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Assessing the Effectiveness of the MOVER Program for Treating Attention Deficit in Children (MOVER: Movement Opportunities Through Vestibular Engagement Rhythm)

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Abstract

Background*: The purpose of this study was to investigate the effects of participation in a movement- to music program on the attention span of elementary school-aged children who have attention deficits. The hypothesis was that participants would demonstrate improved attention on the Test of Sustained Selective Attention (TOSSA) (Kovacs, 2015).*

Methods*: This quantitative study involved nine children who participated in four movement-to-music sessions with a staggered stop over a period of six weeks. The study incorporated a single group pre-test/post-test design, and a non-parametric Sign Test was utilized to analyze data from the TOSSA subcategories of concentration, detection, response inhibition, and test-taking time tolerance. Supporting qualitative data was also collected through peer debriefing, field notes, and a reflexive journal.*

Results*: TOSSA results found that the movement-to-music program can significantly improve the attention of children who have attention deficits.*

Discussion*: This study demonstrated positive implications for occupational therapy practice and for policy change regarding the inclusion of vestibular/proprioceptive movement opportunities available for children, especially those who have attention deficits.*

Keywords*:* Children, Movement, Attention, Music, Rhythm; Attention Deficit Disorder

Introduction

This study investigated the effects of an original movement-to-music program for children who have attention deficits identified by their caregivers. The program, entitled Movement Opportunities through Vestibular Engagement to Rhythm (MOVER), was created by the primary researcher. The selected study region (Northeastern Tennessee) not only has a lack of resources due to its small size and rustic mountain location, but also within the last decade, there was a significant influx of infants diagnosed with neonatal abstinence syndrome (NAS) (Health Grove, 2017). NAS is a medical diagnosis given to babies who are born addicted to drugs and who experience symptoms of withdrawal due to their mother's dependence on medications or illicit substances during pregnancy (United States National Library of Medicine, 2017). The long-term effects of prenatal exposure to drugs include but are not limited to attention deficits, issues with sensory processing, and lack of age-appropriate social skills (Ranger, 2018). Barthel (2017) also found that children who were diagnosed with NAS as infants have continued issues with inattention as well as problems with sensory modulation including (a) an increased need for vestibular and proprioceptive input, (b) the necessity for reduced environmental stimuli for effective learning, and (c) the tendency to become overstimulated.

Due to the continued rise in the diagnoses of NAS, as well as the identified long-term effects of this condition, there has been a significant increase in elementary school-aged children with attention deficits and issues with sensory modulation (Tennessee Department of Health, 2015). Unfortunately, across the United States, school systems have decreased the frequency of proprioceptive activities and vestibular-based movement opportunities within the school day in order to focus on academic skills and test score improvement (Centers for Disease Control and Prevention, 2010). Stemming from this curriculum modification, children's free play and movement opportunities are being replaced by more sedentary activities including structured academic activities and screen time (Pappas, 2011).

Cleary (2002) connected issues with vestibular processing to attention deficits, finding that when the vestibular system is underactive, the reticular arousal system is not stimulated enough to control alertness. This results in a person demonstrating distractibility and hyperactivity (Cleary, 2002). Chasnoff (2014) described how sensory processing and attention are related, stating that proper sensory modulation assists in the maintenance of attention. This explains why children with sensory processing difficulties (especially those who demonstrate vestibular-seeking behavior) often receive diagnoses of ADHD when they become school-aged (Chasnoff, 2014). Furthermore, the activated areas of the brain that perceive complex temporal patterns (e.g. music) are the same areas that control sequencing, timekeeping, and attention (Janata & Grafton, 2003). The rhythmic and temporal structure of music has been found to have positive implications for therapeutic use with individuals who have attention deficits. Several studies have found that children who participated in vestibular and proprioception-based dance intervention demonstrated decreased hyperactivity, reduced hostility, increased social skills, diminished issues with sensory modulation, improved concentration, and enhanced self- awareness (Freundlich, et al., 1989; Grönlund, et al., 2005; Lobo & Winsler, 2006; Kim & Chung, 2015). While current research is limited to individuals with ADHD and autism, individuals with NAS often experience similar challenges (Barthel, 2017).

Batty et al. (2009) found that not only do children with attention deficit hyperactivity disorder (ADHD) have reduced whole brain volume, but they also have lower gray matter in all lobes of the brain and a thinner cortex in the pars opercularis bilaterally. The pars opercularis, a brain region located in the inferior frontal gyrus, plays a key role in response inhibition which explains why these children have impulsivity in addition to attention deficits (Batty et al., 2009). In addition, drug exposure during the prenatal period has been found to disrupt the monoaminergic function of neurotransmitters within the brain which assists with controlling attention span and focus (Chiriboga, et al., 2009). This provides evidence

that prenatal drug use (and subsequently NAS) negatively affects attention, activity levels, and processing skills of diagnosed children. Overall, evidence indicates that the utilization of a vestibular and proprioceptive-based movement-to-music program could demonstrate promising results in the promotion of attention, social competence, and self-regulation in children.

