THESIS

COMPARISON BETWEEN NEUROSCIENCE- AND DIR/FLOORTIME™-INFORMED APPROACHES WITHIN MUSIC THERAPY: A DESCRIPTIVE CASE STUDY

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ABSTRACT

COMPARISON BETWEEN NEUROSCIENCE- AND DIR/FLOORTIME™-INFORMED APPROACHES WITHIN MUSIC THERAPY: A DESCRIPTIVE CASE STUDY

The purpose of this study was to examine the differences of client and therapist behaviors between a neuroscience-informed approach and a DIR/Floortime™-informed approach for one child involved in music therapy. There are no current studies comparing how the two approaches differently facilitate social skills. The author examined five videos from a neuroscience-informed approach and five videos from a DIR/Floortime™-informed approach and coded seven non-musical social skill behaviors, four musical social skill behaviors, and seven therapist behaviors. The author observed how a music therapist assisted in skill development, responded to and interacted with their client, and utilized the music between approaches and how those changes between approaches affected client social skill behaviors. In the neuroscience approach, there was a higher prevalence of six of the client behaviors and three of the therapist behaviors. In the DIR approach, there was a higher prevalence of five of the client behaviors and four of the therapist behaviors. Descriptive statistics and visual analysis indicated that multiple client behaviors were similar between approaches while the therapist behaviors had more differences between the two approaches. The author discusses why the differences may have been observed and clinical implications for working the client and using each approach within treatment. Further studies are needed to explore these different approaches.

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CHAPTER 1: INTRODUCTION

Autism Spectrum Disorder (ASD) is a neurodevelopmental disorder that impacts an individual's ability to engage with their environment. A hallmark characteristic of children with ASD is difficulties with social communication and interactions (American Psychiatric Association, 2013). Evidence-based treatments, including music therapy, can help to minimize social difficulties and maximize independence (Steinbrenner et al., 2020). Music therapists working with children with ASD reported targeting social skills through songwriting, instrument play, movement, and other techniques (Kern et al., 2013), using a variety of different approaches including behavioral, neurologic, and humanistic (Geretsegger et al., 2014). Although there is emerging evidence that each of these approaches can promote social skills in children with ASD (Geretsegger et al., 2014), there are no studies comparing different approaches. In this study, the author examined videos of a clinical music therapist who used neuroscience-informed and DIR/Floortime™-informed approaches.

In a neuroscience-informed approach, the music therapist considers neurological research in ASD including the unique perception of music that researchers have documented in many children with ASD (LaGasse, 2019). For example, the music therapist considers research showing that children with ASD have an enhanced or age-appropriate perception of pitch and melody (Heaton, 2009; Ouimet et al., 2012; Stanutz et al., 2014), an increased activity in speech areas of the brain during song (Lai et al., 2012), and an ability to recognize emotions within music (Gebauer et al., 2014). Additionally, since music may uniquely enhance neuroplasticity due to the presence of dopamine (Stegemöller, 2014), the music therapist facilitates success through different elements of musical structure including repetition of material, rhythmic entrainment, and anticipation (LaGasse, 2019). Altogether, during treatment, the music therapist focuses on the musical strengths of children with ASD when designing engaging musical experiences to promote outcomes and develop and organize neural networks (LaGasse, 2019). According to LaGasse (2014), children with ASD showed increased social skills during a group intervention from a neuroscience-informed approach, including joint attention, interactions, and eye contact. Additional research from a neuroscience-informed approach has demonstrated improvements in attention (LaGasse et al., 2019; Pasiali et al., 2014) and communication (Lim, 2010).

In a Developmental, Individual-Difference, Relationship-Based (DIR)/Floortime™-informed approach, the music therapist follows the interdisciplinary DIR/Floortime™ model, which focuses on improving the core deficits of children with ASD, including social skills (Greenspan et al., 2008). The DIR/Floortime™ model emphasizes child development and guides music therapists on how to assist children in meeting developmental milestones (Greenspan & Wieder, 1997). Music therapy within the DIR/Floortime™ model is based in creative music making and improvisation, where social interactions are facilitated through natural engagement in the music experience (Carpente & LaGasse, 2016). Therefore, the music therapist uses play within the music to drive treatment. Music therapists using a DIR/Floortime™-informed approach during treatment report that children with ASD demonstrate improved social skills, including engagement and reciprocal communication (Carpente, 2012, 2016).

There is emerging evidence showing that neuroscience-informed and DIR/Floortime™-informed approaches can promote social skills in children with ASD; however, there are no comparisons on how these approaches promote social skills. Such a comparison can provide valuable information about how the music therapist differently facilitates outcomes, client responses, and music-making. Therefore, the purpose of this descriptive case study was to delineate the differences between a neuroscience-informed approach and a DIR/Floortime™-informed approach for one child involved in music therapy. Through video analysis of sessions between a client and clinical music therapist, the author described client responses and therapist behaviors relating to social skills in order to determine differences in targeted behaviors and musical responses. The present study aimed to answer the following research questions (R.Q.):

R.Q.1: To what extent was the therapist consistent in applying the critical clinical elements of the two approaches?

R.Q.2: What differences were observed in the client's non-musical social skill behaviors between the two approaches?

R.Q.3: What differences were observed in the client's musical social skill behaviors between the two approaches?

R.Q.4: What differences were observed in the therapist interactions and responsiveness with the client between the two approaches?

CHAPTER 2: LITERATURE REVIEW

Autism Spectrum Disorder (ASD)

Autism Spectrum Disorder (ASD) is a neurodevelopmental disorder with an estimated global prevalence for children of 1 in 160; however, there is a lack of reporting in low- and middle-income countries, which suggests the prevalence may be higher (Elsabbagh et al., 2012). In response to the uncertainty of these data, the Centers for Disease Control and Prevention (CDC) launched the Autism and Developmental Disabilities Monitoring Network to report on changes in prevalence, characteristics, and impact for ASD within the United States (CDC, 2007). In their first report based on data from the year 2000, researchers found that approximately 1 in 149 children aged eight years old had a diagnosis of ASD (CDC, 2007). However, prevalence is increasing. In the most recent study based on data from 2016, researchers found that 1 in 54 children aged eight years had a diagnosis of ASD (Maenner et al., 2020), which is a 10% increase from the previous report on data from 2014 (Baio et al., 2018) and a 175% increase from the first report on data from 2000 (CDC, 2007). This increase could be due to changes in reporting patterns, a better understanding of diagnostic criteria, an actual increase in the number of individuals with ASD, or other unknown factors (Lord & Bishop, 2010). Historically, more males than females have a diagnosis of ASD, with the latest report of 4.3 males to 1 female (Maenner et al., 2020). However, researchers suggest that this prevalence discrepancy may be related to an under-reporting of females, as females present differently compared with males, including less severe repetitive and stereotypical behaviors (Knutsen et al., 2019; Mandy et al., 2012). The reasons for this sex difference, much like the etiology of ASD, is unknown.

Criteria and Characteristics of ASD

The Diagnostic and Statistical Manual of Mental Disorders, Fifth Edition (DSM-5) lists five diagnostic criteria for ASD. The first criterion is that the child exhibits persistent deficits with social skills, which may include a lack of verbal communication, minimal eye contact, absence of social norms, or difficulty adjusting to different social environments (APA, 2013). The second criterion is that the child exhibits restrictive or repetitive behaviors or interests, which can include lining up objects, adhering to strict schedules, and hypersensitivity, hyposensitivity, or extensive interest in sensory stimuli (APA, 2013). The final three criteria for a diagnosis of ASD are the presence of symptoms during the child's development, an impairment to the child's daily functioning, and that the child's behaviors are not better explained by another diagnosis, such as an intellectual disability (APA, 2013). The specific social and behavioral characteristics are also accompanied by a support level: Level 1, requiring support; Level 2, requiring substantial support; Level 3, requiring very substantial support (APA, 2013). Variations of these levels affect how children with ASD socialize with others.

Due to the nature of the spectrum diagnosis, individual difficulties with social skills vary, but can include difficulties with making eye contact, engaging in social reciprocation, imitating gestures and vocalizations (Finnigan & Starr, 2010), and participating in joint attention (Franchini et al., 2017). Differences in sensory processing and motor skills can also impact how children manifest socialization (Hyman et al., 2020). For example, a child may compensate for sensory processing through behaviors like hand flapping, which in turn could impact the child's social interactions. Additionally, a child may have difficulty sequencing motor movements, which impacts their ability to wave to peers and predict and respond to social cues. Difficulties with social skills can be particularly impactful for children with ASD because it can limit their success and independence at home, in school, and in the community.

Neural Differences in Children with ASD

Children with ASD demonstrate differences in sensory processing, which impacts social skills. Sensory processing is the ability to appropriately perceive, filter, associate, organize, and respond to incoming stimuli (Miller et al., 2007). Therefore, if an individual cannot effectively respond to and engage with their environment, their socialization will likely be limited (Thye et al., 2018). For example, if an individual is over-responsive to auditory stimuli, they may avoid or withdraw from social interactions. Additionally, children learn many social skills through observation, and if an individual is less responsive to visual stimuli they may not learn, notice, or respond to social cues. Therefore, understanding neural differences in sensory processing may influence social skill interventions.

Researchers have found neural bases for sensory processing differences in children with ASD through brain imaging techniques. For example, EEG studies have shown that children with ASD process tactile (Cascio et al., 2015) and auditory (Crasta et al., 2021) stimuli differently than typically developing peers. In addition to EEG, researchers using fMRI and MEG supported previous behavioral studies and demonstrated that children with ASD can present with under-responsiveness and/or over-responsiveness to stimuli, although this research is still emerging (Schauder & Bennetto, 2016). Differences in responsiveness is congruent with the spectrum diagnosis but it also makes treatment complex since all children with ASD can present with a different sensory profile. Although researchers have indicated differences in neural responses and processing, the results and imaging techniques used did not explain why.

Differences in brain structures may offer an explanation as to why children with ASD process stimuli differently. First, researchers have found differences in connectivity, volume, and neuronal integrity of the thalamus, which is a critical structure for sensory processing (Thye et al., 2018). Second, there are neuroanatomical differences of the insula and anterior cingulate cortex, which are both involved in emotion processing, memory, learning, interoceptive awareness, and socialization (Patriquin et al., 2016; Thye et al., 2018). Third, researchers have found that the superior temporal cortex, which is involved in gaze detection, emotion recognition, social-cognitive skills, and multisensory integration, has reduced volume, decreased activity, and decreased connectivity to other areas of the brain (Patriquin et al., 2016). Additionally, researchers have found differences in cerebellar anatomy and connectivity, which assists in modulating emotion, social processes, predictions, learning, and timing (Su et al., 2020). While this is not an exhaustive list of the neural differences that researchers have found, functions of these structures specifically include socialization and sensory processing, which may explain some of the difficulties children with ASD experience.

Researchers have also found neural connectivity differences in children with ASD that may further contribute to difficulties with social skills. First, researchers have found evidence of both over-pruning (Thomas et al., 2016) and under-pruning (Carroll et al., 2020) during the synaptic pruning process, which is an essential process for strengthening important neural connections and eliminating unimportant connections. Deviations from the synaptic pruning process could explain some of the symptomatology of ASD, including difficulties with socialization. Additionally, although there is still debate, researchers have found that individuals with ASD have more local connections and fewer widespread connections (Carroll et al., 2020; O’Reilly et al., 2017). Fewer widespread connections between brain structures would likely impact social skills, since the process of understanding and producing social behaviors relies upon widespread cortical integration (Frye, 2018). Given this information, there is a need for interventions to effectively and predictably meet sensory needs and promote changes in the brain that increase social skills.

