	8–13	Alertness and peacefulness, readiness, meditation, deeply-relaxed
Lower alpha	8–10	Recalling
Upper alpha	10–13	Optimize cognitive performance
SMR (sensorimotor rhythm)	13–15	Mental alertness, physical relaxation
Beta	15–20	Thinking, focusing, sustained attention, tension, alertness, excitement
High beta	20–32	Intensity, hyperalertness, anxiety
Gamma	32–100 or 40	Learning, cognitive processing, problem solving tasks, mental sharpness, brain activity, organize the brain

Note. From “Neurofeedback: A Comprehensive Review on System Design, Methodology and Clinical Applications,” by Marzbani, H., Marateb, H. R., & Mansourian, M, 2016, Basic and Clinical Neuroscience, 7(2), p. 143. (https://doi.org/10.15412/J.BCN.03070208). Copyright © 2016 Iranian Neuroscience Society.

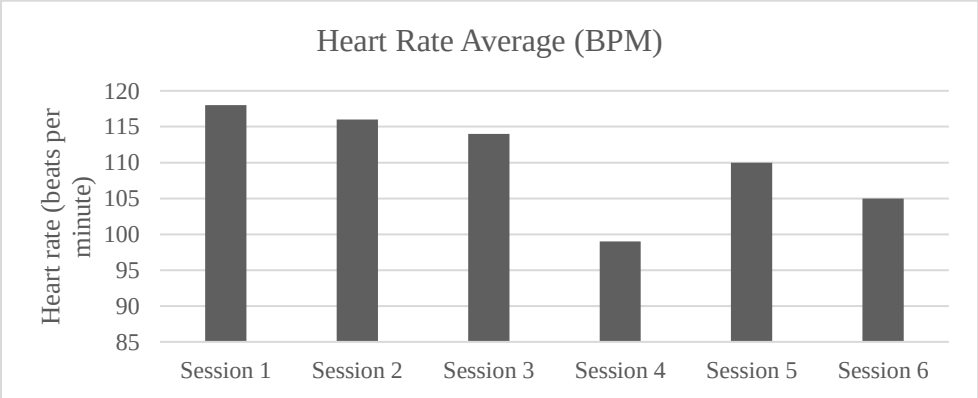
Results

The data analysis results from all the sessions are summarized below. Gamma (γ) and delta (δ) won't be analyzed in this study since existing literature offers greater insights into alpha, beta, and theta protocols (Marzbani, H., et al, 2016) that aim and engage mainly within high to moderate arousal. It's worth mentioning that Session 1 experienced some disruptions during the first 2 minutes, with staff and clients entering and exiting the room. Additionally, this was the first time the facilitator was introducing the method to those present.

Heart Rate (HR)

Heart Rate (HR) is the measure of heart beats per minute (bpm). A higher HR indicates higher arousal. To identify an HR baseline, the average HR across all values was 110 bpm.

Figure 1. Heart Rate (BPM) average results from headband across all session

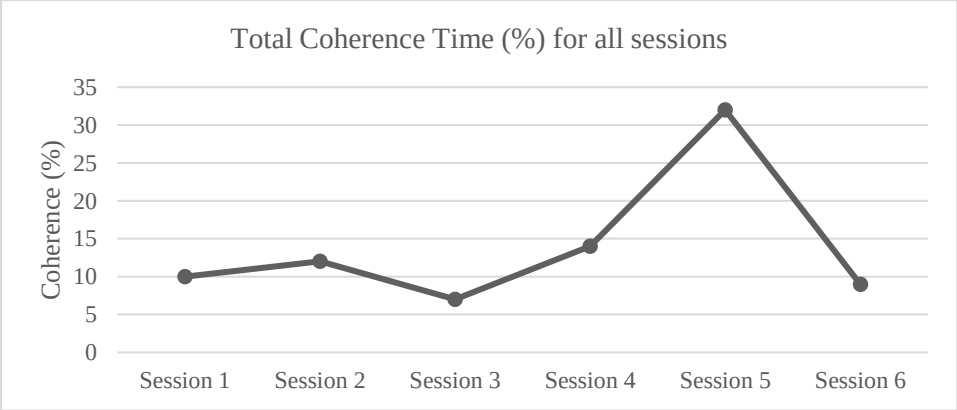


The results, as depicted in Figure 1, indicate that the lowest recorded heart rate value was observed in Session 4 (99 bpm), while the highest was recorded in Session 1 (118 bpm). Interestingly, Session 5 displayed a heart rate value at baseline (110 bpm).

Coherence Time

Coherence is a crucial measure in this analysis, representing a fundamental aspect of nervous system arousal relative to baseline. A higher percentage of Coherence Time indicates greater synchronization between breathing and heart rate, reflecting enhanced nervous system synchronization and potential improvements in cognitive abilities and energy levels.

Figure 2. Coherence Time (%) results from headband across all sessions

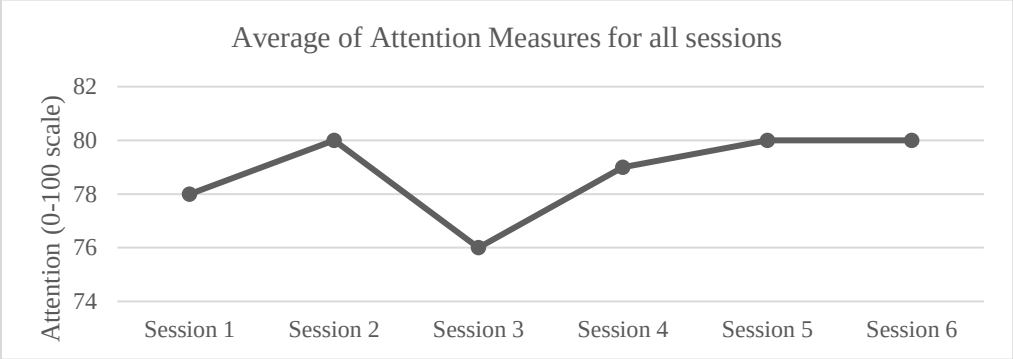


Throughout the initial sessions, Coherence Time remained consistently low and stable. However, in Session 5, a notable increase was observed, with Coherence Time accounting for 32% of the total duration. Across all sessions, Total Coherence Time remained above 5%.

