IJSE Journal International Journal of Special Education

Social Emotional Effects of Drumtastic: A Dyadic Within-Group Drumming Pilot Program for Children with Autism Spectrum Disorder

Published in 33.1. Domain's address: www.internationalsped.com/issues.cfm

Trason Willemin, Lyn G. Litchke, PhD, Ting Liu, PhD

Texas State University

Carrie Ekins, MA

Doctoral candidate at the University of Chemnitz, Germany.

Educators and practitioners working with children diagnosed with Autism Spectrum Disorder (ASD) are concerned with deficits in positive affect and social-emotional reciprocity, which may affect their daily living and school success. This pilot study explored the social-emotional impact of eight one-hour sessions of a novel dyadic within-group drumming program called Drumtastic for children with ASD at a four-week summer camp. Participants were 14 children diagnosed with ASD ranging in age from 5-14 years. Paired sample t-test revealed that children with ASD scored significantly higher on the posttest on Smiley-o-meter, t(13) = -2.193, p=.047 and Fun-o-meter, t(13) = -2.235, p=.044 when compared to their pretest scores. The Social Personal Relationship Scale showed a trend for improvement but did not elicit a statistically significant change in children's social and personal skills. These results suggest that the children with ASD significantly improved in the domains of enjoyment and fun, and showed a positive trend for developing improved social relationships with peers and camp counselor partners.

Key words: *Autism, Drums Alive, Dyadic Drumming, Social Relationship, Affect.*

Introduction

Autism Spectrum Disorder (ASD) is a neurodevelopmental condition that effects 1 in 68 children ages 3 to 17 (CDC, 2016). Kogan et al. (2007) suggests that the prevalence rates of ASD are much higher and the true number is closer to 1 in 50. ASD is identified by persistent deficits in social communication and social interaction across multiple contexts. Deficits are manifested in social-emotional reciprocity, nonverbal communicative behaviors used for social interaction, and in developing, maintaining and understanding relationships (APA, 2013). Srinivasan, et al., (2015) noted that "socially embedded movement-based contexts are valuable in promoting imitation/praxis, interpersonal synchrony, and motor performance and should be included within the standard-of-care treatment for children with ASD" (p.1), suggesting that socio-motor skills are essential to education and intervention strategies in ASD.

Practitioners who work with children with ASD have found many social-emotional benefits from different types of gross motor skills like group drumming (Ekins et al., 2017; Guzic, Tonkin,

Roberts, & Demuth, 2011; Ho, Tsao, Bloch, & Zeltzer, 2011; Kartasidou, Varsamis, & Sampsonidou, 2012; Locke & Clark, 2009). Group drumming is a recreational music making activity that builds social-emotional skills creating a collectivistic diverse culture, which can eliminate the stigma of therapy (Ho et al., 2011). Ho et al. found significant improvements in social-emotional behaviors in low-income children who engaged in contemporary drum circles and group counseling. In addition, children with intellectual disabilities and behavioral challenges who engaged in African drum circles led to positive improvements in motor coordination, memory, attention, eye contact and aggression (Locke & Clark, 2009). Moreover, children with intellectual disabilities who engaged in brain-body group drumming on large exercise balls to music, called Drums Alive® kid beats, demonstrated increased motor function, feelings of motivation, fun, concentration, and rule compliance (Ekins et al., 2017).

Another type of drumming is dyadic drumming which involves the biological concept of rhythmic entrainment, whereby two rhythmic processes interact with each other in such a way that they adjust towards and eventually 'lock in' to a common phase and/or periodicity (Trost et al., 2014). Another key aspect of dyadic drumming is the addition of "reciprocity" to rhythmic entrainment that focuses on socially coordinated behavior between two individuals. Dyadic drumming promotes interpersonal action synchronization (IAS) whereby two partners intentionally adapt their own timing of social behavior to the timing of others' actions. This type of physical and social synchronization is necessary to promote success in one's social life as individuals need to synchronize their actions in a wide range of situations and with different partners (Kleinspehn-Ammerlahn et al., 2011), especially if the rhythm is produced with "strong beat," "high groove" music that a person is emotionally connected to. A link can be built between emotions and proprioceptive feedback (Trost, et al., 2014). Guzic et al. (2011) reported that dyadic drumming with a college partner resulted a positively impact on children with ASD's ability to concentrate and attend to task.