Social Skill Interventions for Children with ASD

The National Autism Center (NAC, 2015) completed a systematic review of interventions for children with ASD in an effort to help parents, guardians, and therapists understand the effectiveness of different interventions, including those targeting social skills. Established interventions addressing social skills in children with ASD included behavioral interventions, modeling, peer training, and social skills packages. The NAC determined that these interventions had sufficient positive evidence to predictably promote social skill outcomes. Additionally, the NAC (2015) listed music therapy as an emerging intervention, indicating a need for further research; however, recently the National Clearinghouse on Autism Evidence and Practice listed music therapy as an evidence-based intervention for children with ASD (Steinbrenner et al., 2020). This contrasted with the NAC report, indicating that music therapy is an intervention that can predictably promote outcomes in children with ASD.

Music Therapy to Address Social Skills in Children with ASD

Music therapists have historically worked with children with ASD using “music interventions to accomplish individualized goals within a therapeutic relationship” (American Music Therapy Association, n.d.). Music therapists often capitalize on the client’s strengths within treatment in order to address needs, including musical strengths since researchers have found that music processing is a strength in many children with ASD. For example, music therapists use pitch and melody within interventions to help children with ASD learn processes or encode information considering researchers have found they have an enhanced or age-appropriate perception of pitch and melody (Heaton, 2003; Ouimet et al., 2012; Stanutz et al., 2014). Additionally, even though children with ASD characteristically demonstrate difficulty recognizing emotions in others, music therapists use music to address emotional awareness because children with ASD reportedly recognize emotions within music (Gebauer et al., 2014). Furthermore, Lai and colleagues (2012) found that areas of the brain that process speech and song were more active during song for individuals with ASD, which suggests that music may be used to target receptive and expressive communication. Altogether, this provides a basis that music is a strength in children with ASD which may provide a foundation for the therapeutic use of music through goal-directed musical experiences.

One goal area commonly targeted by music therapists is social skills (Kern et al., 2013; Reschke-Hernandez, 2011). Specifically, music therapists working with children with ASD reported improvements in non-musical measures of social skills such as increased eye contact, joint attention, and communication (LaGasse, 2014). Additionally, music therapists reported progress on musical measures of social skills such as engaging with the music, imitating the music, musical responsiveness, and initiating music (Carpente, 2013). Music therapists effectively target these skills through a variety of approaches including behavioral, improvisational, neurologic, and humanistic (Geretsegger et al., 2014; Kern et al., 2013); however, there are no comparisons of approaches in the literature, which was the focus of the present study. The clinical music therapist in this study utilized neuroscience-informed and DIR/Floortime™-informed approaches during treatment of one child with ASD.

Neuroscience-Informed Approach Within Music Therapy

Music therapists treating children with ASD from a neuroscience-informed approach integrate findings from neurological research into their practice. LaGasse (2019) referred to this integration as a neurodevelopmental approach. In addition to the unique processing of music seen in many children with ASD, the approach also includes five considerations and areas of support: neuroplasticity, OPERA hypothesis, SEP hypothesis, sensory regulation, and musical engagement.

Neuroplasticity Through Music

Neuroplasticity is the process of change in the brain that is critical to the learning or re-learning of skills and behaviors. This change happens on both the synaptic and network levels through new and repeated experiences, environmental responses, or damage to the brain, such as a lesion (Ismail et al., 2020). Changes on the synaptic level include increasing and strengthening synaptic activity (long-term potentiation) as well as decreasing synaptic activity (long-term depression; Citri & Malenka, 2008). Synaptic plasticity also results in the reorganization of network connections, both within the same brain region and between separated areas of the brain (Avena-Koenigsberger et al., 2018). Because of the role neuroplasticity plays in learning, the process is more active during a child's critical and sensitive periods of development; however, neuroplasticity continues until death (Cisneros-Franco et al., 2020). Notably, abnormalities in plasticity may be a factor in neurological disorders (Citri & Malenka, 2008), including ASD. Therefore, in order for interventions such as music therapy to be effective, they need to be able to stimulate neuroplasticity in children with ASD.

Stegemöller (2014) hypothesized that the therapeutic use of music has unique capabilities to promote neuroplasticity based on researcher's findings of an increase in dopamine, synchronization of neural firing, and consonance of music. Researchers have documented that dopamine, a neurotransmitter in the brain that is released during positive emotional responses, plays an important role in the learning process and neuroplasticity (Bao et al., 2001). Additionally, researchers found that dopamine release increases during music listening experiences (Koelsch, 2020). Even though researchers have primarily studied this response during passive listening, Stegemöller (2014) argued that positive responses during music listening demonstrates the potential for music to increase neuroplasticity when provided within a therapeutic context since active music-making experiences can also elicit positive emotions (Kim et al., 2009). Music therapists may therefore be utilizing dopaminergic responses to music in order to promote social skill development in children with ASD, such as engaging group music experiences resulting in increased peer socialization (LaGasse, 2014).

In addition to dopaminergic responses, researchers found that entrainment, including the rhythmicity, structure, and predictability of music, may further assist in neuroplasticity. Entrainment, also called synchronization, is the phenomenon by which internal human systems synchronize with an external stimulus, like a rhythmic pulse in music (Bouwer et al., 2020). Researchers pair this phenomenon with the Hebbian principle, which states that when neurons fire together, they also wire together (Hebb, 1976). Stegemöller (2014) then hypothesized that if neurons for musical engagement are firing at the same time as neurons for the non-musical behaviors, those actions may be wired together, which has been demonstrated in music therapy entrainment studies. For example, Sharda (2018) found that rhythm-based music interventions targeting social goals changed neural connections in children with ASD, modulated sensory systems, and positively impacted social communication. Additionally, Yoo and Kim (2018) used rhythmic drumming paired with social interactions and found that children with ASD demonstrated increased social skills. Therefore, music therapists working with children with ASD from a neuroscience-informed approach may use entrainment for social skill development.

It is important to note, though, that there are factors that can negatively impact neuroplasticity, including noise (dissonant, unpredictable, or unpleasant sounds), which is associated with stress. However, music can uniquely combat the negative effects of noise in two ways. First, exposure to music reportedly decreases stress responses and increases positive responses (de Witte et al., 2020). Second, Stegemöller (2008) found less variability in the acoustic signals of music compared with spoken language, including a clearer signal in the spoken language of musicians compared with non-musicians, which aided in speech perception. Therefore, music therapists may be uniquely qualified to communicate effectively to children with ASD, address social skill development, and promote neuroplasticity through the clarity of music and the presence of coherent spoken language.

OPERA Hypothesis

Patel's (2011) OPERA hypothesis claimed that music has the potential to meet five conditions that are critical for neuroplasticity in speech and language processing, which is also important for social communication (Schwartz & Pell, 2012): overlap, precision, emotion, repetition, and attention. For the first condition, researchers have found that there is an overlap in music and speech processing at the subcortical level, which implies that music has access to the areas of the brain that process speech and could therefore influence the speech encoding process (Patel, 2011). The music used in the experience must meet this condition in order for the other four to influence neuroplasticity. Second, the condition of precision is concerned with how listeners encode music in the brain compared with the encoding process of speech and language. Music contains fine details, including pitch, timbre, harmonics, and rhythm, that place a higher demand on the brain for listeners compared with speech; therefore, the areas of the brain that are overlapping with speech are encoding music perception with high precision (Patel, 2011). This ability to precisely encode music positively impacts speech areas of the brain and aids in neuroplasticity. Third, the musical experience must be emotionally rewarding. Specifically, de Witte and colleagues (2020) noted that musical experiences can activate networks that elicit positive emotional responses and release dopamine, which is congruent with Stegemöller's (2014) hypothesis of music's unique dopaminergic responses. Fourth, in order for the musical experience to be effective, the child with ASD must repeat it since repetition helps the child complete the skill with less effort (Patel, 2011). In the fifth condition, the music must capture the child's attention (Patel, 2011). Without attention, the brain may not efficiently encode the music, which would limit the impact on speech encoding.

A music therapist working from a neuroscience-informed approach considers these five conditions when designing musical experiences. If a music therapist is working with a child with ASD on greetings, they first operate from the assumption that the music selected will overlap (O) with speech processing areas of the brain and be encoded with high precision (P). Then, when selecting the music to use, the music therapist will ensure that the music is engaging enough to maintain attention (A) and motivating enough to provide emotional (E) reward. Finally, the music therapist will repeat (R) the exercise within a session as well as between sessions to allow for multiple learning experiences. The music therapist uses this same process when addressing other speech and language processes that are important for social skills, including active listening, verbal communication, and auditory discrimination. In conclusion, music therapists working with children with ASD may have a unique opportunity to influence social skills by repeating musical experiences that engage speech areas of the brain, require attention to details, and are emotionally rewarding.

SEP Hypothesis

The SEP hypothesis is a rhythm-based extension on the OPERA hypothesis that explains how and why music therapists can use rhythm to increase speech and language skills in children with ASD (Fujii & Wan, 2014). The SEP hypothesis includes two components: Sound Envelope Processing (SEP) and Synchronization and Entrainment to Pulse (SEP). For both components, the SEP hypothesis operates from the assumption that there is a neural overlap of rhythm perception and speech, as well as an overlap in the sensorimotor coupling of music and speech production, which is congruent with the first condition in the OPERA hypothesis (Fujii & Wan, 2014). Neural circuits associated with the two components of the SEP hypothesis, sound envelope and entrainment, support the other four conditions of the OPERA hypothesis.

First, rhythm is important for the sound envelope, which is critical for discrimination of letters, words, and instruments and translates into skills required during social interactions (Fujii & Wan, 2014). Specifically, rhythm affects the Auditory Afferent Circuit (AAC) and Subcortical-Prefrontal Circuit (SPC). Researchers studying the effect of music on the AAC have found that listeners more precisely code rhythm in the brain than non-rhythmic inputs (Fujii & Wan, 2014). Rhythm also engages the SPC, which researchers associate with eliciting positive emotions that can lead to an increase in repetition to reinforce the emotion (Fujii & Wan, 2014). Taken together, the AAC and SPC pathways fulfill precision, emotion, and repetition from the OPERA hypothesis.

Second, rhythm is critical to the process of entrainment, which is linked to increased speech understanding, intelligibility, and socialization (Giraud & Poeppel, 2012; Peelle & Davis, 2012; Riecke et al., 2018; Sharda et al., 2018; Yoo & Kim, 2018) as well as speech rehabilitation (Thaut & McIntosh, 2014). Through entrainment, rhythm influences the Basal Ganglia-Thalamo-Cortical Circuit (BTC) and Cortical Motor Efferent Circuit (CMC). Specifically, rhythmic entrainment increases activation of the BTC, which researchers connect with attention (Fujii & Wan, 2014). Rhythmic entrainment also affects motor circuits, including the CMC (Fujii & Wan, 2014). Given this, the BTC and CMC pathways satisfy attention from the OPERA hypothesis and suggest an importance of motor engagement for communication and socialization.

To further explore this hypothesis, the same authors tested the Auditory-Motor Mapping Training (AMMT) intervention on children with ASD to target verbal output (Wan et al., 2011), which has been replicated (Chenausky et al., 2016, 2017). Aligning with the SEP hypothesis, the researchers paired words with differently tuned drums through repeated rhythmic exercises. After looking at the results, the authors suggest that AMMT can successfully increase speech and language skills for children with ASD (Wan et al., 2011). It is important to note that this increase in verbal communication may better prepare children for social settings to communicate with adults and peers. Therefore, music therapists working from a neuroscience-informed approach may use AMMT to address social skills in children with ASD.

Sensory Regulation

The music therapist working from a neuroscience-informed approach considers the child's regulatory state throughout sessions. Since differences in sensory processing can impact how a child understands, adjusts to, and responds to incoming sensory stimuli (Schauder & Bennetto, 2016), sensory regulation is essential. By actively helping the child regulate, the music therapist helps avoid dysregulation, which can manifest in inappropriate behaviors, lack of attention, and emotional disruptions that can negatively impact the therapeutic process (Miller et al., 2007). Furthermore, by constantly monitoring the child's needs and meeting those needs through the music, the music therapist optimizes treatment and sets the child up for success to make progress in social skills and other areas (LaGasse, 2019).