Attention

Attention reflects an individual's ability to concentrate and disregard distracting stimuli, measured on a scale from 0 to 100. Typically, heightened beta (β) waves are linked with focused attention (Barakat, 2022; Palacios-García et al., 2021)

Figure 3. Average Attention Measures results from headband across all sessions.

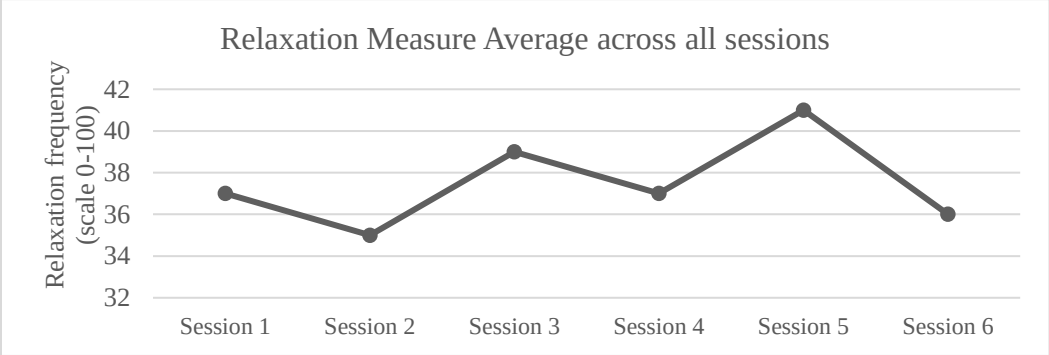


As depicted in Figure 3, the lowest Attention value (76) was recorded in Session 3, while the highest value (80) was observed in Sessions 2, 5, and 6. Overall, based on the scaled values, all sessions demonstrated moderate to high levels of attention.

Relaxation

Relaxation is a measure (scored 0-100) of how calm and relaxed one feels. The higher the score, the more relaxed this writer was. This is indicated by an increase in alpha (α) and theta (θ) brainwaves.

Figure 4. Average Relaxation Measures result from headband across all sessions.

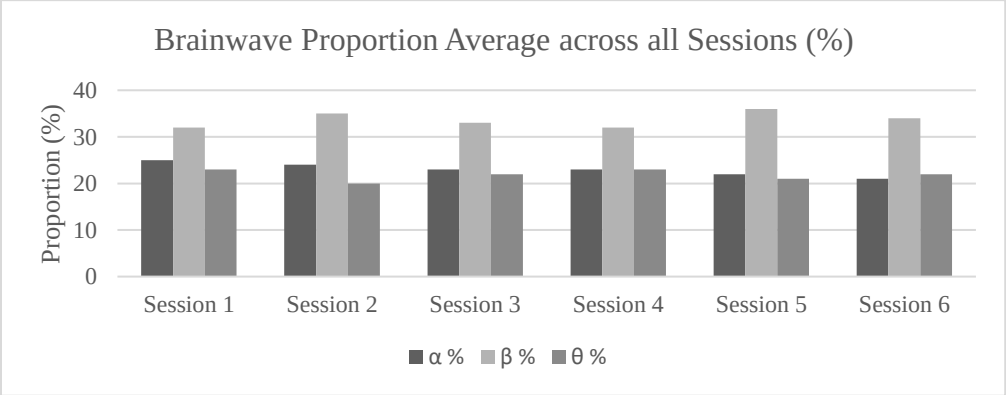


The results depicted in Figure 4, indicate that the highest relaxation time was observed in Session 5, with a value of 41. Conversely, the lowest relaxation value was recorded in Session 2. Overall, relaxation levels ranged from low to moderate, with values ranging between 35 and 41.

Alpha(α), Beta (β) and Theta (θ) Brainwaves Proportions

Flowtime analyzes the distribution of energy in brain waves to assess brain states. The higher the percentage, the greater the proportion (the sum equals 100% across θ, α, γ, β, and δ waves). Regarding arousal protocols, α and θ waves are indicative of relaxation, while β waves signify attention and cognitive processing. However, an excessive amount of β waves may indicate heightened arousal linked to stress and hyper-alertness.

Figure 5. Alpha (α), beta (β), and theta (θ) Brainwaves average proportions



As depicted in Figure 5, beta waves predominated across all sessions, with the highest proportion observed in Session 5 (36%). Regarding α waves, they ranked next in proportion alongside θ waves, with the highest proportion seen in Session 1 and Session 4, respectively. Both brainwaves demonstrated similar proportions across all sessions, with the largest difference being 4% in Session 2.

Brainwaves (α, β, θ) throughout time (s) across all sessions

To further analyze the points in the method where in time the most overall shifts and changes occurred, the figures below provide detailed brainwave data for the entire 5-minute duration of each session.

To remind the reader, the 5-minute method was divided into three main components: The first minute (0-60s) was dedicated to the pre-"Body Check-in" phase.

The subsequent time until minute 4 (60-250s) involved the bilateral stimulation-based movement intervention. The final minute (250s<) concluded with the post-"Body Check-in" phase.

Figure 6. Theta (θ) brainwaves through time (s) across all Sessions.