The concept of IAS is in line with Vygotsky (1998)'s zone of proximal development (ZPD) theory which describes the discrepancy between the child's current level of development and the desired level of development to function in the necessary context. According to Vygotsky, development of young children occurs within a social-cultural context and there is a distance between actual development during independently solved tasks and potential development when tasks are solved under the assistance of an older and more experienced partner. Older individuals activate children's ZPD, allowing them to reach levels of performance that they would not reach without a facilitating social context (Kleinspehn-Ammerlahn, Riediger, Schmiedek, von Oertzen, Li, & Lindenberger, 2011) Using Vygotsky's perspective, dyadic drumming is considered a necessary tool of the social-culture context. Children with ASD are at-risk for developmental delays in social-emotional skills unless successful educational interventions occur. Interventions incorporating dyadic drumming may provide positive experiences for children with ASD's social, emotional and behavioral deficits. However, limited research has been conducted to investigate the effects of drumming on social-emotional development for children with ASD. Research focusing on rhythmic drumming, in a group or dyad, suggest that drumming may be a viable therapeutic intervention to address social-emotional deficits in current treatment interventions. Therefore, the purpose of this research was to pilot and investigate the effects of a four-week novel dyadic within-group drumming intervention program, Drumtastic®, on social relationships and mood for children with ASD.

Method

Participants

Participants were recruited from a four-week summer day camp for children and adolescents diagnosed with ASD. Fifty participants of the Autism Summer Camp were invited to participate in the study. Parents and guardians of participants were given a detailed description of the study before being asked to sign an informed consent approved by the Texas State University Institutional Review Board (IRB). Fourteen of the 50 participants invited met the inclusion criteria of the study. To be eligible for this study, participants needed to attend a minimum of six of the eight sessions over a four-week period. All the eligible participants were male, ages ranging from 5 to 14 years of age (M = 10 years). Each of the 14 participants were diagnosed with Autism Spectrum Disorder, and severity ranged from Level 1 to Level 3. The level of severity ranges from Level 1, "Requiring support," Level 2, "Requiring Substantial Support," and Level 3, "Requiring very substantial support." Six children were categorized as Level 1, seven were classified as Level 2, and one was Level 3 (APA, 2013).

Procedures

The primary investigator (PI) utilized assistance from 19 Graduate Student Mentors (GSMs) predominately therapeutic recreation students who were engaged in the assessment, planning, implementation, and evaluation of the drumming program. The PI trained these GSMs in program planning and implementation, therapeutic best practice approaches towards facilitating recreation programming with children with ASD, as well as instruction on collecting data with the instruments used in this study. GSMs collected periodic data from participants in both a pre-test–post-test format as well as intervention session-specific collection of participant data before and after each drumming intervention session. The sessions were facilitated by the PI and two GSMs all certified Drumtastic® Instructors.

Children with ASD participated in the dyadic within-group drumming intervention for four weeks with two 60-minutes sessions a week. The primary intervention used for the participants was Drums Alive Drumtastic®. Drums Alive is an evidence-based "All inclusive - No participant left behind" program that applies fitness, drumming, music, and educational concepts designed to improve social, emotional, physical and cognitive health, and well-being (Drums Alive, 2017). Throughout the four-week intervention, all participants had an assigned GSM whose role was to monitor behavior, assist in the movement, drumming, rhythmical and cognitive activities, help improve socialization skills, foster teamwork, model, assess and correct proper body mechanics and create a positive sense of social and emotional wellbeing without discouraging participation in individual or group activity.

There were three main areas of the Drumtastic® curriculum selected. The first area focused on implementation of the multi-modular protocols that combined physical education, fitness, dance, drumming, music education, mindfulness and relaxation strategies. Second. we accelerated learning through movement and rhythm exercises that supported and reinforced "Motor and Sensory Memory" through targeted and continuous incorporation of multi-sensory inputs (Sight, Sound, Smell, Touch, Emotion) to elicit immediate and measurable auditory, visual and physical feedback. Third, we facilitated engagement of productive physical and cognitive activities that enhanced neural plasticity and improved executive function.