Researchers include sensory considerations in music therapy literature. For example, when comparing the effect of music on social skills in children with ASD between a music therapy group and a non-music group, LaGasse (2014) provided sensory supports in both conditions in order to meet those needs and help eliminate sensory dysregulation as a confounding variable. Carpente & LaGasse (2016) also note that music can provide multisensory stimulation to help decrease sensitivity to auditory stimuli and increase sensory regulation. Music-based sensory supports can include interventions crossing midline, rhythmic deep pressure, and input from drumming (LaGasse, 2019). Furthermore, LaGasse and colleagues (2019) suggested that music therapy attention interventions positively impacted sensory processing in children with ASD. Altogether, music therapists working from a neuroscience-informed approach attend to sensory needs throughout treatment to optimize skill development, including social skills.

Musical Engagement

Music therapists working from a neuroscience-informed approach also consider the child's engagement in the music. Children learn when they play with and engage in their environment, which applies to classrooms, homes, and therapies (Ginsburg et al., 2007); therefore, musical experiences focused on skill development are more effective when the music therapist offers the child opportunities to play and engage. For example, LaGasse (2014) found that when children with ASD were engaging with the music, they demonstrated increased peer awareness and interactions. Additionally, Kalas (2012) demonstrated that children with ASD participated better in joint attention opportunities when the selected music was appropriately complex, and thereby engaging. Furthermore, music therapists used engaging music to increase attention to tasks in children with ASD (Pasiali et al., 2014; Thompson & Abel, 2018; Wolfe & Noguchi, 2009). The OPERA hypothesis also supports the use of engaging musical experiences, since engagement may increase attention and the child may find the experience more emotionally rewarding. LaGasse (2019) encouraged music therapists to use client-preferred music, musical novelty, and instrument play during treatment for children with ASD.

Neuroscience-Informed Clinical Approach in Music Therapy

When beginning treatment for children with ASD, the music therapist working from a neuroscience-informed approach assesses the child's non-musical strengths and needs and then creates non-musical goals to work towards (LaGasse, 2019). For example, the music therapist might target turn taking, joint attention, or reciprocal communication within a social domain. The music therapist may return to non-musical exercises and assessments throughout the treatment process to measure the client's progress. After assessment, the music therapist designs music interventions that are functional and generalizable to the client's non-musical needs, using mostly a systematic use of music or music protocols, often rhythmically driven (Carpente & LaGasse, 2016). For example, when targeting turn taking, the music therapist may use a song that cues the child to take a turn then pass the instrument to the music therapist or another peer. Although music may be protocolized, the music therapist uses high-quality music-making to optimally engage the child in the music experience, repeating experiences and building off of the client's strengths (LaGasse, 2019). Finally, throughout each session, the music therapist monitors the child's sensory needs and adjusts the music to help them regulate in order to optimally target functional outcomes (LaGasse, 2019). The music therapist may follow the child's lead when appropriate, but often takes an active leading and directing role (LaGasse, 2019). Overall, the music therapist uses the music to systematically help the child gain functional skills, integrating neuroscience research into treatment and adjusting treatment as more information becomes available.

DIR/Floortime™-Informed Approach Within Music Therapy

Through research on child development, Greenspan and colleagues pioneered the Developmental, Individual-Difference, Relationship-Based (DIR)/Floortime™ model that therapists, parents, and educators can use when assessing and designing treatment programs for children with ASD, including music therapists working from a DIR/Floortime™-informed approach (Greenspan & Wieder, 1997). Specifically, Greenspan and Wieder designed the DIR/Floortime™ model to identify a child's current level of functioning in three areas that are key to development: emotional development, sensory processing, and relationships with others (Greenspan & Wieder, 1997). Although the DIR/Floortime™ model is considered an unestablished treatment for children with ASD (NAC, 2015), a growing group of researchers are contributing to a body of literature which suggest that practitioners using the model help children with ASD build healthy foundations for relating, communicating, and thinking (Binns & Oram Cardy, 2019; Casenhiser et al., 2013; Dionne & Martini, 2011; Pajareya & Nopmaneejumruslers, 2011; Solomon et al., 2014). Music therapists working from this approach consider each individual component of the DIR/Floortime™ model (development, individual-difference, and relationship-based) within music experiences that are largely improvisational.

Developmental

Rather than focusing on acquiring specific skills or reducing maladaptive behaviors in children with ASD, music therapists working from a DIR/Floortime™-informed approach design treatment to help children with ASD progress through stages of development. The concept of developmental stages is not unique, though. For example, Piaget theorized that children work through developmental stages from birth to age 11, including engaging with their world, using imagination, and thinking strategically (Jansen, 2011). The DIR/Floortime™ model, however, describes six functional emotional developmental capacities (FEDCs) that children work through by age four. The Interdisciplinary Council on Development and Learning (ICDL, n.d.) outlines the FEDCs as:

1. Self-regulation and interest in the world (seen at 0-3 months)
2. Engaging and relating with others (seen at 2-7 months)
3. Purposeful two-way communication (seen at 3-10 months)
4. Complex communication and shared problem solving (seen at 9-18 months)
5. Using symbols and creating emotional ideas (seen at 18-30 months)
6. Logical thinking and building bridges between ideas (seen at 30-48 months)

These FEDCs are embedded into the Functional Emotional Assessment Scale (FEAS), which helps the assessor design a treatment plan (Greenspan et al., 2001). In the FEAS, the assessor rates the child on different statements within each developmental category using a three-point scale. For example, under "Purposeful two-way communication" the assessor rates "opens circles of communication: initiates intentional actions with objects while also engaged in interactions with caregiver" as either brief/never (0), sometimes (1), or consistently (2) (Greenspan et al., 2001). This concept of opening and closing circles of communication, or the reciprocal verbal or non-verbal communication between two people, is a fundamental concept within the DIR/Floortime™ model (Dionne & Martini, 2011). After compiling information from the FEAS, the assessor determines which capacity to address first, since children must master capacities sequentially. This concept of meeting the child at their level mirrors Vygotsky's theory on the Zone of Proximal Development, which states that the adult can maximize the learning process for children by offering appropriate assistance and helping to transition skills that require support into skills that children can do independently (Moore, 2011). Therefore, in a DIR/Floortime™ approach, the assessor identifies which skills the child has mastered, the skills that are too difficult, and the skills that the therapist should support the child in mastering next.

According to Carpente (2012), the music therapist's role is to facilitate progress on the FEDCs by responding to and enhancing the child-led musical experience. Specifically, Carpente (2012) noted that the DIR/Floortime™ model uniquely complemented improvisational music therapy, which music therapists commonly use within this approach. For example, the music therapist may use improvisation techniques such as mirroring, when they mimic the client's music to reflect their own behaviors, or grounding, where they apply music to increase the client's musical stability (Wigram, 2004). The music therapist might also use dialoguing, where they communicate with the client through a musical conversation (Wigram, 2004), which is a direct musical translation of opening and closing circles of communication.

To measure client progress, music therapists may use the FEAS or the Individual Music-Centered Assessment Profile for Neurodevelopmental Disorders (IMCAP-ND), which is a musical assessment designed to mirror the FEAS (Carpente, 2009, 2012, 2014). For example, the music therapist reports on the client's engagement with the music, musical imitation, musical responsiveness, and initiating of music. Carpente (2009) tested whether musical progress made on the FEAS could mirror progress on a music-based assessment and found promising results. Altogether, the music therapist working from a DIR/Floortime™-informed approach uses musical assessments and goals to guide the experience and help children with ASD develop foundational social-emotional skills.

Individual-Difference

When considering how to help a child with ASD move through the FEDCs, music therapists tailor interventions to meet the individual biological differences of that child (Greenspan & Wieder, 2006). By tailoring interventions to meet individual needs, the therapist can effectively help the child work through the FEDCs. Specifically, music therapists meet differences for sensory processing, sensory modulation, and motor planning, since those impact how a child interacts with their environment, peers, and caregivers (Bodison & Parham, 2017; Greenspan & Wieder, 2006; Watling & Hauer, 2015). For example, the music therapist may provide sensory breaks, musical anticipation for sensory input, or instruments that are appropriate for the child's sensory diet. Additionally, since music is a multisensory modality (Carpente & LaGasse, 2016), music therapists can uniquely use music to adapt to meet differing sensory needs and optimally engage the child in relationships and socialization.

Relationship-Based

The last foundation of the DIR/Floortime™ model that caregivers and music therapists consider is the importance of relationships, which is different from most traditional behavioral therapies for children with ASD (Binns & Oram Cardy, 2019). Greenspan and Wieder (2006) emphasize that children develop cognitive, social, and emotional skills through interactions with their caregivers. Gernsbacher (2006) supported this belief through a review of literature on caregiver interactions with children with ASD, which found that parent reciprocation increased their child's language and social development. Additionally, parents implementing the DIR/Floortime™ approach at home reported improvements in parent-child interactions and a decrease in parent stress (Solomon et al., 2014). It is therefore important for the caregiver to provide a sense of security, engage with their child, and utilize emotional signals and language.

Music therapists using a DIR/Floortime™-informed approach develop a relationship with their clients within the music, considering that positive therapeutic relationships better predict social skill development in children with ASD (Mössler et al., 2019). Specifically, the music therapist uses active music-making which simultaneously increases social skills and prosocial behaviors (Kirschner & Tomasello, 2010). The music therapist is also aware of providing a secure environment, creating enjoyment through the music, and using the history of shared musical experiences to build rapport and develop the therapeutic relationship (Geretsegger et al., 2015). Additionally, music therapists enhance the child-family relationship by involving family members in the treatment (Carpente, 2013). The relationship-building remains salient across the treatment process in order to optimize the child's progress on their social-emotional development.

DIR/Floortime™-Informed Clinical Approach in Music Therapy

In a DIR/Floortime™-informed approach, the music therapist typically uses a musical assessment, such as the IMCAP-ND, and creates musical goals based upon the client's current strengths and needs (Carpente, 2013). For example, the music therapist may target musical participation or musical responsiveness, which are musical indicators of social interactions. As treatment begins, the music therapist follows the child's lead and observes how they respond and react to the music while considering their individual and musical differences (Carpente, 2012). The music therapist continues to create a musical-emotional environment, offer opportunities for play, and follow the child's musical-emotional lead, commonly using improvisational methods (Carpente, 2012); however, improvisation is not required. For example, the child may begin by playing the drums and the music therapist supports their exploration of the drums by accompanying on the piano and involving the child in a dialogue between the two instruments. The music therapist continues to synchronize the music with the child and open up communication through musical interactions, treating all behaviors as intentional (Carpente, 2012), like if a child opens a door to a cabinet. The music therapist would represent the action of opening the door musically and wait for the child to respond with another action, such as closing the door, which the music therapist would also represent within the music. As circles are opened and closed between the therapist and client, the music therapist uses the music to help expand the child's communication and interactions (Carpente, 2012). Overall, in a DIR/Floortime™-informed approach the music therapist uses musical experiences to relate with the child and drive changes in social skills.

Purpose of This Study

Through individual studies and systematic reviews, researchers are contributing to the body of literature supporting both neuroscience-informed and DIR/Floortime™-informed approaches; however, there are no studies comparing the approaches. While researchers have shown that each one has evidence of promoting social skills in children with ASD, the quantity and quality of those skills are unknown. Further, each approach may provide different opportunities or have different limitations for social skill development. Case study methodology specifically allowed the researcher to compare each approach in a natural setting to inform future practices (Ridder & Fachner, 2016). The purpose of this study was to delineate the differences of social skill promotion between a neuroscience-informed and DIR/Floortime™-informed approach. The author used video analysis of sessions of one child involved in music therapy and identify client and therapist musical and non-musical behaviors relating to social skills. The author presented descriptive statistics and clinically relevant observations. The present study aimed to answer the following research questions (R.Q.):

R.Q.1: To what extent was the therapist consistent in applying the critical clinical elements of the two approaches?

R.Q.2: What differences were observed in the client's non-musical social skill behaviors between the two approaches?

R.Q.3: What differences were observed in the client's musical social skill behaviors between the two approaches?