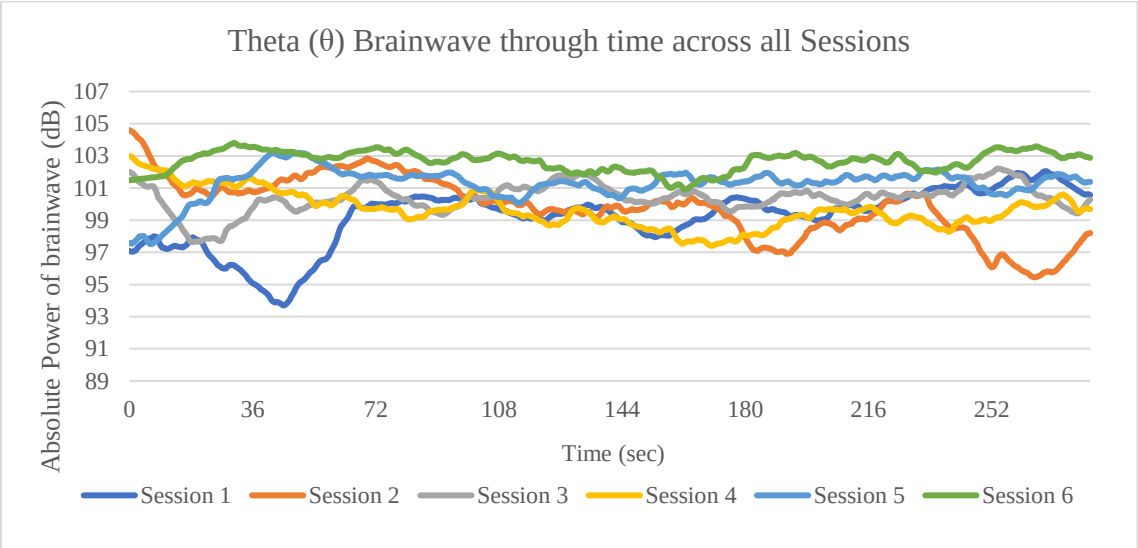


Figure 6 illustrates the fluctuations in θ activity over the course of the 5-minute sessions. It is noteworthy that across all seven sessions, θ activity increased after the first minute of the method. This trend remained consistent, with a slight decline towards the 3-minute mark. Particularly, there was a noticeable increase in θ activity at the final-minute mark.

Theta's biomarker overall trend is consistent with previous data seen in its cognitive and arousal characteristics (see Table 1) and role in relaxation (see Figure 4), where θ increased during points the method engaged in creative and insightful (first minute) and would slightly decrease to allow stabilization and access towards increased arousal (min 4). Similarly, in a session characterized by lower relaxation, such as Session 2, the θ trend steadily decreased towards the end of the session and exhibited the lowest absolute power of θ compared to other sessions.

Figure 7. Alpha (α) brainwaves through time (s) across all sessions

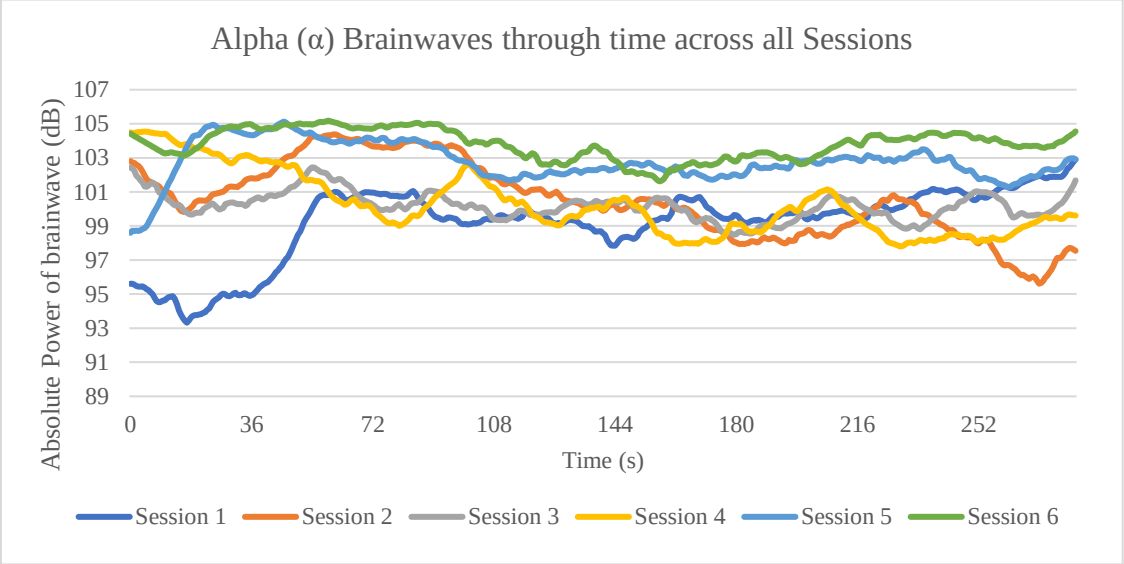


Figure 7 presents the overall trajectory of α waves across all six sessions. Notably, these waves demonstrated a consistent pattern across sessions, with an initial surge during the first minute, followed by a gradual decline towards the 3 to 4-minute mark. Interestingly, in the final minute, α waves exhibited a resurgence.

Alpha waves, serving as a marker for relaxation, were coherent with the relaxation values observed across sessions. For instance, in Session 5, the α trend, along with θ (refer to Figure 6), experienced an initial increase during the first minute of the session. Although there was a slight subsequent decrease, α activity remained notably elevated compared to other sessions throughout the duration of the session. Conversely, in a session characterized by lower relaxation, such as Session 2, the α trend, in conjunction with θ, steadily decreased towards the end of the session and exhibited the lowest absolute power of α compared to other sessions.