The primary theoretical framework that guided the development of this study was the person-environment-occupation (PEO) model (Law et al., 1996). The focus of the traditional PEO model is to address a 'person', their 'environment,' and their desired 'occupation' to optimize their occupational performance. Within this study, the "person" was an elementary school-aged child with his/her various occupational preferences and experiences as well as the primary researcher who was the person acting as a catalyst for change through her guidance of the movements to music. The "occupation" was moving in space, and it involved a variety of vestibular motions, proprioceptive components, movement styles/speeds, and tactile experiences with props. The "environment" was a social group setting with the presence of rhythmic auditory stimuli. Ultimately, the three components (child, music/rhythm, and movement) overlap to create the optimal attention that is needed to participate in academic tasks until completion, the social behaviors required to interact appropriately with peers and adults, and the ability to control problematic sensory behaviors that prevent success in activities of daily living (see Figure 1).

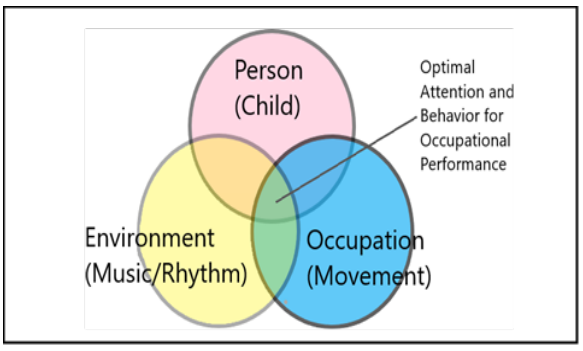

Figure 1. The PEO model as represented in the MOVER program study.

Another theoretical model that informed this study was the Ayres sensory integration (ASI) framework. Within this framework, therapeutic techniques aim to impact a child's behavior by providing needed sensations such as vestibular, proprioceptive, or tactile input which promote the child's ability to engage in daily occupational performance (Ayres, 1972). Luborsky (2017) found that participating in various sensory integrative activities positively modulates attention in children.

In this study, the participants were exposed to a variety of proprioceptive, tactile, and vestibular experiences set to rhythmic musical selections. Various combinations of these sensory experiences were guided by the primary researcher to songs that had consistent, powerful rhythms, and the overlap of the sensory exposure and the rhythmic auditory stimuli created the superlative scenario for increased attention for optimal occupational performance (Ayres, 1972).

Ultimately the objective of this research was to answer the following questions: (A) Is there a correlation between participation in weekly structured movement-to-music sessions and improved attention? (B) Is the MOVER program credible with children who have attention deficits? The hypothesis of this study was that the children who participated in the MOVER program, which included both proprioceptive and vestibular components, would demonstrate improved attention.

Methods

Participants

The participants of the study were nine elementary school-aged children within a rural county who received occupational therapy services and who had difficulty with their attention span and regulation of sensory-related behaviors. The sample was selected using non- probability, convenience sampling with the following inclusion criteria: (a) Children were required to be between 5 years and 10 years old, (b) to have an attention deficit as identified by their parent, legal guardian/caregiver, and/or teacher, (c) to be able to follow single step commands, (f) to

have hearing within normal limits, (g) to be able to physically move without equipment or human assistance, and (h) to be currently receiving occupational therapy services. Both the child and his/her caregiver had to cognitively be able to complete assent and informed consent. No child with a particular diagnosis was denied if they met the inclusion criteria so that the study could be more easily generalized to the pediatric population.

Design

This pilot study involved a quantitative, one-group cohort and a pre-test/post-test design. This design was chosen so that changes that occurred as a result of the children's participation in the researcher-created MOVER program could be tracked after each child completed at least four sessions over a six week period. Examples of vestibular activities that were implemented within the MOVER program include jumping on a trampoline, bouncing on large exercise balls, running, skipping, swaying, swinging arms, mirroring researcher dance movements, imitating child-led dance movements, and switching directions (e.g. high to low, left to right, forward to backward). Examples of proprioceptive components were stomping, rolling up in a sleeping bag, using scooter boards, clapping, weightbearing, jumping in and out of hula hoops, and forming yoga poses. The incorporation of tactile input involved the utilization of rhythm sticks, a djembe drum, percussive instruments, and large balls.