R.Q.4: What differences were observed in the therapist interactions and responsiveness with the client between the two approaches?

CHAPTER THREE: METHOD

Design

The present study was a descriptive single case study examining how a music therapy participant responded to changes in real-life music therapy sessions. The author described observations and themes but was limited in inferring causation due to the single subject and absence of research protocols. The author used quantitative measures when analyzing videos of music therapy sessions.

Participant and Interventionist

The participant was a teenage boy diagnosed with autism spectrum disorder (ASD), level II. During the time the videos were taken, he was receiving music therapy services from a board-certified music therapist (MT-BC) at Colorado State University (CSU). The participant was integrated into the typical classrooms in his school, with paraprofessional support. The client used verbal communication; however, often used scripted phrases and words. The participant had a younger sister and lived at home with his mother and father. His primary caregiver was his father, who also attended his music therapy sessions. The participant's goals at the time of this study were focused on communicating his needs (verbally or non-verbally), demonstrating inhibitory control, improving selective attention/executive control of attention, improving reading comprehension, and demonstrating social awareness. Music therapy sessions were provided for 60 minutes one time per week.

The clinical music therapist had 15 years of experience practicing from a neuroscience-informed approach. They were certified in levels I – II of DIR/Floortime™ and were completing level III certification during the recording of the DIR videos used in this study. The treatment period for the neuroscience-informed approach and DIR/Floortime™-informed approach was separated by the clinical music therapist's family leave, during which the boy received services from another therapist. This family leave created a treatment break between the neuroscience sessions and the DIR/Floortime™ sessions with the music therapist in this study. The participant's guardians consented to video recording of all sessions and later provided consent for the sessions to be analyzed for use in this study. The study was reviewed and approved by the University's Institutional Review Board (IRB).

Materials

The author used 10 five-minute clips from videos taken during the participant's 50-minute music therapy sessions from March 2016 to April 2017, with a break in treatment with the clinical music therapist from August 2016 to January 2017. In the first five videos the clinical music therapist led from a neuroscience-informed approach and in the second five videos the clinical music therapist led from a DIR/Floortime™-informed approach. Student music therapists were present in many of the neuroscience videos; however, the clinical music therapist led all interventions. The sessions were completed prior to consideration of research and were not originally intended to be used in research. The author and research assistant (both board-certified music therapists) used the Behavioral Observation Research Interactive Software (BORIS) to complete checklists of the critical elements for each approach in each video (Borrelli, 2011). Additionally, the author and research assistant recorded frequency, duration, and partial interval recording (PIR) within 20 second intervals (Zakszeski et al., 2017) of specific behaviors for each of the clips.

Procedure

The clinical music therapist who provided treatment to the participant reviewed all 10 videos and identified the start and finish of the first social skills-focused intervention (if there were multiple) per session. A five-minute clip from the middle of each intervention was selected for coding. The videos were then uploaded so the author (an MT-BC) and a research assistant (also an MT-BC) had access to them. Additionally, the videos were labeled in a way that kept the author and research assistant masked to the approach used in each one. The author trained the research assistant on what qualified as critical clinical elements (as listed and defined in Table 1 and Table 2), client non-musical social skill behaviors (as listed and defined in Table 3), client musical social skill behaviors (as listed and defined in Table 4), and therapist responsiveness and interactions (as listed and defined in Table 5), as well as how to code for frequency, duration, and PIR. Then they coded one video together using BORIS until an inter-rater agreement of 90% was reached. Each coder then independently coded four more videos using BORIS. The author compiled inter-rater agreements for all videos and any behavior with less than 80% agreement was re-coded until the author and research assistant came to a consensus. Then they coded the final five videos independently using BORIS and the author computed inter-rater agreements for all videos and any behaviors with less than 80% agreement were re-coded to reach a consensus. After coding was completed, the author compiled descriptive statistics for all critical elements and each behavior.

Critical Elements of the Approaches

Since the interventionist was the same for both approaches, the author examined the extent to which the therapist consistently applied the critical elements of the intended approach (Borrelli, 2011). The author created a critical elements checklist for each approach (see Table 1 and Table 2), consisting of three core characteristics. In every video, the coders measured the duration of each characteristic to determine the extent of consistency. The approach used in each video was anonymized, and the coders completed the critical elements checklists without knowing the intended approach.

Data Analysis

All data were analyzed using descriptive statistics and visual presentation through Microsoft Excel. The author first calculated inter-rater agreements for all critical element characteristics and behaviors of each video. To answer question one (consistency of critical elements), the author examined the durations of each critical element for each video to determine the extent of consistency and whether the video would be included in the study. To answer questions two, three, and four (differences in behaviors) the author calculated the means, standard deviations, medians, and interquartile ranges for each behavior and compared statistics between the two approaches. Finally, the author completed a visual analysis of the individual data sets, charts, and graphs for additional interpretation of the data and to add to the clinical implications.

Table 1

Critical Elements of the Neuroscience-Informed Approach (Based off of LaGasse, 2019)

Characteristic	Definition	Type of Measure
Therapist-directed	The therapist is leading the intervention where each person has specific roles and responses	Duration
Systematic use of music	Musical experiences contain known musical structures (i.e., ABA) and/or are rhythmically driven	Duration
Skill-based	Music experiences are designed to target a specific non-musical skill (e.g., verbally responding) in the client	Duration

Table 2

Critical Elements of the DIR/Floortime™-Informed Approach (Based off of Carpente, 2012)

Characteristic	Definition	Type of Measure
Client-directed	The therapist provides autonomy within musical experiences and allows the client to direct musical play	Duration
Fluid use of music	The therapist uses the music to naturally respond in the moment to the client's vocal, physical, or musical behaviors, often using elements of improvisation	Duration
Relationship-based	The therapist interacts in circles of communication with the client, expanding upon the client's musical interactions to engage the client in a relationship	Duration

Table 3

Client Non-Musical Social Skill Behaviors (Based off of LaGasse, 2014)

Behavior	Definition	Type of Measure
Eye contact	Client directs their head gaze toward the therapist/student	Partial interval recording (PIR)
Joint attention	Client engages in shared attention (jointly attending to an object) with the therapist/student and demonstrates social awareness of situation (e.g., looking at therapist/student, responding, pointing, etc.)	PIR
Initiation of communication *(not reciprocal)*	Client verbally (using words or sounds) communicates with the therapist without a prompt or antecedent	Frequency
Response to communication *(not reciprocal)*	Client verbally (using words or sounds) responds to the therapist after therapist's initiation	Frequency
Reciprocal Communication	Client initiates then responds after therapist OR responds to therapist twice in a row. If a full reciprocation occurs, it is not also counted as initiation or response (above)	Frequency
Nonmusical imitation	Client attempts or successfully imitates the therapist's behaviors (e.g., speech, non-musical movements, facial expression, etc.)	PIR
Off-task behaviors	Client displays a behavior of disengaging from the session or task for more than 5 seconds (e.g., walking away from therapist, fixation on something else, etc.)	PIR

Table 4

Client Musical Social Skill Behaviors (Based off of Carpente, 2013)

Behavior	Definition	Type of Measure
Joins in the music	Client participates in a musical experience with the therapist (either simultaneously or alternating, dependent upon the structure)	Duration
Musical imitation	Client attempts to or successfully mimics the therapist's music (e.g., tempo, dynamics, force, etc.)	PIR
Musical responsiveness	Client changes and matches their musical expression based upon therapist cues and/or music	PIR
Initiates music	Client spontaneously creates or changes music	Frequency

Table 5

Therapist Responsiveness and Interactions (Based off of Carpente, 2013; Kim et al., 2008; Shoemark & Grocke, 2010; Walworth et al., 2009)

Behavior	Definition	Type of Measure
Verbal prompting	Therapist verbally directs client towards instrument or another task	Frequency
Physical prompting	Therapist physically or gesturally directs client towards instrument or another task	Frequency
Acknowledge/ Affirm	Therapist provides positive feedback to client vocally (e.g., "yeah") or physically (e.g., head nod)	Frequency
Nonmusical attunement	Therapist changes their own facial affect, tone of voice, etc. to match, mirror, reinforce, or complement the client's own behaviors	PIR
Musical attunement	Therapist changes their tempo, dynamics, style, etc. to match, mirror, reinforce, or complement the client's music	PIR
Nonmusical imitation	Therapist mimics the client's behaviors (e.g., speech, non-musical movements, facial expression, etc.)	PIR
Musical imitation	Therapist mimics the client's music (e.g., tempo, dynamics, force, etc.)	PIR

CHAPTER 4: RESULTS

The data were analyzed using the Microsoft Excel data analysis package. Pearson correlations for frequency and duration behaviors showed a 99% inter-rater agreement. Averages of partial interval recording (PIR) behavior agreements calculated for each video showed a 98% inter-rater agreement. Descriptive statistics for each behavior between the neuroscience-informed approach and the DIR/Floortime™-informed approach were calculated. Behaviors measured by frequency and duration were reported separately from PIR behaviors, as the PIR statistics were calculated as percent the behavior occurred out of total opportunities (15 total 20-second periods). Due to the single subject and small video sample size, inferential statistics were not used. Table 8 shows all descriptive statistics for client and therapist behaviors.

Critical Elements of the Approaches

Research question one was to what extent did the therapist apply the critical elements of the two approaches? To answer the question, the author calculated the durations of each element for each video. When all three elements were represented for at least 80% of the time, the video was automatically included in the study. Any video that did not meet the 80% representation were examined further to determine if they would be included in analysis. After further analysis, all ten videos were included. The only neuroscience video with less than 80% representation was video Neuro5 where “therapist-directed” was observed for 56% (169.42 seconds) of the time. All critical element measures for the neuroscience videos are presented in Table 6. Two of the DIR videos had less than 80% representation. In video DIR4, “client-directed” was observed for 59% (178.82 seconds) of the time. In video DIR5 “client-directed” was observed for 71% (213.80 seconds) of the time and “fluid use of music” was observed for 4% (12.76 seconds) of the time.

All critical element measures for the DIR videos are presented in Table 7. A comparison of critical elements between the neuroscience videos and DIR videos is presented in Figure 1.

Table 6

Measures for the Critical Elements in the Neuroscience-Informed Videos

Video	Neuroscience-Informed Elements			DIR-Informed Elements		
	Therapist-Directed	Systematic Use of Music	Skill-Based	Client-Directed	Fluid Use of Music	Relationship-Based
Neuro1	298.65	298.652	298.652	0	0	0
Neuro2	295.86	293.53	295.78	0	0	0
Neuro3	300.63	300.50	300.69	0	0	0
Neuro4	295.23	294.73	294.73	0	0	0
Neuro5	**169.42**	279.84	280.77	108.56	0	0

Note: Bolded numbers were under the expected 80% prevalence for the particular video

Table 7

Measures for the Critical Elements in the DIR/Floortime™-Informed Videos

Video	Neuroscience-Informed Elements			DIR-Informed Elements		
	Therapist-Directed	Systematic Use of Music	Skill-Based	Client-Directed	Fluid Use of Music	Relationship-Based
DIR1	0	79.379	0	300.07	155.78	300.07
DIR2	31.65	0	0	281.89	287.64	287.77
DIR3	0	0	0	284.07	279.66	290.18
DIR4	94.67	0	0	**178.82**	248.53	259.16
DIR5	71.51	71.54	0	**213.80**	**12.76**	291.93

Note: Bolded numbers were under the expected 80% prevalence for the particular video