Figure 8. Beta (β) brainwave through time across all sessions

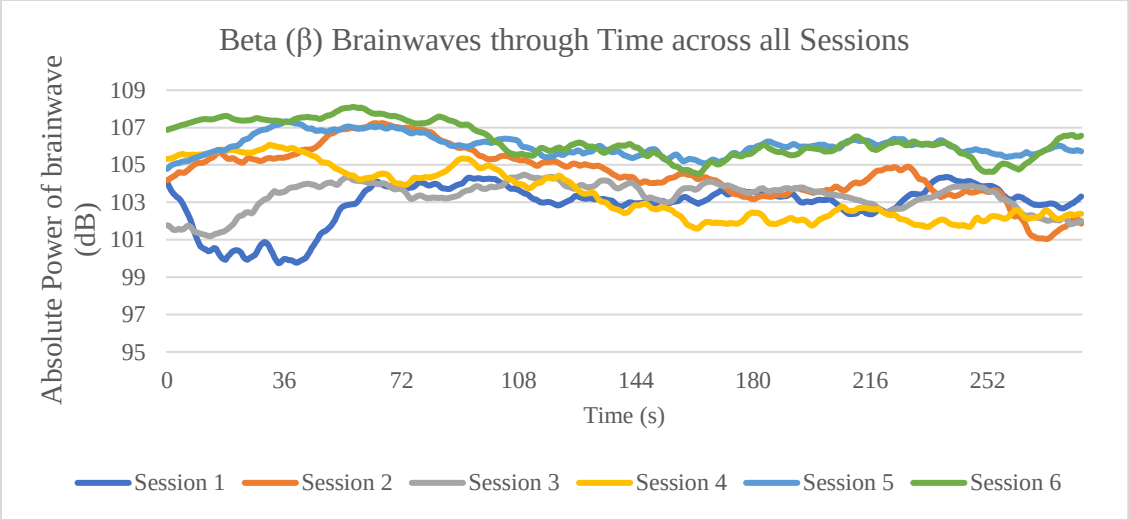


Figure 8 illustrates the variation of β (Beta) across all 5-minute sessions. Notably, β exhibited an initial increase within the first 2 minutes across all sessions, although with slight variations. Particularly, Session 1 demonstrated a brief decline before ascending toward the 2-minute mark. Subsequently, as the sessions progressed, there was a consistent and moderate decrease in β towards the session's conclusion.

Consistent with the findings depicted in Figure 3, sessions characterized by low attention data points corresponded with diminished β brainwave activity. For instance, both Sessions 1 and 3 exhibited the lowest average attention values (refer to Figure 3). Correspondingly in Figure 8, in these sessions, β brainwave patterns showed a discernible downward trend compared to other sessions.

Embodied Experience: Movement and Body Data

To enrich the practical and clinical significance of the method, the following table, taken from the movement journal (See Appendix A), presents the data gathered concerning embodied experiences before and after the method. This also includes factors that may influence physiological responses, such as prior stress, basic ADLs (Activities of Daily Living), and the number of participants in the room.

Table 2. Movement and Body Journal Data across all Sessions.

Session	**Pre-body and movement check-in**	**Post- body and movement check-in**	**Other factors:** **a) Number of participants** **b) Stress scale 1-10 (1 no stress, 10 worst stress)** **c) Food consumption (Under, Adequate)** **d) Hydration (Good, Fair, Bad)**
1	Tense in back muscles, stiffness in legs, slight sweating, nervousness, fidgety, restricted breathing.	Feeling of internal excitement, deeper breathing, increased muscle tone in legs, grounded, energized, and focused.	a) 3 b) 6 c) Adequate d) Fair
2	Tired however able to regulate. Closed posture and flat affect. Anxious and cautious.	Increased eye contact, smiling, and bright affect. Engaged in farther reach kinesphere, open posture, grounded.	a) 4 b) 4 c) Adequate d) Good
3	Tired and low energy. Flat affect. Heavy arms, back tension.	Engagement in sagittal plane. Energized, increased eye contact, relaxed arms, grounded legs.	a) 4 b) 6 c) Under d) Good
4	Anxious, low energy, slow pace, tension in back, and stiff legs.	Soft yet grounded presence, energized yet calm and focused. Engaged in horizontal plane.	a) 3 b) 5 c) Adequate c) Good
5	Nervous, tension in back and arms, tired, slow pace, chest breathing, Shifting posture from closed to open.	Focused and energized. Sense of attunement to others; increased eye contact. Bright affect, smiling. Far-reach kinesphere, engaged in horizontal and sagittal plane.	a) 7 b) 5 c) Adequate c) Good
6	Tired, closed posture, flat affect, heavy arms, and legs.	Alert, a little dizzy yet energized, heightened sense of body awareness, remained tension in the upper body.	a) 2 b) 5 b) Adequate c) Good

By incorporating the embodied responses into the biomarker data, we gain a clearer understanding of how the facilitator physically experienced the sessions. All sessions exhibited noticeable physical changes in embodied arousal before and after the method. Post-method movement/body descriptions, such as "increased eye contact," "engaged in horizontal/sagittal movement," "smiling," "open posture," and "bright/calm affect," highlight shifts in state in relation to others. Conversely, post-method descriptions of internal changes, such as feeling "energized," "focused," having a "soft presence," and experiencing "softened/relaxed back/arms/legs," underline interoceptive and cognitive shifts. Most significantly, the sessions that showcased the least and most significant embodied change were Session 6 and Session 5, respectively.