Setting and Procedures

The setting for this study was a large open therapy gym at a public community center. This facility was centrally located within the county in which the participants resided and was the appropriate size for the participant's movement Additionally, the location was accessible according to ADA guidelines (Institute for Human Centered Design, 2010). There were small quiet rooms adjacent to the primary dance space in which the children took the pre-test individually at the beginning of the first session and the post-test at the end of the final session. The primary researcher recruited four research assistants who were approved by the Institutional Review Board (IRB) and who agreed to assist during the sessions in order to monitor behavior and to promote safety. All ethical considerations and potential risks were outlined in the consent forms, and both the participants and their legal guardians signed assent and informed consent respectively prior to participation in the study.

Data Collection and Coding

Quantitative data was collected via the Test of Sustained Selective Attention (TOSSA), an eight-minute, computer-based standardized attention examination that requires participants to press the space bar of a computer keyboard when they hear a series of three beeps (Kovacs, 2018). The participants' reactions were recorded as either correct after three beeps, incorrect after two beeps, or incorrect after four beeps. In this test, pressing the space bar incorrectly is interpreted as being insufficiently focused.

The test also identified if the participant failed to react when a series of three beeps passed, showing that the participant was not efficiently attentive (Kovacs, 2019). Ultimately, the TOSSA identifies levels of fatigability and mental slowness, the existence of structural and conditional impulsivity, suboptimal effort, and problems with auditory perception which all affect the three tested areas of the assessment: concentration strength, detection strength, and response inhibition.

This test was selected for the following reasons: (a) it is one of the shortest of the continuous performance assessments of attention, (b) it does not require visual concentration or computer knowledge, (c) it is easily accessible once purchased and downloaded onto a computer, and (d) it is standardized with the neurological population (Kovacs, 2018). The TOSSA also has sufficient test-retest reliability (.84-.92 range) and convergent validity (.17-.43 range) as shown by previous studies with neurological patients (Onderwater, et al., 2004; Kovacs, 2009; Kovacs, 2018).

Data Analysis

A non-parametric sign test was implemented for each of the three TOSSA categories, as well as for the total test time tolerance since only one group was followed and the sample size was small (Taylor, 2017). The effect size for each of the four categories was calculated and analyzed using a paired-samples Wilcoxon test.

For qualitative data analysis, the primary researcher utilized peer debriefing, field notes and a reflexive journal to build trustworthiness in the results. After each of the five MOVER sessions, the primary researcher transcribed program field notes including participant behaviors, verbalizations, and actions. In addition, every evening immediately after the program implementation period, the primary researcher participated in critical self-reflection through reflexive journaling.

Within these journal entries as well as in peer debriefing sessions, she documented her experiences, thoughts, feelings, and concerns regarding the progress of the participants as well as her leadership skills and growth as a researcher. The addition of this qualitative data increased the transparency of the research process and heightened the credibility of the results through data triangulation (Ortlipp, 2008).

Results

Over a period of six weeks, nine children attended and participated in the minimum of four weekly 60-minute movement-to-music sessions. Four of the nine children had a history of prenatal drug exposure as reported by their legal guardians. Every child had an attention deficit secondary to an existing condition as reported by a primary caregiver; however, the primary researcher was unaware of how long each child had a diagnosis with an attention deficit as a symptom (see Figure 2). Each participant took the TOSSA prior to program participation and at the conclusion of his/her fourth session.

Pre-test and Post-test data sets were collected and analyzed using nonparametric sign tests for each of the four TOSSA subcategories of Concentration Strength, Detection Strength, Response Inhibition, and Total Time in Test (see Table 1).

Within the table, the individual pretest and post-test scores for the nine participants are recorded under each of the TOSSA subcategories. The negative sign direction (-) signifies that a negative number is obtained when the post-test score is subtracted from the pre-test score. The positive sign direction (+) indicates that a positive number was found from the score subtraction.

The following p values were found: concentration strength, p =.002; detection strength, p = .002; response inhibition p =.018; and total time in test, p = .008. In addition, the effect size calculations (r) were found to be: concentration, r = 0.89; detection, r = 0.89; response inhibition, r = -0.83; and total test time, r = 0.84.

Through clinical observations within individual sessions, the primary researcher identified several factors that were observed to increase the attention of the children. Eight out of the nine children demonstrated active attention when it was their turn to select and lead a movement experience during the introduction song each week. This was demonstrated by increased eye contact, the ability to stay in rhythm with the music, matching the primary researcher's movements, and staying in their assigned spots. Attention was also increased whenever the primary researcher incorporated a movement to imitate that was perceived as humorous. All nine of the children demonstrated increased attention while the rhythmic music was present and decreased attention (e.g. reduced eye contact, inability to stay on a carpet square, and initiation of running around the treatment space) in the transitional periods between activities during which the musical stimuli was absent. Within the first two sessions, all nine of the children demonstrated consistently heightened attention to interventions that incorporated props (e.g. balls, rhythm sticks, drum, hula hoops, boom whackers, etc.) over those that did not involve manipulation of objects in-hand. This was shown by increased eye contact and the children's ability to correctly mirror the movements presented by the researcher.