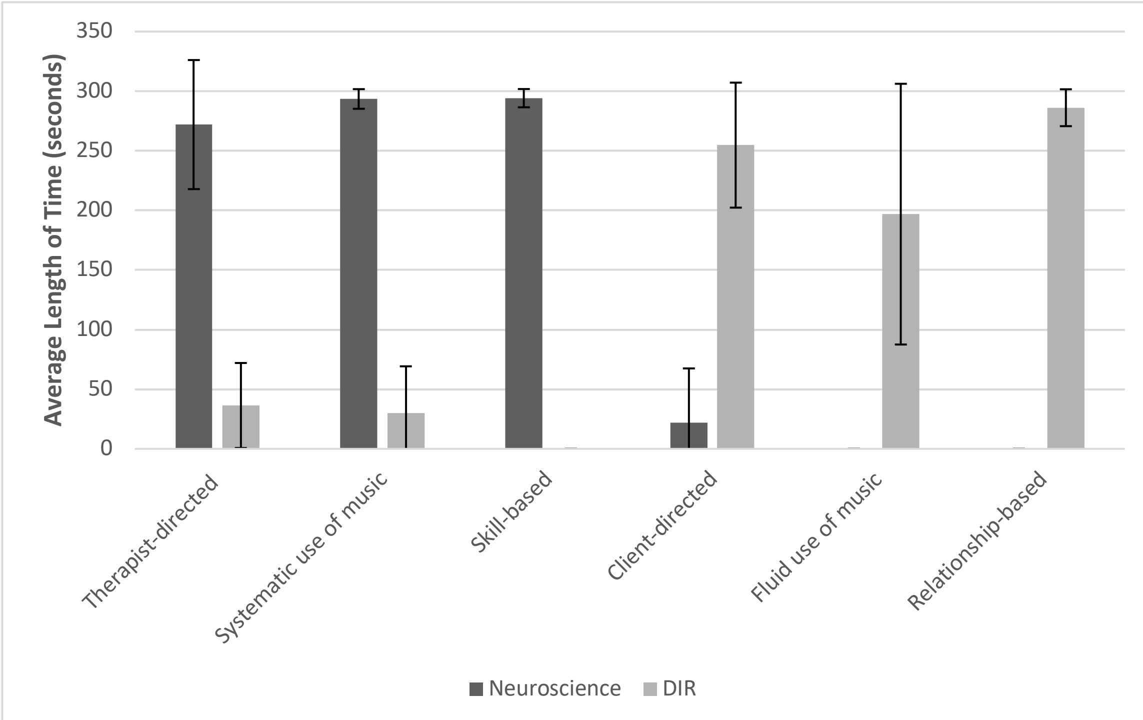

Figure 1. Comparison of the critical elements for each approach (duration).

Note. The error bar represents the standard deviation.

Client Behaviors

Research question two was what differences were observed in the client's non-musical social skill behaviors between the two approaches? To answer the question, the author compared the means for all seven non-musical behaviors between the two approaches. Research question three was what differences were observed in the client's musical social skill behaviors between the two approaches? To answer the question, the author compared the means for all four musical behaviors between the two approaches. The means and standard deviations for all client behaviors are in Table 8.

Table 8

Descriptive Statistics of All Client Behavior Data

	Neuroscience Videos		DIR Videos	
	Mean (SD)	Mdn (IQR)	Mean (SD)	Mdn (IQR)
Client Non-Musical Behaviors				
Eye contact (P)	58% (26%)	46% (31%)	48% (26%)	60% (33%)
Joint attention (P)	29% (27%)	20% (27%)	47% (8%)	47% (6%)
Initiation of communication (F)	1.2 (1.03)	1 (0)	0.6 (0.84)	0 (1)
Response to communication (F)	1.4 (1.96)	1 (1)	4.6 (3.03)	5 (4)
Reciprocal communication (F)	5.0 (4.67)	3 (3)	6.4 (3.17)	7 (5)
Nonmusical imitation (P)	3% (5%)	0% (4%)	1% (3%)	0% (0%)
Off-task behaviors (P)	1% (2%)	0% (0%)	0% (0%)	0% (0%)
Client Musical Behaviors				
Joins in the music (D)	234.59 (40.35)	214.29 (67.75)	174.35 (57.96)	175.76 (80.73)
Musical imitation (P)	43% (34%)	63% (65%)	19% (23%)	7% (32%)
Musical responsiveness (P)	19% (26%)	13% (18%)	30% (17%)	27% (5%)
Initiates music (F)	3.6 (4.25)	3 (4)	4.8 (2.7)	5 (1)

Note: The table includes partial interval recording (P), frequency (F), and duration (D) measures

Non-Musical Social Skill Behaviors

During the DIR videos, the client demonstrated a higher rate of reciprocal communication (*M* = 6.4; *SD* = 3.17) and response-only to communication (*M* = 4.6; *SD* = 3.03) compared with the neuroscience videos (see Figure 2). A comparison of all frequency outcome measurements for mean social skills behaviors are displayed in Figure 2. The client also demonstrated joint attention (*M* = 47%; *SD* = 0.8) for more opportunities in the DIR videos compared to the neuroscience videos (see Figure 3). Alternatively, in the neuroscience videos, the client demonstrated eye contact (*M* = 58%; *SD* = .26) during more opportunities than in the

DIR videos (see Figure 3). A comparison of all PIR outcome measurements for social skills behaviors are displayed in Figure 3.

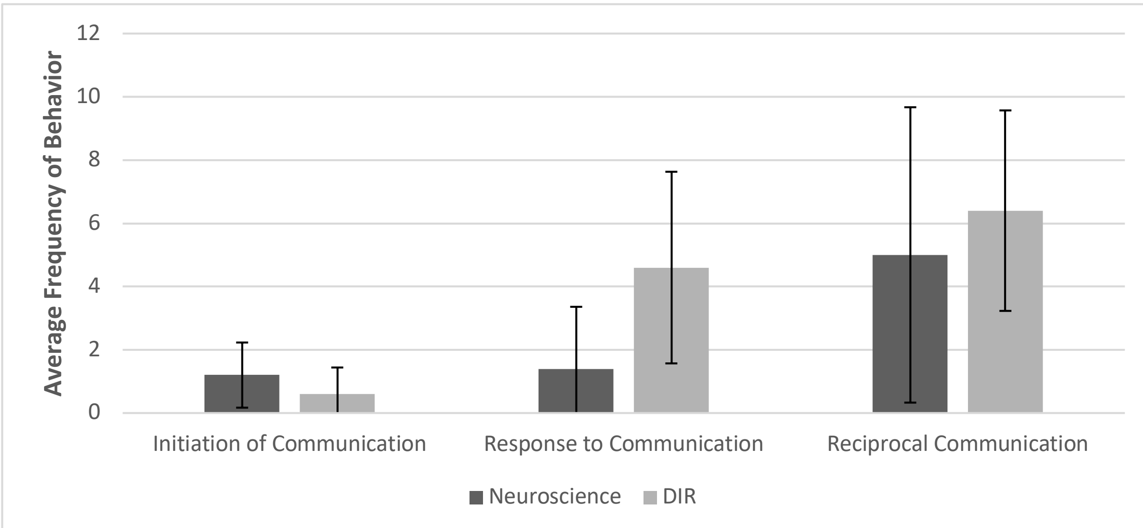

Figure 2. Client social skill behaviors (frequency).

Note. The error bar represents the standard deviation.

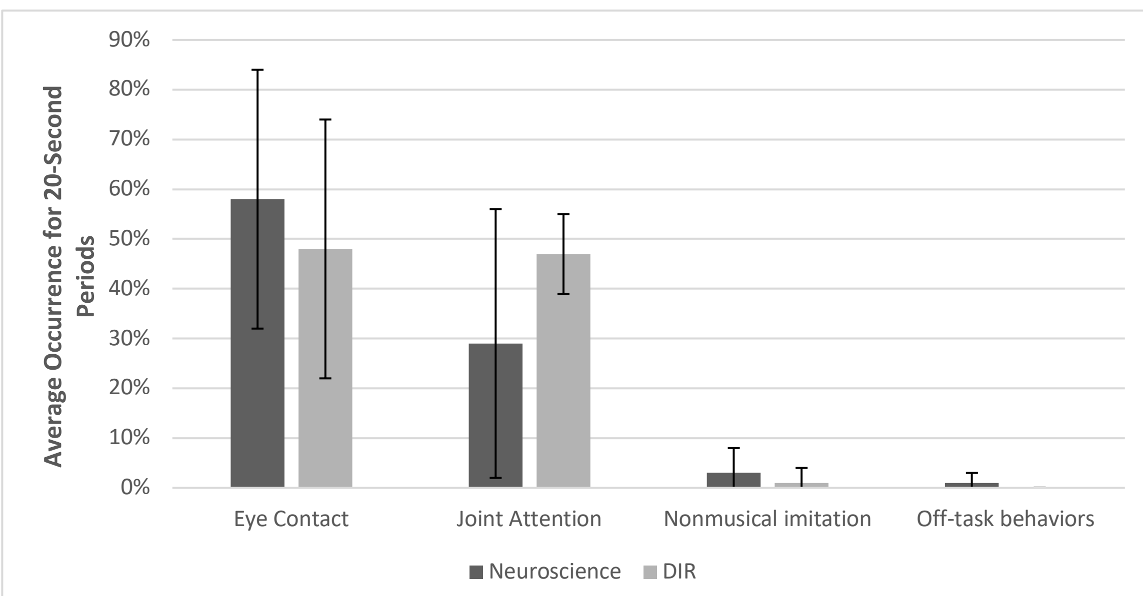

Figure 3. Client social skill behaviors (PIR).

Note. The error bar represents the standard deviation.

Client Musical Social Skill Behaviors

During the DIR videos, the client initiated music (*M* = 4.8; *SD* = 2.7) more frequently than in the neuroscience videos (*M* = 3.6; *SD* = 4.25) (see Figure 4). The client also demonstrated musical responsiveness (*M* = 30%; *SD* = .17) during more opportunities in the DIR videos than in the neuroscience videos (*M* = 19%; *SD* = .26; see Figure 5). Alternatively, the client demonstrated musical imitation (*M* = 43%; *SD* = .34) during more opportunities in the neuroscience videos than in the DIR videos (*M* = 19%; *SD* = .23; see Figure 5). The client also participated in longer average durations of music-making (*M* = 234.59; *SD* = 40.35) in the neuroscience videos than in the DIR videos (*M* = 174.35; *SD* = 57.96; see Figure 6).

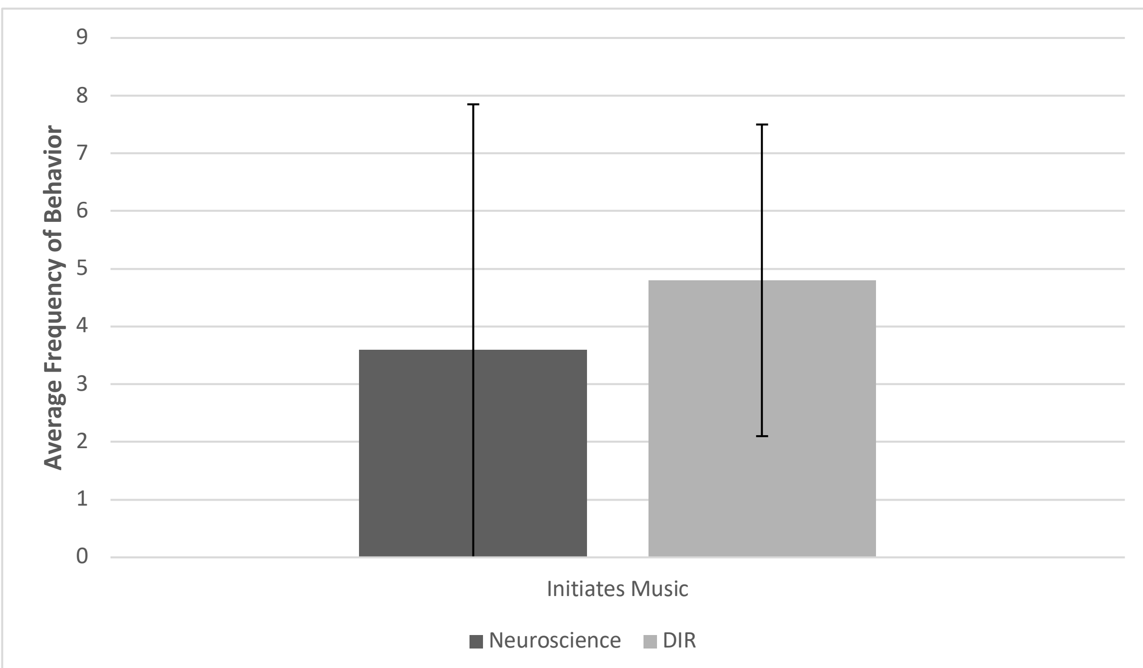

Figure 4. Client musical social skill behaviors (frequency).