Session 6 displayed the least significant embodied change. Pre-body check-ins highlighted the authors felt sense of feeling “tired”, arms and legs feeling “heavy” as well as having a “closed posture.”. Post-method author reported feeling “alert” yet “dizzy” and “remained tensions in the upper body.” Other factors showed a prior stress level of 5, fair to adequate ADLs as well as only 2 clients being a part of the method, which is a very low number of clients compared to other sessions.

Session 5 displayed the most significant embodied change pre and post-method. Even though pre-method the author was reporting feeling “tired”, “nervous” and felt tension in the body, post-method there was a wide array of connected and attuned embodied experiences and increased arousal such as “focused,” “energized,”, “bright affect,” “mutual gaze,” and engaging on different planes in space. Other factors showed prior stress level of 5, good and adequate ADLs as well as 7 participants, the highest level of participants across all sessions.

In considering where both quantitative (biomarkers) and qualitative (embodied experience) demonstrate the most cohesive and significant effects, this author will now delve into a more detailed analysis of Session 5.

Effectiveness of The Method: Analysis of Session 5

To remind the reader of the quantitative and qualitative collected data in Session 5, this session showcased the average HR of 110 (baseline), and various highest values across all sessions with a Total Coherence Time of 32%, Relaxation value of 41 (highest), Attention value of 80 (highest), β proportion of 36%, α proportion of 22%, θ proportion of 21%. More specifically during the method, Session 5 displayed a significant increase in β, α, and θ during pre- "Body Check-in" and a consistent absolute power through the BLS-informed movement game and either baseline of the increased trend towards the end of the method, post-"Body Check-in.". Additionally, Session 5 showcased the highest β brainwave proportion, which would be indicative of possible high arousal or even hyperarousal/hyper-alertness states. However, this writer felt the sense of this session towards the end was "attunement," "focused," and "bright.".

The embodied descriptions showcased a big change in the facilitator's pre and post-felt sense of the body thus relating them with arousal states. The author will elaborate using the original journal to collect the narrative and body/movement cues (See Appendix A) in addition to Table 2. Pre-embodied states showcased "tension", "tiredness," and "shifting posture close to open" which this writer remembers as a sense of wanting and willingness to change the body's current state. Here the writer already had rapport with most clients in the room and felt more comfortable regardless of feeling "nervous." Seven clients were willing to participate in the method. Through the pre-body check-in, the writer noticed a

sense of nervousness and tiredness. As everyone present in the method became aware and named how they were feeling, the writer felt a willingness to shift this low, tired energy state. The writer started the method and started feeling aware of how the body wanted to change in the moment. The writer noticed how she was able to be more of a witness to others engaging in the movement game as there were more people than usual. In noticing non-verbal “conversations” happening between others, this writer felt more in tune and focused. As the “energy flow” was passed back and forth, this writer felt her body soften and be present to the point that the focus was on the movement and keeping track of where the “energy flow” was in the moment. Movement in different places felt easier and smoother, accompanied by increased eye contact with others. Towards the end, post-body check-in felt easier to access as the writer felt her body was energized, focused, and attuned to others in the room. All in all, post-method embodied experiences encompassed “Focused and energized”, and “Sense of attunement to others” as evidenced by “increased eye contact” and change in affect.

Discussion

In line with co-regulation and neurobehavioral systems theories and their early development, the fusion of biomarkers with the author's embodied experience offers insights into how other participants likely engaged with and experienced the method. The combination of qualitative and quantitative data provides valuable information about the assessment and effectiveness of embodied arousal co-regulation through the DMT method. For instance, associating descriptive terms with each session's biomarkers helped discern between heightened arousal in a "stressful and anxious" sense versus an "energized and alert" sense. For example, in Session 1, although the highest average heart

rate (HR) was recorded, indicating potential high stress, when coupled with embodied data, it revealed a transformation from "nervousness" and “anxiousness” to "excitement."

According to the literature, the pathways for transforming feelings of "nervousness" or "anxiousness" into "excitement" are closely linked to the utilization of reappraisal and acceptance strategies. Reappraisal strategies involve reframing interpretations or appraisals to mitigate stress reactions while increasing the ability to manage emotional stimuli (Hofmann et al., 2009; Hartley et al., 2010). These techniques often involve labeling the current emotional state, which would showcase the significance of the “Body Check-in” in the proposed DMT method, as participants embody and name how they are feeling in the moment. Rather than suppressing emotions, the literature highlights the importance of acknowledging, accepting, and appraising the current state of the body and mind, as it allows for the transformation and regulation of the intensity of emotions (Hofmann et al., 2009; Hartley et al., 2010). Additionally, both excitement and anxiousness are characterized by high arousal states, indicated by biomarkers such as increased heart rate (Niven & Miles, 2013). When combined with accepting and appraising emotions through the identification of bodily states, engaging in movement has the potential to prompt embodied reappraisal and facilitate the exploration of various rhythmic patterns and movement qualities (Shafir et al., 2015). In light of this, BLS-informed DMT interventions hold promise for directing and regulating arousal and perceived emotional states through movement (Shafir et al., 2015; Aoki et al., 2019).

Moreover, the embodied experiences offered a baseline and context for the shifts in brainwaves over time. For instance, across most sessions, during the first minute of "Body-Check in," there was an increase in theta (θ) and alpha (α) waves, despite the

facilitator reporting feelings of stress and tension. This sheds light on the importance of understanding the context and baseline of the facilitator or participant to have a more accurate appraisal of the experience of the method. Considering this, it would be important to ponder how the internal physiology of an experience and the cognitive and embodied appraisal of that same experience are intertwined in what appears to be a feedback mechanism. The author argues that by acknowledging and moving according to the body's energy state there can be more integration and alignment between this feedback system. This aligns with existing literature suggesting the role of biofeedback as a way for individuals to learn how to regulate their physiological activities (Yu, B., et al, 2018) and the importance of labeling emotions as a pathway to reduce emotional reactivity and integration of the mind and body (Lieberman, M. D., et al., 2007). Additionally, the author contends that understanding the baseline and context both physiologically and mentally, in turn, holds promise in increasing the body’s tolerance or expansion of the WOT as individuals integrate shifts through different arousal states (Dan Siegel, 1999, as cited in Corrigan et al., 2011). In essence, evaluating a mind-body involvement may demand a combination of measurable physical outcomes and an embodied narrative to provide a thorough and holistic understanding of the individual’s experience.