The Drumtastic® equipment provided each participant with a large exercise stability ball (sometimes referred to as a "drum"), a large bucket to hold the ball in place during the exercises; and two pair of drumsticks (one normal set and another set adorned with scarfs). The drums were placed throughout the room in a four person "+" pod formation to accommodate all the participants and their GSMs and to create a dyadic within-group drumming experience.

Each one-hour Drumtastic® session consisted of seven sections. Section one was a five-minute warm-up that included fine motor dexterity exercises using drumsticks while participants and GSMs lightly bounced as they were seated on their exercise ball. Section two consisted of ten minutes of drumming and movement exercises on the large balls while simultaneously singing familiar songs and chants. The third section involved ten minutes of cognitive and rhythmical clapping games using the various drum equipment and visual cue cards. The fourth section was a five-minute break for recovery with participants choosing from three resting, self-soothing positions: 1) bouncing while seated on their ball, 2) laying on their stomach over their ball and rocking, or 3) supine on the floor with legs resting on their ball. The fifth section was fifteen minutes of drum and dance choreography set to music that was selected by the participants. The sixth section was ten minutes of yoga relaxation exercises with participants laying on, or rolling up in, yoga mats while engaged in deep breathing protocols and receiving a carefully monitored GSM massage using lavender scented oil. Section seven, the final section, was a cool down period five minutes in duration. Participants were seated alongside their GSM on a yoga mat, sharing in the closing session with yoga stretches, rhythmical Kirtan Krya chanting and "call and response" positive affirmations.

Instruments

Observational data was collected before and after the eight sessions by each participant's GSM using the Social and Personal Relationship Scale (SPRS). The SPRS was piloted for this study and based on the goals of the Drumtastic® curriculum. This assessment provided information regarding the participant's demonstration of pro-social emotive responses and pro-social adaptive skills. The SPRS includes 20 items measured on a five-point Likert-scale which describe the child's pro-social affect presentation (e.g., respect for others, appreciates others' performances) as well as each participant's demonstration of pro-social behaviors (e.g. shows concern when others are upset, participates as a follower).

In addition, GSMs used modified elements of Read, MacFarlane, and Casey's (2002) Fun Toolkit. The modified Fun Toolkit was used to provide participants the opportunity to give meaningful feedback as to their level of enjoyment in the activity. Instrumentation used from this toolkit included the use of the "Smiley-o-meter" and the "Fun-o-meter." The "Smiley-o-meter" consisted of five visual smiley "emoji" faces depicting feelings on a horizontal enlarged board outside the drumming room. The "Fun-o-meter" had the same five emoji faces only in a vertical thermometer enlarged board posted outside the drum room. The children were asked by their GSM to point or stand next to the emoji face that represented how they felt before and after each drum session. Both tools were used to compare the accuracy and usability of these scales with the participants. GSMs recorded these scores before and after each session and the scores they believed were most accurately represented the child's level of enjoyment. comparison.

In the second week of the pilot study, GSMs noted that many of the participants requested scores greater than allowed on the five-emoji face Smiley-o-meter indicative of the ceiling effect, thus a newer Smiley-o-meter was developed with eight emoji faces that ranged from Frustrated/Angry to Excited. Another change adopted at the same time was to discontinue the use of the fun-o-meter. GSMs noted that some of the participants were unable to physically reach all of the emoji faces, limiting them from choosing emoji faces higher on the meter. The eight-visual emoji smiley-o-meter gave researchers greater accuracy choice and more effectively covered the range of emotions continuum for the participants, thereby improving the validity of the scales. (Krosnick & Presser 2010) describes this on two of the four points he noted in his book in the chapter titled "Number of points on rating scales." "First, the points offered should cover the entire measurement continuum, leaving out no regions. Second, these points must appear to be ordinal, progressing from one end of a continuum to the other, and the meanings of adjacent points should not overlap."

Facilitator-derived data collection was augmented by parental/ guardian's feedback before and after the eight-session intervention using the Positive and Negative Affect Schedule for Children (PANAS-C; Laurent et al., 1999). The PANAS-C parent version includes a 20-item inventory of both positive affective terms (e.g., energetic, happy, joyful), as well as negative affective terms (e.g., lonely, mad, scared; (Ebesutani, Smith, Reise, Higa-McMillan, & Chorpita, 2012). Each affect item is Likert rated one to five; a score of one indicating that the affect is very slightly or not at all present, and a score of five indicating that the affect is "extremely" present. When reporting on the extent of each affective term, parents were directed to consider the last several weeks of the young person's affect when selecting responses for their child.