Note. The error bar represents the standard deviation.

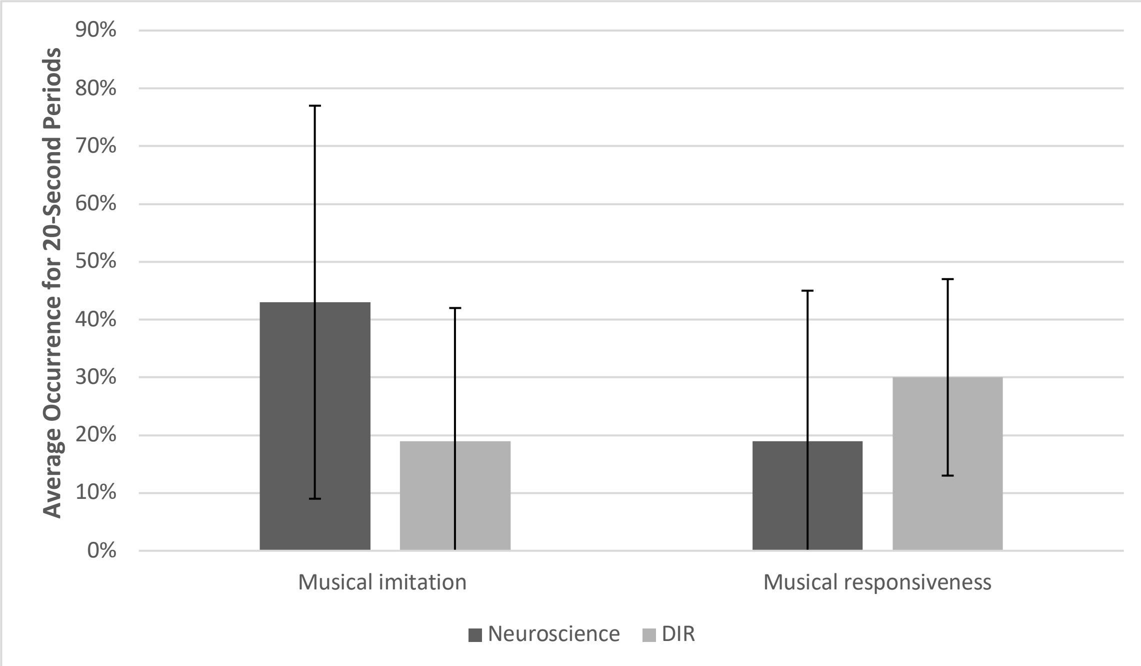

Figure 5. Client musical social skill behaviors (PIR).

Note. The error bar represents the standard deviation.

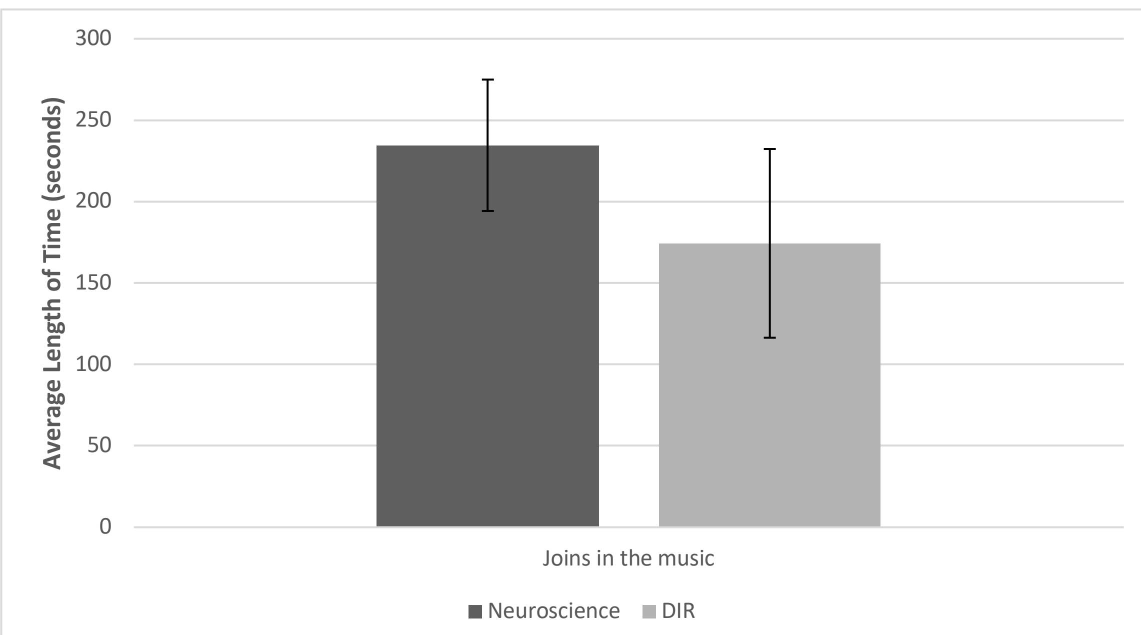

Figure 6. Client musical social skill behaviors (duration).

Note. The error bar represents the standard deviation.

Therapist Interactions and Responsiveness

Research question four was what differences were observed in the therapist interactions and responsiveness with the client between the two approaches? To answer the question, the author compared the means of all seven behaviors between the two approaches. The means and standard deviations for all therapist behaviors are in Table 9. During the neuroscience videos, the therapist demonstrated a higher frequency of verbal prompting (M = 3.6; SD = 2.72) and acknowledging/affirming (M = 6.4; SD = 2.27) compared with the DIR videos (see Figure 7). A comparison of all frequency outcome measurements for therapist behaviors is presented in Figure 7. Alternatively, in the DIR videos, the therapist demonstrated non-musical attunement (M = 30%; SD = 0.13) and musical attunement (M = 28%; SD = 0.21) during more opportunities than in the neuroscience videos (see Figure 8). Additionally, the therapist demonstrated non-musical imitation (M = 3%; SD = 0.3), and musical imitation (M = 9%; SD = 0.14) during DIR videos and those behaviors were not observed in the neuroscience videos. See Figure 8 for a comparison of all PIR outcome measurements for therapist behaviors.

Table 9

Descriptive Statistics of All Therapist Behavior Data

	Neuroscience Videos		DIR Videos	
	Mean (SD)	Mdn (IQR)	Mean (SD)	Mdn (IQR)
Verbal prompting (F)	3.6 (2.72)	2 (3)	1.6 (1.43)	1 (1)
Physical prompting (F)	2.0 (0.94)	2 (2)	1.9 (2.28)	1 (1.75)
Acknowledge/Affirm (F)	6.4 (2.27)	7 (3)	2.9 (2.28)	3 (4)
Nonmusical attunement (P)	14% (13%)	10% (7%)	30% (13%)	33% (18%)
Musical attunement (P)	4% (8%)	0% (0%)	28% (21%)	20% (27%)
Nonmusical imitation (P)	0% (0%)	0% (0%)	3% (3%)	0% (7%)
Musical imitation (P)	0% (0%)	0% (0%)	9% (14%)	0% (13%)

Note: The table includes partial interval recording (P), frequency (F), and duration (D) measures

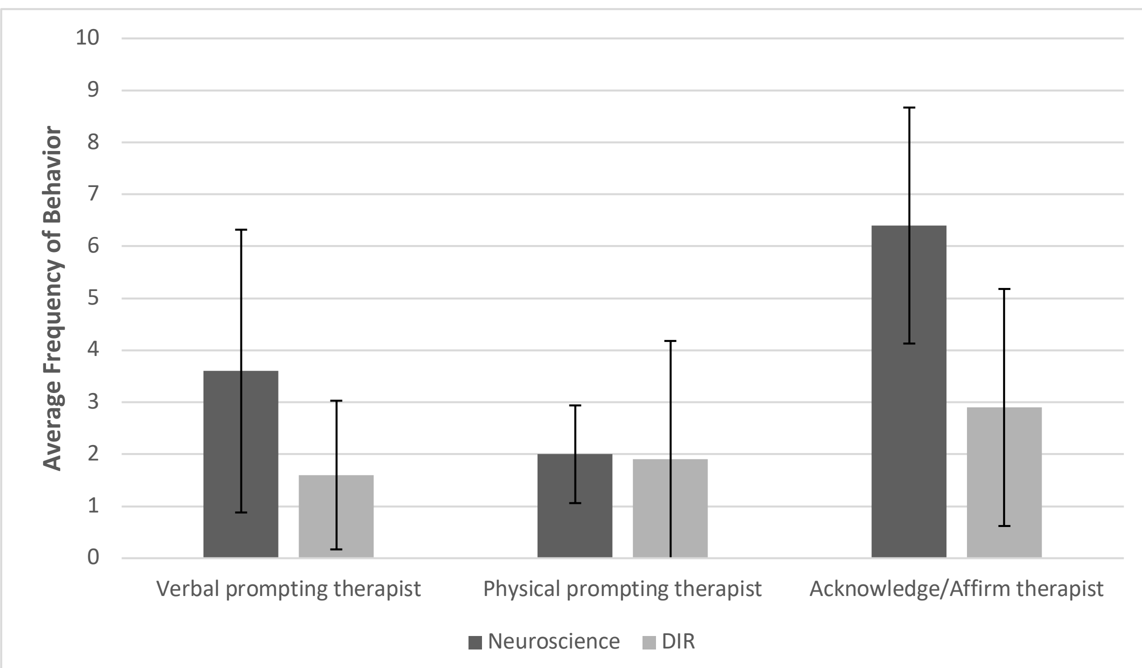

Figure 7. Therapist interactions and responsiveness (frequency).

Note. The error bar represents the standard deviation.

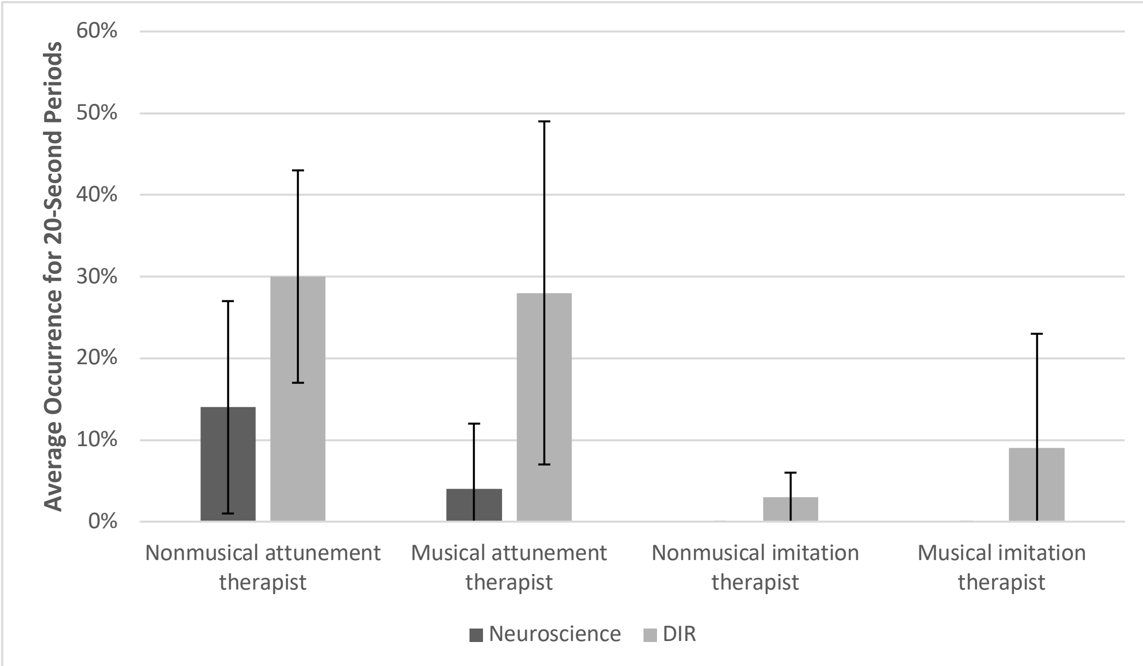

Figure 8. Therapist interactions and responsiveness (PIR).