While all sessions exhibited a degree of shift and change before and after the DMT method, Session 5 demonstrated the most significant change. The narrative, combined with the embodied experience and biomarkers, revealed the most pronounced shifts in terms of arousal regulation and embodied co-regulation, with the highest recorded values in Relaxation, Attention, Total Coherence Time, and the most consistent

brainwave trends throughout time. Additionally, Session 5 featured important embodied data, including increased eye contact, enhanced energy and focus, and a heightened sense of attunement to the group. Comparing the qualitative and quantitative results of Session 5 to other sessions, the author found the number of engaged clients to be a crucial piece of information; with more participants, the facilitator could better observe and witness interactions within the group. In DMT, witnessing serves as an additional method for incorporating kinesthetic empathy and this entails the therapist or group offering empathetic attention to the client's movements (Meekums, 2011). Witnessing is an important factor to consider in understanding how Session 5 effectively showcased both effective co-regulation and arousal regulation.

In terms of co-regulation, witnessing more positive interactions between participants fostered an increased sense of kinesthetic empathy, consistent with shifts in embodied data related to eye contact and body posture. According to Polyvagal theory, affect shifts alongside increased eye contact are indicative of co-regulation (Porges, 2022). This also aligns with existing literature that suggests individuals with low baseline vagal regulation and high or low task-related vagal reactivity may exhibit more gaze avoidance and less effective regulation (Niedźwiecka, A., 2023). The reported sense of attunement and increased eye contact during and after the method, alongside stable improvements in arousal, indicates the facilitation of a co-regulatory space. This experience was more pronounced in sessions with a higher number of clients (>4), suggesting the importance of group dynamics in co-regulation.

Regarding arousal regulation, changes in biomarkers and embodied experiences focused on energy and focus demonstrated the method's potential usefulness in

moderating arousal levels. Despite sessions showing increased beta (β) waves over time, typically indicating hyperarousal (Marzbani, H., et al, 2016), the facilitator reported feeling elevated energy levels accompanied by increased focus and attention. This alignment between qualitative and quantitative data strengthens the argument for significant experienced regulation in arousal. Session 5, in particular, showcased embodied arousal regulation, which the author believes is attributed to the increased number of participants. It appeared that with more individuals engaged, the facilitator found it easier to focus attention on collaborative tasks, facilitating arousal regulation. The literature suggests that synchronized physiological arousal is sensitive to socio-emotional aspects of collaboration (Li, X., et al., 2023). However, it is important to consider that the engagement of the group depends on the individuals that comprise it, and if there were individuals who were challenged by participating in larger groups, then the experience of the method would likely have varied. Consequently, the overall results could have differed significantly.

Furthermore, this is corroborated by the contrast in Session 6, involving only two participants. Session 6 demonstrated increased beta (β) waves, with the facilitator feeling alert yet "dizzy" and experiencing residual tension. Even though Session 5 and 6 had a similar beta (β) trend, the author suggests that the absence of a larger group size compared to other sessions highlights the importance of considering group size as a variable in interventions tailored for groups. While all sessions showed pre and post-differences in arousal and co-regulation, the stark difference between the least effective session (Session 6) and the most effective session (Session 5), as evidenced by both types of data, highlights the significance of the number of participants as a crucial variable.

Recommendations and Implications

Recommendations for future studies in clinical intervention research focusing on arousal and co-regulation include considering the number of participants as a primary variable in potential pilot studies. To enhance internal validity, it would be essential to apply the research method either with the same group of clients or with randomly selected clients in a short-term program within a similar age range, diagnosis, and treatment goals. Gathering data directly from the participants through IRB-approved research would greatly enhance the clinical outcomes of the effectiveness of the studied method.

Furthermore, there is a need for additional research endeavors that seek to narrow the gap between theories and practical clinical implementation, as this will ultimately enrich the field of Dance/Movement Therapy. Particularly within the context of this capstone thesis, there is an emphasis on the importance of short-term and transitional DMT interventions for traumatized youth. In this regard, there is a need for more interventions that offer simple and accessible approaches, allowing these individuals to gradually re-establish a safe connection with their bodies.

In addition, more published and peer-reviewed research studies on the integration of Eye Movement Desensitization and Reprocessing (EMDR) and Dance/Movement Therapy (DMT) would enrich the understanding of how these two modalities can be effectively applied in clinical settings, both in group therapy and individual therapeutic work. Considering the clinical application, it is also essential to make future research more accessible to clients involved in the study, providing psychoeducation and sharing

the results with them would empower them with the knowledge gathered and demonstrate how they can apply it to their own treatment.