Data Analysis

Descriptive analyses were used to analyze children's performance on Smiley 5, Smiley 8, Fun, and SPRS overall scores before and after the 8-session of intervention. Emoji faces were used and corresponded with a number to obtain the Smiley raw scores. A Likert Scale was used to measure the SPRS raw scores and 20 affective characteristics were measured. Paired sample t-tests were conducted on the Smiley 5, Smiley 8, Fun, and SPRS scores to examine the significant differences between pre-and post-tests. Results were considered significant when alpha value was less than .05. Effect sizes (ES) was calculated for practical significance using Cohen's *d* (Cohen, 1988).

Results

Descriptive statistics showed that children with ASD had higher overall scores in the post-test when compared to their pre-test scores on Smiley 5, Smiley 8, Fun, and SPRS after 8 sessions of intervention. The paired sample t-test revealed that children with ASD scored significantly higher on the posttest in Smiley 8, $t(13) = -2.193$, $p=.047$ and Fun, $t(13) = -2.235$, $p=.044$ when compared to their pretest scores. Children improved 9% in Smiley and 5% in Fun in their post-test. However, no statistical significant differences were found on Smiley 5 and SPRS. These findings suggested that drumming activities improved children with ASD's fun and enjoyment after eight sessions of intervention. Participants' significant pre-test and post-test improvement is presented in Figure 1.

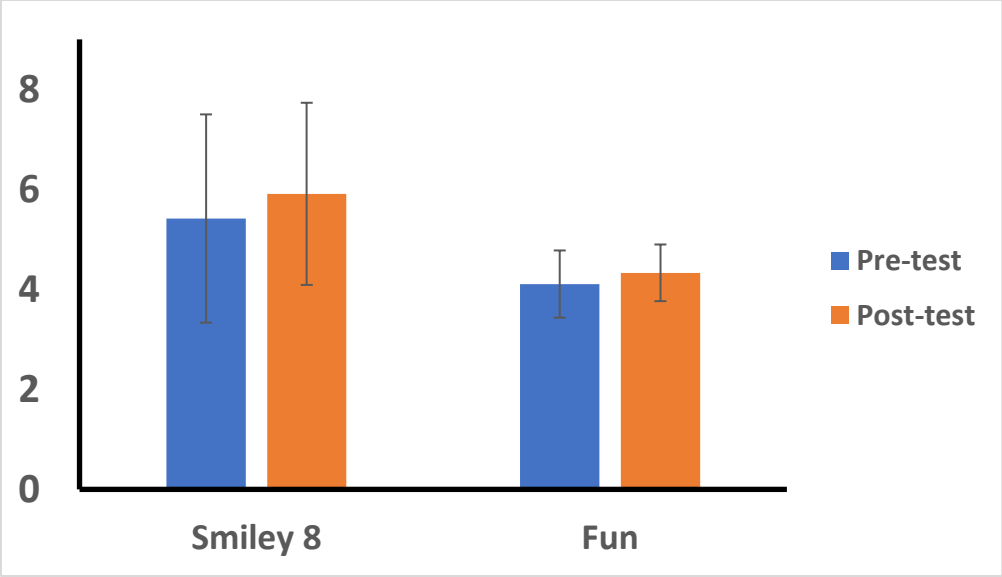

Figure 1. Smiley 8 and Fun after the eight-week intervention.

The effect sizes (ES) describing the children with ASD pre-test and post-test performance differences were moderate on smiley 8 (ES = -.25) and fun (ES = -.36). The medium ES results suggest that the true effect of the pre-test and post-test differences in the populations might be medium.

Discussion

This pilot study explored the effects of a novel dyadic within-group drumming intervention program on social-emotional skills of children with ASD, The children in the summer camp program significantly improved in the domains of enjoyment and fun, and showed a positive trend for developing improved social relationships with peers and camp counselor partners. The results of this study suggest that this type of alternative therapy may be used to effectively mitigate some of the social-emotional difficulties of children with ASD in a fun, non-stigmatizing energetic environment. This is important because as children with ASD develop into adolescents, this type of drumming activates can be a segway to build relationships amongst inclusive peers (Ho et al., 2011).