Note. The error bar represents the standard deviation.

CHAPTER 5: DISCUSSION

The purpose of this study was to delineate the differences of social skill promotion within music therapy sessions between neuroscience-informed and DIR/Floortime™-informed approaches. The comparison was intended to provide information about how a client's social skill behaviors may be influenced by the two approaches and how a music therapist may differently facilitate outcomes, client responses, and music-making.

Critical Elements of the Approaches

The author first wanted to know the extent to which the therapist was consistent in applying the critical elements of the two approaches (similar to fidelity measures). The videos were anonymized for the approach used and the reviewers were able to identify which videos were from each approach. Additionally, most of the videos had high representation of the critical elements checklist (see Table 1 and Table 2), indicating that the videos were representative of the approach used. According to Borrelli (2011), an 80% prevalence for each characteristic would indicate high fidelity, which was the threshold used in this study. Some of the videos fell below this 80% criteria. In video Neuro5, only 56% of the intervention was coded as "therapist-led." However, the clinical music therapist designed the intervention in Neuro5 for the client to take turns and have autonomy in their music-making. The coders agreed that the client-led portions (a DIR/Floortime™ characteristic) of the intervention were within the parameters of a "systematic use of music" and that a deviation from 80% prevalence was understandable. Therefore, the video was deemed representative of the approach and included in the study.

In video DIR4, the coders only coded 59% of the video as "client-directed" but they agreed there were periods of therapist instruction in setting up the environment (not coded as client-directed or as therapist-directed) that limited client-directed opportunities. Additionally, even though the therapist led periods of the intervention, the coders agreed it helped keep the music moving and further encourage client-directed play and creativity. This alternating between therapist-led and client-led is encouraged in a DIR/Floortime™-informed approach in order to expand the client's communication skills and can be expected to happen in some sessions (Carpente, 2013). Furthermore, the back-and-forth music-making can be labeled as dialoguing, an improvisational technique (Wigram, 2004) used in a DIR/Floortime™-informed approach. The rest of video DIR4 met the core DIR/Floortime™ characteristics and "client-directed" was justified, therefore the video was deemed representative of the approach and included in the study.

In video DIR5, the coders only coded 71% of the video as "client-directed." However, the video was focused on a music technology application where the coders agreed that the music therapist made clinically necessary decisions to direct the client on how to properly use and play the music device (the Makey Makey™). The coders also only observed "fluid use of music" for 4% of video DIR5; however, the coders only coded for active music-making and there was a lot of time spent setting up the music technology device (i.e., finding items that would produce sound with the device). As a result, there were limited opportunities for music-making. Furthermore, the therapist directed portions of the music play, which further impacted the prevalence of "client-directed." The coders agreed that "relationship-based" was salient throughout the entire intervention and that the video was representative of the approach.

The author intended the clinical music therapist to source the five neuroscience-informed videos from sessions before they began their DIR/Floortime™ training since their clinical approach became more of a blend between the two approaches during and after their training.

However, the clinical music therapist was unable to locate five examples of videos that addressed social skills and were at least five minutes in length from before beginning their training (that occurred within the specified time period). As a result, the clinical music therapist chose one video that occurred after they were trained in DIR/Floortime™ (Neuro4). The coders agreed that the video upheld the critical elements of a neuroscience-informed approach and it was included in the study.

The clinical music therapist in the videos practiced from a neuroscience-informed approach for 15 years prior to their DIR/Floortime™ training. This may also explain why there were more variations of the critical elements in the DIR/Floortime™ videos than the neuroscience videos. Furthermore, the DIR/Floortime™ videos were taken during their training program when the therapist was still learning how to practice from a DIR/Floortime™-informed approach. Although they were using the principles of DIR/Floortime™, it appeared that they used practices from the neuroscience-informed approach when responding in the moment for about a quarter of the time (23.25%; see Table 7). Therefore, it is not unexpected that there are more inconsistencies and variations within the DIR/Floortime™-informed approach.

Client Non-Musical Social Skill Behaviors

The second research question was focused on the differences in client social skill behaviors between the two approaches. In the neuroscience approach, the client demonstrated a higher rate of eye contact, initiation-only of communication, nonmusical imitation, and off task behaviors. In the DIR approach, the client demonstrated a higher rate of joint attention, response to communication, and reciprocal communication. However, a visual analysis of the data showed that most client behaviors between the two approaches were relatively similar, with the potential exception of joint attention and response to communication. It is not clear if the differences in non-musical behaviors are due to video variability, the client's development over time, or differences in the approaches themselves. Further discussions of each behavior are presented below.

Eye Contact

Eye contact was coded for using partial interval recording (PIR, 15 total opportunities of 20 second periods within each five-minute video) and the client demonstrated eye contact in more opportunities during the neuroscience videos (see Table 8). The prevalence of eye contact was highest in Neuro1 and Neuro5. Joint attention was also highest in these videos and since joint attention often includes eye contact (LaGasse, 2014), similarities in numbers were expected. The author also observed that in many of the neuroscience videos, the clinical music therapist directed the client to look at the MT-BC or a student, which explains the higher prevalence of eye contact in these videos. However, the median and interquartile range data suggest that this behavior may be similar between the two approaches and that there may be outliers within the data set (see Table 8). The similarity in behavior may indicate that each approach is appropriate for addressing increased eye contact. A larger sample size of videos could potentially show significant or no significant difference between the two approaches.

Joint Attention

Joint attention was coded for using PIR and the client demonstrated joint attention in more opportunities during the DIR approach (see Table 8). The client demonstrated joint attention in the neuroscience approach; however, joint attention was targeted systematically in a few videos, which increased an expectation for the client's behavior in those videos. For example, in Neuro1 the therapist targeted joint attention by having the client follow the eye gaze of the student or therapist to determine which instrument to play. However, even with the therapist targeting joint attention in a few videos, the client demonstrated the skill more consistently in the DIR/Floortime™-informed approach. Opposed to the systematic nature of the neuroscience approach, the DIR/Floortime™-informed approach also allowed for natural opportunities of joint attention, particularly during music-making. According to Carpente (2012), the therapist typically intends for skills to be addressed during active music-making.

Initiation of Communication, Response to Communication, and Reciprocal Communication

The client demonstrated a higher frequency of response to communication and reciprocal communication behaviors in the DIR approach than in the neuroscience approach (see Table 8). This observation is consistent with the DIR/Floortime™ framework, which is primarily focused on increasing the individual's communication, specifically opening and closing circles of communication within natural interactions (Gernsbacher, 2006; Greenspan & Wieder, 2006). In contrast, music therapists working from a neuroscience-informed approach often target communication by providing direct prompts (Fujii & Wan, 2014; LaGasse, 2019; Patel, 2011). However, the clinical music therapist did not specifically prompt verbal output in any of the neuroscience videos chosen for this study. The client demonstrated higher initiation-only communication behaviors in the neuroscience videos; however, the author observed that many of the initiation-only behaviors were off-topic comments. After off-topic comments, the clinical music therapist re-directed the client to the task (but not long enough in length to be coded as an off-task behavior), which was not observed as frequently in the DIR videos.

It is interesting that communication behaviors happened more frequently in the DIR/Floortime™-informed approach, even though the therapist did not specifically target communication in the videos used in this study. This difference is likely due to the nature of the two approaches (systematic vs. natural) and the role of the therapist and client in each approach (leader vs. follower). These concepts are discussed further under the headings, "Verbal and Physical Prompting" and "Acknowledge/Affirm."

The coders only looked at the prevalence of communication behaviors, however, the author observed that in the neuroscience approach the therapist asked more dichotomous questions (i.e., "this one or that one?") and the client responded with more basic responses (i.e., "this one"). Since the goal of the exercise was not verbal production, the interactions were more systematic and directive, consistent with a neuroscience-informed approach (LaGasse, 2019). The author conversely observed in the DIR approach that the therapist used more open-ended questions and the client demonstrated a wider variety of language during responses. This difference between the two approaches is likely due to the nature of the DIR/Floortime™ framework, which encourages the therapist to engage in natural conversations, provide the client with opportunities to make choices, and use a variety of language within the experience (Carpente, 2016; Greenspan & Wieder, 2006). Additionally, the process of opening and closing circles of communication within the DIR/Floortime™-informed approach appeared to play a role in a client's initiation of communication turning into an instance of reciprocal communication (Dionne & Martini, 2011; Gernsbacher, 2006).

It is important to note that all coded communication behaviors were non-musical. The coders did not include any non-verbal signals or musical interactions when coding the communication behaviors. Musical behaviors that may have been communicative were likely coded for in other categories, such as initiates music, musical responsiveness, or musical imitation.

Non-Musical Imitation, and Off-Task Behaviors

While non-musical imitation and off-task behaviors were higher in the neuroscience approach, the coders did not observe either behavior often (see Table 8) and a visual analysis showed that the behaviors were similar between the two approaches. Non-musical imitation was coded most frequently when the client verbally repeated after the therapist and the coders agreed it was repetition (echolalia) and not an initiation or independent response to the therapist's communication. An off-task behavior was observed only once (in Neuro2) but one coder did not agree it was an off-task behavior. Off-task comments, as mentioned previously, were more common in the neuroscience videos, but those were not coded as an off-task behavior since the definition required the behavior to happen for at least 5 seconds.

Client Musical Social Skill Behaviors

The third research question was focused on the differences in client musical social skill behaviors between the two approaches. The client demonstrated a higher rate of joins in the music and musical imitation in the neuroscience approach. Additionally, the client demonstrated a higher rate of musical responsiveness and initiates music in the DIR approach. Similar to the non-musical client behaviors, a visual analysis showed that most musical behaviors were not substantially different except for joins in the music and musical imitation. It is unclear if differences were due to the characteristics of each approach or other factors. Further discussions and inferences on each behavior are below.

Joins in the Music

The client demonstrated longer average durations of joining in the music during the neuroscience approach (see Table 8). In a neuroscience-informed approach, the therapist emphasizes client engagement and active music-making when working on skills (LaGasse, 2014, 2019; Patel, 2011), therefore long durations of music play was expected. Additionally, the systematic and prescriptive use of music within a neuroscience-informed approach (LaGasse, 2019) resulted in mostly music-making for each of the neuroscience videos. Music-making is also core to the DIR/Floortime™-informed approach (Carpente, 2012), but the approach allows the therapist to have natural discussions and set-up time (like with the Makey Makey™ in DIR5), which limit the possible amount of time for active music-making. It is important to note that the coders did not record if the client joined in the music at appropriate times or not, just when the behavior was present. As an observation, the author estimated that the client joined in the music for at least 90% of appropriate times for all videos, including when the opportunities were lower.

Musical Imitation

Musical imitation was coded for using PIR and the client demonstrated musical imitation in more opportunities during the neuroscience approach (see Table 8). In addition to the differences observed between the mean and standard deviations, the median and interquartile range data suggest an even larger difference between the two approaches, likely due to outlier observations (see Table 8). In many of the neuroscience-informed interventions the therapist and client had different and distinctive musical roles and they would switch roles following an ABAB musical structure, which is congruent with a neuroscience-informed approach (LaGasse, 2019). Often, one of the roles was a repetitive, structured musical refrain (A) while the other role was more improvisational (B). Sometimes when the client was supposed to be improvising, they instead imitated what the therapist was playing. The author believes the higher prevalence of musical imitation in the neuroscience approach may be due to the client's uncertainty in improvisation, which resulted in the client falling back on more familiar, structured material.