Finally, as this method is intended for clinical application in DMT, it is crucial to acknowledge the possibility of clients and facilitators adapting to the movement method. This means it is important to consider the role of nervous system adaptation (Cramer, S et al., 2001) as young clients may become increasingly accustomed to the method with repeated engagement. As a result, this familiarity could potentially lead to different future outcomes, as their nervous system may not respond as strongly to accustomed stimuli and movements (van Duijvenvoorde, A, et al., 2016; Telzer, E., 2016). Hence, it's essential to contemplate the potential need for adjustments and variations in bilateral stimulation movements, while also expanding upon the guidelines of the movement game. This consideration could ensure that the co-regulatory and embodied aspects of the method remain even after clients and facilitators have repeatedly used it for transitions. By doing so, it also becomes possible in future pilot studies or clinical applications to extend this method beyond mere transition to a more extended intervention aimed at not only stabilizing clients by gaining arousal regulation but also opening space for further exploration and processing. In light of this, it's crucial to recognize repetition as a variable that can either enhance and/or limit the effectiveness of the BLS DMT method, thus meriting consideration in future research.

Conclusion

The integration of arousal development and neurobehavioral systems theories, combined with biomarkers and embodied experiences, offers valuable insights into the effectiveness of a short neuroregulatory-informed transition-based Dance/Movement Therapy (DMT) in achieving arousal regulation and embodied co-regulation. Through a combination of qualitative and quantitative data, this study has shed light on how DMT interventions can help in the regulation of arousal states and interpersonal dynamics in a Partial Hospitalization Program (PHP) group therapy setting, with the writer facilitating the method among adolescents affected by trauma.

The findings of this research demonstrate that short DMT sessions utilizing Bilateral Stimulation (BLS) facilitate a transformation in arousal states from stressful and anxious to energized and focused, as evidenced by both biomarker data and subjective experiences. Additionally, witnessing is a key variable as these enabled observations of positive interactions between participants which fostered kinesthetic empathy and contributed to the creation of a co-regulatory space, aligning with theories such as Polyvagal theory. Considering this, the study also sheds light on the importance of considering group size as a variable, as sessions with fewer participants may present challenges in achieving optimal arousal and co-regulatory outcomes.

All in all, this study emphasizes the importance of bridging the gap between theoretical understanding and practical application in DMT practices. Specifically, there is a need for more interventions tailored to traumatized youth, providing simple and accessible methods for gradual reconnection with their bodies in a safe manner considering their baselines. By addressing these recommendations and implications,

future research can continue to enhance the effectiveness of DMT interventions and improve outcomes for individuals experiencing trauma.

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Author Acknowledgements

I dedicate this to my family, who, despite being far away in my home country, have consistently shown unwavering support for me. I express profound gratitude to my friends and mentors who have supported me through this journey. Thank you to the clients who made my work possible. This dedication extends to future science and arts-based researchers, serving as a reminder to continue integrating the arts and science to create new pathways of learning and understanding human experience.

Appendix

A) Movement/Body Journal

Session 1- 01/23

Pre-Session and Method: This is my first time trying out the method, and I'm feeling a bit nervous because I'm not sure how it's going to go. Right now, as I'm writing before heading into the session, I'm feeling a little tired, but the mix of excitement and nervousness about trying the method for the first time is helping me show up with presence and willingness. I'm also excited to give it a shot, and I know that if I build good rapport with the clients, it'll help me feel more confident about putting this intervention into practice. I do notice some tension in my arms and legs, and my breathing feels a bit shallow because of the nerves, but recognizing this helps me regulate. My heart rate and breathing are trying to find their rhythm, and I'm going into this with an open mind and curiosity to see how it all plays out. Another thing I'm noticing is the sweat in my hands, probably from nerves, and my body posture shifting as it tries to adjust to how I'm feeling. I know some of this nervousness will actually help me explain and introduce this method to the clients in the best way possible.

Post-Session and Method: So, I've wrapped up the method, and I've run the last session of the day. Honestly, I think it went well. The clients seemed to enjoy it, and I feel like my nervous system's gotten itself back on track. Towards the end, I still had some of the nerves lingering, but I think it was more on the excitement side of things. There was not as much eye contact with others as I thought, but I felt more grounded— like my legs were really planted on the ground, and my upper body softened up. My heart was still thumping hard throughout the whole session, but I figure it's just my body getting used to trying out this method for the first time and making sure everything stayed safe and sound for everyone involved. I'm curious to see how the second round will go, and I'm crossing my fingers that it'll be a little smoother now that I've got a better handle on running the intervention. Plus, the clients will have a better idea of what to expect, so we can start being more consistent between sessions with this method.

Session 2- 01/15

Pre-Session and Method: Right now, I'm feeling pretty anxious. I've had a bit of a stressful day, but it's more or less my usual baseline compared to how things have been during the internship. Knowing that we still have the same clients who were part of the intervention helps ground me a little. I know what to expect and how to adjust according to their needs. My muscles still feel a bit tense, and I'm also feeling a bit tired from today. I recognize that because the intervention is towards the end of the day, I'm usually at my most tired. But this is one of the reasons I want to consistently try this method at this point—to help myself and, in turn, help the clients by raising arousal levels and feeling more energized and focused for the last group of the day. So, I'm feeling curious and looking forward to seeing how the method goes.

Post-Session and Method: After running the group for the second session, I feel more calm, grounded, and also excited to see the difference in energy levels and attention post-method. The session went well; clients felt more present in the room, and the energy felt calmer. The session was able to proceed smoothly after the method. I noticed how my arms and back softened, although my legs still retained some muscle tone. Overall, I felt my body softening, and my focus shifted more into my body and then towards the space with the clients.

Session 3- 01/26

Pre: So, I'm feeling tired today. It wasn't a super stressful day, but I can feel my back muscles tensing up and some stiffness in my legs. My body just feels worn out. I've been keeping busy, and I even feel like I'm sweating a little, but that might also be because I'm anticipating doing the method again. I'm hoping it goes well, and even though my upper body feels heavy, I still feel like I have enough energy to give the method another shot and see where it takes me. I feel like I can still engage and interact with others, but it's just taking a bit more effort. We'll see how it goes.