Our findings were in support of Vygotsky (1998)'s ZPD theory that learning takes place with other individuals in the environment. The effectiveness of the intervention maybe due to the combination of key aspects of the drumming program including dyadic within-group drumming formation, inclusion of an intergenerational partner (GSM), and a consistent routine including: familiar songs, rhythmical clapping and cognitive games, and movement to music drum choreography. The use of dyadic within-group drumming partnerships promoted the formation of social relationships by reinforcing the biological construct of reciprocal rhythmic entrainment at the motor and social levels (Kleinspehn-Ammerlahn et al., 2011; Trost et al., 2014). Research on dyads in drumming and physical activity confirm that there is a social relationship factor that is reciprocal in nature and may contribute to improved activity participation in a cooperative manner with another person (Kleinspehn-Ammerlahn et al.; Lopes, Gabbard, & Rodrigues, 2016). Furthermore, since reciprocal rhythmic entrainment is an important component of emotional connection to music,

perhaps the use of "strong beat" 'high groove" music that was self-selected by our participants led to improving their enjoyable and fun drum experience (Trost et al., 2014).

Furthermore, an intergenerational more experienced college partner (GSM) was added to the dyadic within-group drumming to meet children's needs amongst a larger rhythmical group ensemble. This change conformed to Vygotsky (1998)'s ZPD theory whereby two people working together have a greater potential to achieve levels of performance they otherwise would not. Therefore, our study supports the use of the educational ZPD concept in play, creating a new type of learning environment building on the connection between kinesthetic experiential movement and cognition (Guzic, et al., 2011; Hannaford, 2005; Klienspehn-Ammerlahn et al., 2011). In addition, our findings are in line with Reinders, Fletcher, & Bryden, (2015) and Guzic et al., who also employed college student partners to dance and drum with children with ASD. This one-to-one partner showed significant activity engagement for each participant because they received constant help and attention as needed.

The strength of the intervention was reflected in the effectiveness of our protocol derived from the main focus areas of the Drumtastic® program comprised of singing, games, rhythmical clapping, and full body choreography movements while drumming (Drums Alive, 2017). Researchers suggest that when working with children with Intellectual and Developmental Disorders (IDD) and ASD, the most critical components for success are listening, singing, music-making, and rhythmic actions synchronized to music, experienced in individual or socially embedded, dyadic, and group activities (Ekins et al., 2017; Locke & Clark, 2009; Srinivasan & Bhat, 2013). This type of multisystem treatment tool may be a contributing factor to the trend for improved social relationship and enjoyable affect found in our study. The research of Ekins et al. and Locke and Clark give interesting results regarding the significant enjoyable experience of their young participants with IDD who engaged in Drumtastic® and African group drumming respectively. Their findings suggest that it is the unique aspect of drumming to the same beat, in a social group setting that contributed to their additional significant changes in motor coordination, memory, engagement (eye contact), aggression impulse control, and listening that children with special needs respond positively to. This suggests the need to further investigate this Drumtastic® protocol beyond this pilot study.

Research in both neuroscience and socio-emotional development show that movement to music, such as dance, has additional benefits that go beyond traditional learning. The strategic use of drum choreography with dance type movements were a main part of our protocol that finds support in the dance and movement to music research (Bonbright Bradley, & Dooling, 2013; Gonzalez, 2015; Paulson, 2002; Pierman, 2016; Reinders, Fletcher, & Bryden, 2015). Paulson (2002), for example, argues that learning and performing activities physically changes the brain due to plasticity, and it is possible to use dance to create new neurological pathways for learning. When participants engage in dance or rhythmical movement, such as drum choreography, they activate multiple systems in the brain. Furthermore, dance inspires emotion, and because emotion stays linked to learning, the dance-elicited emotion is a powerful learning tool. In addition, Pierman's "Dancing for Development" program was correlated with gains in all three areas of development in socio-emotional, cognitive, and motor domains. In our study, we asked participants to come up with their own signature drum moves during the game portion of the program to promote cognitive self-creativity, social awareness, and learning.