Since the therapist did not provide structured material in the DIR videos, the client did not have something to fall back on, which gently forced them to improvise and initiate their own music rather than imitate the therapist's music. Alternatively, the client's musical imitation behaviors could indicate that they were attentive to the therapist but did not yet have the ability to relate and respond to the therapist (Carpente, 2013). Since the therapist used a neuroscience approach before a DIR approach, it is possible that the client increased their relational skills between the two approaches and this development was observed musically.

Musical Responsiveness

Musical responsiveness was coded for using PIR and the client demonstrated musical responsiveness in more opportunities during the DIR approach (see Table 8). This is an appropriate observation in a DIR/Floortime™-informed approach, which emphasizes therapist and client responsiveness (Carpente, 2013). There also appeared to be an incentive to continue interactions with the therapist when the client demonstrated musical responsiveness. Additionally, the author observed that many times the therapist would begin responding to the client's music then the client would start responding to the therapist's music. This back-and-forth exchange is a focus in a DIR/Floortime™-informed approach in order to mirror a natural conversation (Greenspan & Wieder, 2006). The musical translation of this exchange is called dialoguing, which is an improvisational music therapy technique (Wigram, 2004) that is often used by music therapists in a DIR/Floortime™-informed approach (Carpente, 2013). Even though responsiveness is not core to a neuroscience-informed approach, the client still demonstrated the behavior in a few of the videos, although it was not consistent. As mentioned previously, the client could have also increased their ability to socially interact and respond over time, which was observed musically between the two approaches.

Initiates Music

The client initiated music more frequently in the DIR approach than the neuroscience approach (see Table 8). Similarly to musical responsiveness, with more opportunities for the client to lead and initiate music within a DIR/Floortime™-informed approach (Carpente, 2012; Greenspan & Wieder, 2006), the author expected more musical initiation in the DIR videos. Sometimes the music that the client initiated was congruent with the musical experience and other times it was incongruent, but the coders only counted frequency, not appropriateness. The client also demonstrated initiating music during the systematic, therapist-led interventions in the neuroscience approach but the author observed that those instances were associated with either the systematic use of music (it was their role to initiate music) or an off-task behavior (but not for a long enough duration to count in the coding process).

Therapist Responsiveness and Interactions

The fourth research question was focused on the differences in therapist responsiveness and interactions between the two approaches. The therapist demonstrated a higher rate of verbal prompting, physical prompting, and acknowledge/affirm in the neuroscience approach. Additionally, the therapist demonstrated a higher rate of nonmusical attunement, musical attunement, nonmusical imitation, and musical imitation in the DIR approach. A visual analysis showed substantial differences in verbal prompting, acknowledge/affirm, attunement behaviors, and imitation behaviors. Compared with the client behaviors, the therapist behaviors appeared to have larger differences between each approach. Further discussions and inferences on each behavior are below.

Verbal and Physical Prompting

The therapist demonstrated verbal prompting more frequently during the neuroscience approach (see Table 8). This behavior is potentially associated with the systematic use of music. In a neuroscience-informed approach, the client and therapist have a role within the intervention (LaGasse, 2019); therefore, the therapist may need to verbally redirect the client to the task if they begin to disengage. The coders likely observed less verbal prompting in the DIR videos because the therapist would often follow the client's lead and engage with most behaviors instead of directing what they were doing. This therapist behavior appeared to also influence the client's communication behaviors, since the therapist would respond to off-topic comments or integrate the comments within the music, opposed to verbally or physically redirecting the client in the neuroscience videos. Physical prompting was slightly higher in the neuroscience approach; however, a visual analysis showed more similarities than differences. It is also important to note that physical prompting was sometimes difficult to code for because the therapist's back was often to the camera and the coders could not always see if the therapist was physically prompting the client.

Acknowledge/Affirm

The therapist demonstrated acknowledging and affirming behaviors more frequently during the neuroscience approach (see Table 8). Similar to prompting, since the therapist had expectations for the client in the neuroscience interventions, it would be natural to affirm when the client completed the desired behavior. Conversely, in the DIR videos, the client and therapist often engaged in the music together and the emphasis was on mutual enjoyment and relationship-building (Carpente, 2012), which did not require affirmations that the client was doing "the right thing." Alternatively, the client may have been leading a majority of the intervention in the DIR videos and instead of affirming the client, the therapist followed their lead. While having the therapist follow their lead may still contribute to the client's motivation, it was not an explicit acknowledgement or affirmation of the client.

Nonmusical and Musical Attunement

Nonmusical and musical attunement was coded for using PIR and the therapist demonstrated more attunement in the DIR approach (see Table 8). However, this was the hardest behavior to code for and the behavior with the highest frequency of disagreement between the two coders. The author defined attunement as the therapist *changing* their musical or nonmusical behavior in response to the client (Kim et al., 2008). Attunement was easier to code for in the DIR videos because the therapist would more obviously change their behavior or music in response to the client. In contrast, attunement was particularly debatable in the neuroscience videos.

In the neuroscience approach, the music therapist remained fairly unchanged. It often appeared like the therapist was providing a consistent, grounding affect opposed to a more expressive, extending, and encouraging affect in the DIR approach. The grounding nature of the therapist and music could be considered attunement if the therapist recognized that the client would respond best to consistency or that it would be effective for sensory regulation (LaGasse, 2019). Alternatively, the therapist could have decided to remain unchanged to emphasize the role of the music, which is a central component of the neuroscience-informed approach (LaGasse, 2019). In a video, though, intention cannot be coded for, so the coders chose to not code for attunement in those instances. As a result, the coders identified little to no attunement in each neuroscience approach video, which is in contrast to the more consistent prevalence in the DIR approach. Additionally, while the coders agreed many times that the therapist's behavior was appropriate in both approaches, they were not coding for appropriate and inappropriate behaviors, just for the presence or absence of behaviors.

Nonmusical and Musical Imitation

Imitation was coded for using PIR and the therapist demonstrated imitation only during the DIR approach (see Table 8). In order for the therapist to imitate the client, the client would have to be leading and that is a core feature of a DIR/Floortime™-informed approach (Carpente, 2012, 2016). Therefore, the author expected to see imitation in the DIR videos only. Additionally, the author also expected to see a higher prevalence of musical imitation since the music therapist's goal is to build a relationship through the music and musical imitation is a beginning step to musical social engagement (Carpente, 2016).

Clinical Implications

As a board-certified music therapist, the author examined the results in order to draw clinical implications from the findings. Due to the single case, the implications are limited to clinical practice with this one individual. Some of the same conclusions may apply to other clients and music therapists; however, further research is warranted. Clinical implications are discussed below.

It is common for the music therapist in a neuroscience-informed approach to target specific skills. Since specific client behaviors (eye contact, joint attention, initiating music, etc.) increased during targeted interventions in the videos, a neuroscience-informed approach may be most appropriate to elicit such skills. Additionally, the structure of the interventions in the neuroscience-informed approach increased the duration of the client's music-making; however, the music-making was more prescriptive in nature. Furthermore, the therapist used more acknowledgements and affirmations within this approach, which may further encourage the client to participate in the interventions. As noted in the results, these affirmations were typically indicating that the client was successfully showing the behavior that the therapist was targeting. These aspects of the neuroscience-informed approach appeared to be helpful in teaching, working on, and prompting specific social skill behaviors. Therefore, this approach may be most appropriate when the client is learning a new skill or needs to work on increasing a particular skill since the environment and interventions are set up to optimally target specific behaviors.

In the DIR/Floortime™-informed approach, most of the client behaviors were observed consistently, which is likely due to the natural and flexible nature of the music-making and client-therapist interactions. Additionally, some behaviors decreased in the DIR approach but were balanced by an increase in another behavior. For example, eye contact decreased but joint attention increased, which is a higher-order social skill and more important for maintaining social relations (Franchini et al., 2017). Additionally, initiation of communication decreased, but responding and reciprocating communication increased, which could also be considered as more essential and for social interactions. Overall, though, the client maintained most behaviors in the DIR approach with a decrease in specific prompting. Therefore, the DIR approach may elicit genuine social skills in a more natural, flexible, and interactive way and may be a better approach for practicing and generalizing the skills learned in a neuroscience approach.

It is important to note that since the neuroscience approach was used first, it is unknown if the client would have still demonstrated some of the same behaviors in a DIR approach had they been exposed to it first. The client's development and maturation over time was not accounted for but could have affected the observations. Additionally, the author did not explore combining the two approaches. By including elements of each approach, the therapist may improve treatment for the client by offering prescriptive experiences in combination with interventions to generalize the skills.

As mentioned in the discussion, a visual analysis of the data showed that many of the client behaviors were not actually that different from each other between the approaches. Therefore, both approaches promoted social skill behaviors in the client, indicating that each approach may elicit similar social skills. The largest visual difference was in the therapist behaviors. This is interesting, because it implies that a change in the therapist behaviors did not significantly affect the client's behaviors. This may indicate that the music, musical interactions, and characteristics of the approaches themselves may be more impactful in the client's development than how the therapist affirms, prompts, and interacts with the client. Or rather, the therapist may have a critical role in applying the characteristics of each approach but both approaches similarly elicit client behaviors and the type of approach may not be as critical to client progress and engagement in treatment.

Limitations

The study has multiple limitations. First, there was only one participant, meaning that the results cannot be generalized. Additionally, the videos were taken over a 13-month time period, with a majority of the neuroscience videos first and the DIR videos afterwards. Along this time period, there may have been changes due to maturation but the author did not account for this in any data analysis.

The videos that were used were not intended for research, which added multiple limitations. Although the therapist addressed similar goal areas throughout the treatment period, the variety of client needs during that time meant that many of the videos did not address the same skills nor were they structured in similar ways. Although this may be typical in treatment, it meant that the videos were not directly comparable for research. There were also points in many of the videos when the client or therapist would not be visible because they were out of frame or behind one another. In order to account for this, the author chose to use PIR for behaviors that might be difficult to measure through frequency count if the individual was not visible (Zakszeski et al., 2017). Additionally, PIR was chosen for other behaviors where there could be grey areas, like attunement, since the sessions were not designed to manipulate those behaviors and PIR would allow for higher accuracy of coder agreement (Zakszeski et al., 2017). However, PIR may have underrepresented the frequency of some behaviors.

Finally, as mentioned previously, the coders did not determine whether a behavior was appropriate or inappropriate, they just coded for the presence or lack of presence. For example, “initiates music” could have been always appropriate during the neuroscience videos but only appropriate 80% of the time in the DIR videos. Since the coders did not discriminate between the two, these determinations are unknown.

Future Directions

The current literature for neuroscience-informed and DIR/Floortime™-informed approaches is limited and studies have only aimed to determine if the selected approach was effective for the individuals receiving treatment. There are no current comparisons of the two approaches. Since this study is the first, there are many avenues for future research. First, researchers could design a study to look at specific behaviors from the beginning instead of retrospective in order to have more control over different variables. Next, researchers could expand the sample size of the videos, including video length and number of videos. Similarly, researchers could expand the population set and examine differences in client behaviors between approaches for different ages and diagnoses. Additionally, future researchers could examine the effectiveness of each approach rather than descriptive statistics, which only provides a picture of behaviors and no information on effectiveness. As a note, it might be helpful to begin an effectiveness study with a smaller set of behaviors to monitor. Finally, future researchers could compare whether the therapist or client demonstrate a higher rate of appropriate or inappropriate behaviors between the two approaches.

The critical element measures designed for and used in this study may be beneficial to future researchers. The descriptions can help move towards the development of fidelity measures to provide high reliability and validity of the two approaches when used in music therapy treatment studies.

Conclusion

This study was the first known study to compare the differences between a neuroscience-informed approach and a DIR/Floortime™-informed approach. The author compared client social skill behaviors, client musical behaviors, and therapist responsiveness between the two music therapy approaches in order to examine the differences. The author found differences between the two approaches in all behaviors and made inferences on those differences and discussed clinical implications of the observations. Future research is needed in order to better inform music therapy treatment.

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