Post: Well, I've done it again, and I was able to carry out the method. I felt engaged and focused, even though I was tired at the beginning. I noticed a shift in energy, and I felt more in sync with the group. I was able to make more eye contact and match the mood of

others. Overall, I felt more relaxed and grounded, which allowed me to continue the session smoothly.

Session 4 – 01/30

Pre: I'm feeling a bit anxious about trying the method today, especially since some of the clients I know have called out and there are some new faces. It's just part of the nature of this short-term program, but it does make me a little nervous since I'll have to re-teach the method. We'll see how it goes. Also, I'm feeling tired and can tell that my energy is low. My body seems to want to move at a slower pace and take some time to adjust to my surroundings. Specifically, my back feels tense from a tiring day, and like other days, my legs feel stiff. I think my body will be open to some light movement, so I know this method is going to help me be more present with the clients.

Post: Today's session went well. There were only three people, but I was able to successfully run the method and then focus on the rest of the session. I felt my body soften and release tension. I also became more grounded, feeling connected to my body and aware of its presence in the space. I felt energized yet calm and focused, and I was able to engage with others around me with ease.

Session 5 – 02/01

Pre: I'm doing all right today; the day hasn't been too stressful. I'm feeling tired, though, and I've noticed a decrease in energy throughout the day. I know that the last session is always the toughest, as I've already used up a lot of energy maintaining my presence in different groups and performing various tasks. Again, similar to previous sessions, I'm feeling nervous. I can feel tension in my back and arms, which has become a physical indicator for me of when I'm tired and my body is craving a change in state. Right now, I'm moving at a slow pace, and I'm noticing that my breathing is shallow. By bringing awareness to this, I feel my posture shifting from closed to open as I try to elongate my spine to feel more present.

Post: What a fantastic session it was! There were seven clients present, and every single one of them wanted to participate in the method. Some already knew the method, while others were learning it for the first time, but they all helped each other learn. Having more people made a noticeable difference. It was the first time we had this many

participants, and it seemed to change the dynamic, even in how I was present. I felt like I was able to observe others more than usual, as it naturally took more time for my turn at "passing the energy." By observing without judgment, I was able to attune and match others' presence and quality of movement. Towards the end, I felt focused and energized, more so than in other sessions. I was attuned to others, and there was a noticeable increase in eye contact. I felt my mood shifting from flat to bright and smiling. My movements expanded beyond my usual kinesphere, and I felt my body taking up more space.

Session 6 – 02/02

Pre: It's the last session to try out the method. I'm feeling quite tired, not because it was a particularly stressful day compared to most, but because it's the end of the week and my body is feeling it. I notice my body wanting to adopt a closed posture, to rest and recover. My mood is flat, and once again, I feel heaviness in my arms and legs. I'm looking forward to running this last method and starting the process of analyzing the data, but I need to remind myself to stay present and take it one step at a time. Let's see how this goes.

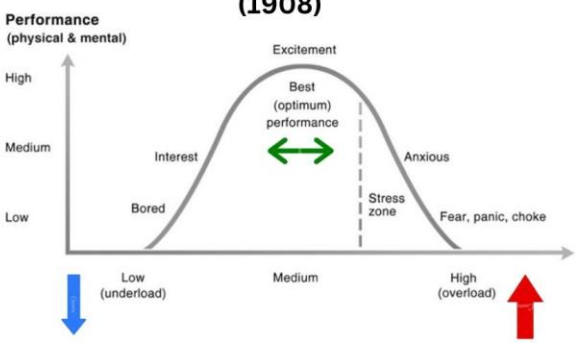
Post: There were only two clients in the room for the method, which is the lowest number of clients we've had. Despite the low numbers, I felt like I was able to encourage participation. However, the method felt clunky and rushed. I felt very alert, as I had to stay focused on "passing the energy" constantly to the clients. I felt like I didn't have a moment to catch my breath or find my footing because I was constantly engaged in the movement game. I even felt a little dizzy. However, towards the end, I felt energized, but my heightened sense of body awareness led to too much interoception, making me feel tense and oddly hypervigilant. I found myself wanting to sit down right after the post-body check-in, and I felt like I needed a little extra time to feel grounded in the space.

B) Psychoeducation Handout

Arousal Regulation and Bilateral Stimulation

What is **arousal**?
Arousal is the body and mind's response to stimuli in the environment. It involves changes in heart rate, breathing, and overall energy levels. Our arousal regulates considering what our bodies need throughout the day.

Yerkes & Dodson Law of Arousal (1908)



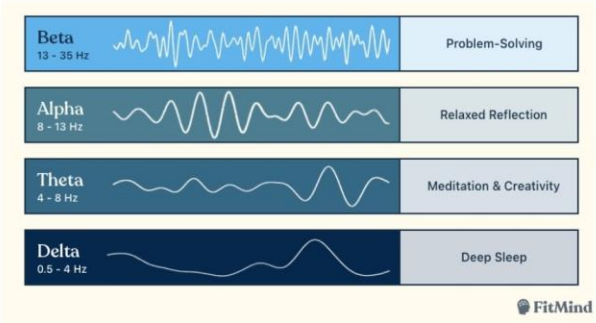
Moderate arousal is key to perform and function on our day to day. However **low and high arousal also serve a function**. When we need to **rest/recover** we need low arousal. When we are in **flight/fight** situations we need high arousal to survive.

A technique to regulate arousal?
Bilateral stimulation

Bilateral stimulation means stimuli that integrates/activates both hemispheres of the brain.

Rhythmic left-right pattern

Energy Flow Game (EFG)



What we have found so far...

- **Beta** and **Alpha** were the two most present during EFG -> Achieved moderate arousal to high arousal.
- There was **Coherence** (When heart and breathing rhythms synchronize).