Central to Bonbright, et al. (2013) and Overy and Molnar-Szakacs (2009) research, dance stimulates mirror neurons (i.e., neurons in the brain that activate both when one performs an action and when one sees another person performing the same action). In our drum choreography, participants watched the demonstration of movement before they attempted it themselves which is similar to dance instruction. Because mirror neurons are activated in both cases, learning can happen more quickly and effectively. Mirror neurons have also been related to the development of empathy in children. In mirroring exercises, students imitate one another while they express themselves through movement. Specifically designed for children with ASD, Gonzalez incorporated in her program the goal of improving "social skills such as listening, taking turns, greeting and parting, and making eye contact" (2015, p. 16). Her class structure was highly regulated to provide a consistent routine which was also a strategic focus of our program as this has been shown to be crucial for children with ASD. Conceivably, this may be the reason for the changes in social-emotional behaviors in our study.

There were some general limitations to our study. The nature of pilot studies themselves limit the generalizability of the findings due to the small sample size and a lack of a control group. Thus, our findings act as suggestions for further research. In addition, we were piloting a new SPRS based on the specifics of the Drumtastic® program components, thus the lack of significant changes in social relationships may have not been adequately captured by this new instrument. Furthermore, the lack of findings on the PANAS-C completed by the parents of the participants before and after the eight drum sessions could be explained by non-transferable behavior changes outside the camp setting.

Conclusion

In summary, educators and therapists have long understood the connection of rhythmic movement, learning, and growth (Hannaford, 2005). Kinesthetic activities have the power to unlock cognitive processes which otherwise remained trapped or inaccessible (Kartasidou, et al, 2012). The viewpoint taken in this study supports other research that there are less stigmatizing therapies that can maximize whole brain impact through incorporating strategic drumming movement to music through dyadic partnerships for children with ASD.

Conclusively, this pilot research indicates that there is a positive social-emotional effect of dyadic within-group drumming with an intergenerational partner (GSM) for children with ASD. Such skills and abilities are critical to positive and lasting inclusion of children with intellectual disabilities into recreational pursuits with their peers (Siperstein, Glick, & Parker, 2009).

References

American Psychiatric Association. (APA; 2013). *Desk reference for diagnostic and statistical manual of mental disorders* (5th ed.). Washington, DC: American Psychiatric Publishing.

Bonbright, J., Bradley, K., & Dooling, S. (2013). Evidence: A report on the impact of dance in the K-12 setting. *National Dance Education Organization*. 1-65.

Centers for Disease Control and Prevention. (CDC; 2016). Autism spectrum disorder data and statistics. Retrieved from https://www.cdc.gov/ncbddd/autism/data.html

Cohen, J. (1988). *Statistical power analysis for the behavioral sciences* (2nd ed.). New York: Academic Press.

Drums Alive. *Drumtastic Program for Educators* (2017), Retrieved from https://www.drums-alive.com/programs/new-drumtastic-program-for-educators

Ekins, C., Boehr-Wright, J., Schulz, H., Wright, P. Owens, D., & Miller, W. (in press December 2017). Effects of a Drums Alive® kid beats intervention on motor skills and behavior in children with intellectual disabilities: A pilot study. *Palaestra, Adapted Sport, Physical Education, and Recreational Therapy.*

Ebesutani, C., Regan, J., Smith, A., Reise, S., Higa-McMillan, C., & Chorpita, B. (2012). The 10-Item positive and negative affect schedule for children, child and parent shortened versions: Application of item response theory for more efficient assessment. *Journal of Psychopathology & Behavioral Assessment,* 34(2), 191-203. doi:10.1007/s10862-011-9273-2

Gonzales, S. S. (2015). A movement and music program for children with autism. *Dance Education in Practice, 1*(1), 16–22. doi:10.1080/23734833.2015.990339

Guzic, B. L., Tonkin, K., Roberts, J. B., & Demuth, B. R. (2011). Using percussion to improve attention-to-tasks in children with autism. *Exceptional Parent,* 41(3), 18-20.

Hannaford, C. (2005) *Smart moves.* Salt Lake City, UT: Great River Books.

Ho, P., Tsao, J. I., Bloch, L., & Zeltzer, L. K. (2011). The impact of group drumming on social emotional behavior in low-income children. *Evidence-Based Complementary & Alternative Medicine,* 8(1), 1-14.

Kartasidou, L. Varsamis P., & Sampsonidou A (2012). Motor performance and rhythmic perception of children with intellectual and developmental disability and developmental coordination disorder. *International Journal of Special Education,* 27 (1), 74-80.

Kleinspehn-Ammerlahn. A., Riediger. M., Schmiedek, F., von Oertzen, T., Li, S.C., & Lindenberger, U. (2011). Dyadic drumming across the life span reveals a zone of proximal development in children. *Developmental Psychology*, 47 (3), 632–644. doi:10.1037/a0021818.

Kogan, M. D., Blumberg, S. J., Schieve, L. A., Boyle, C. A., Perrin, J. M., Ghandour, R. M., . . . VanDyck, P. C. (2009). Prevalence of parent-reported diagnosis of autism spectrum disorder among children in the US, 2007. *Yearbook of Pediatrics,* 124(4), 74-77. doi:10.1542/peds.2009-1522

Krosnick, J.A., & Presser, S. (2010) *'Question and questionnaire design'* in: Handbook of Survey Research (2ed.), Emerald Group Publishing. pp.263-313.

Laurent, J., Catanzaro, S. J., Joiner, T. J., Rudolph, K. D., Potter, K. I., Lambert, S., & ... Gathright, T. (1999). A measure of positive and negative affect for children: Scale development and

preliminary validation. *Psychological Assessment,* 11(3), 326-338. doi:10.1037/1040-3590.11.3.326

Locke, K. & Clark, D. (2009). Can African drumming impact social/emotional development of young children. *Canadian Children,* 34(2), 10-15.

Lopes V. P., Gabbard C., & Rodrigues. L. P. (2016). Effects of psychosocial variables in the similarity and interdependence of physical activity levels among adolescent best friend dyads. *Journal of Sports Sciences,* 34(9), 821–828. doi.org/10.1080/02640414.2015.1075054

Overy, K., & Molnar-Szakacs, I. (2009). Being together in time: musical experience and the mirror neuronsystem. *Music Perception,* 26, 489–504.

Paulson, P. (2002). The brain and learning. *Journal of Dance Education,* 2(3), 81–83.

Pierman, EL. (2016) *Wiggle Room: The impact of dance on Pre-K children with special needs.* Master's Thesis, Ohio State University.

Read, J. C., MacFarlane, S. J., & Casey, C. (2002). *Endurability, engagement and expectations: measuring children's fun.* In Proceedings of interaction design and children (pp. 189–198).

Reinders, N., Fletcher, P., & Bryden, P. (2015). Dreams do come true: The creation and growth of a recreational dance program for children and young adults with additional needs. *Journal of Dance Education,* 15(3), 100–109. doi:10.1080/15290824.2015.1056792

Siperstein, G. N., Glick, G. C., & Parker, R. C. (2009). Social inclusion of children with intellectual disabilities in a recreational setting. *Intellectual & Developmental Disabilities,* 47(2), 97-107. doi:10.1352/1934-9556-47.2.97

Srinivasan, S. M., Kaur, M., Park, I. K., Gifford, T. D., Marsh, K. L., & Bhat, A. N. (2015). The effects of rhythm and robotic interventions on the imitation/praxis, interpersonal synchrony, and motor performance of children with autism spectrum disorder: A Pilot Randomized Controlled Trial. *Autism Research and Treatment*, 1-18. doi:10.1155/2015/736516

Srinivasan, S. M., & Bhat, A. N. (2013). A review of "music and movement" therapies for children with autism: embodied interventions for multisystem development. *Frontiers in Integrative Neuroscience*,7(22), 1-15. doi: 10.3389/fnint.2013.00022

Trost, W., Frühholz, S., Schön, D., Labbé, C., Pichon, S., Grandjean, D., & Vuilleumier, P. (2014). Getting the beat: Entrainment of brain activity by musical rhythm and pleasantness. *NeuroImage,* 103, 55–64.

Vygotsky, L. S. (1998). *Early childhood*. In R.W. Reiber (Ed.), Child Psychology, Vol 5. *The collected works of L.S. Vygotsky,* (pp.187-205). New York: Plenum (original works published 1982-1984)