Figure 2. Identified conditions of the children who participated in the MOVER program

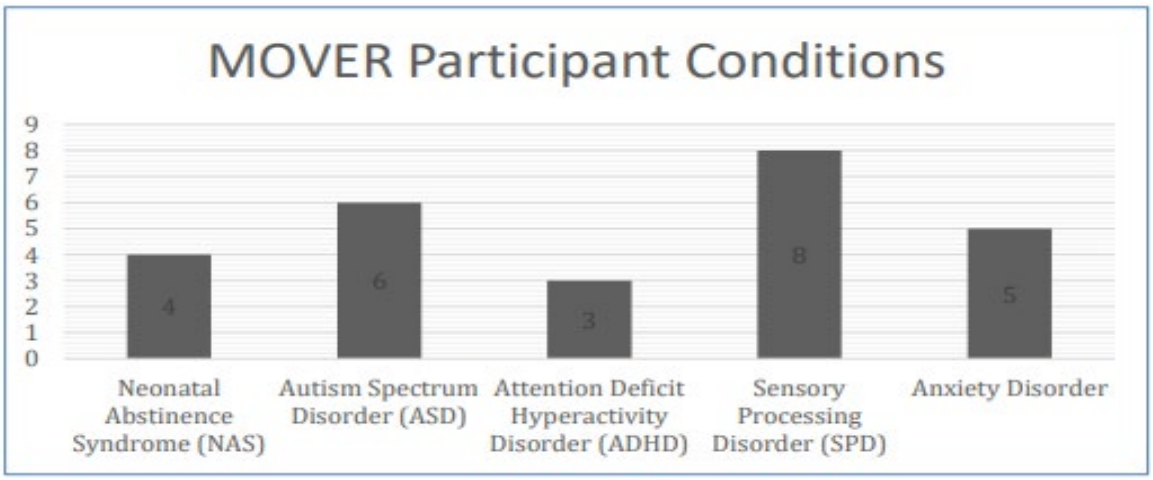

Table 1. Results of the sign tests and effect size calculations for each of the TOSSA categories.

Concentration Strength

	Pre	Post		
1	31.6	32.9	-1.3	(-)
2	2.5	11.1	-8.6	(-)
3	37.3	86.4	-49.1	(-)
4	5.9	24.1	-18.2	(-)
5	23.1	23.4	-0.3	(-)
6	3.4	14.2	-10.8	(-)
7	3.7	16.7	-13	(-)
8	9.8	40.7	-30.9	(-)
9	2.4	35.9	-33.5	(-)
			p= 0.001953125	
			r= 0.8885233	

Detection Strength

	Pre	Post		
1	86.3	96.3	-10	(-)
2	2.5	12.5	-10	(-)
3	38.8	87.5	-48.7	(-)
4	6.3	37.5	-31.2	(-)
5	30	32.5	-2.5	(-)
6	3.8	18.8	-15	(-)
7	3.8	20	-16.2	(-)
8	10	46.3	-36.3	(-)
9	2.5	75	-72.5	(-)
			p= 0.001953125	
			r= 0.8893038	

Response Inhibition

	Pre	Post		
1	36.7	34.2	2.5	(+)
2	98.3	88.8	9.5	(+)
3	96.3	98.8	-2.5	(-)
4	94.6	64.2	30.4	(+)
5	77.1	72.1	5	(+)
6	90.8	75.8	15	(+)
7	98.8	83.3	15.5	(+)
8	98.3	87.9	10.4	(+)
9	97.5	47.9	49.6	(+)
			p= 0.017578125	
			r= -0.8300168	

Total Time in Test (minutes)

	Pre	Post		
1	8	8	0	NA
2	2	5	-3	(-)
3	4	8	-4	(-)
4	1	8	-7	(-)
5	3	5	-2	(-)
6	8	8	0	NA
7	2	4	-2	(-)
8	3	8	-5	(-)
9	1	7	-6	(-)
			p= 0.0078125	
			r= 0.837408	

However, within the third session, the children continued to demonstrate age-appropriate attention to all activities, no longer needing props to attend. The children demonstrated enhanced attention when the movements incorporated vestibular components, such as spinning, head- turning, jumping, and body swinging. Each program meeting ended with a participant debriefing session. The primary researcher would begin a discussion about which activities were considered favorites, which tasks were considered the most difficult, and suggestions for experiences in upcoming weeks. Within these debriefing sessions, the children unanimously reported that they enjoyed the dance mirroring songs just as much as the activities that incorporated hands-on experiences such as the utilization of tactile objects including rhythm sticks, a djembe drum, obstacle course items, boom whackers, and other forms of equipment.

The primary researcher was previously familiar with five out of the nine participating children as they were also seen at her pediatric therapy clinic for intervention. She identified behaviors that were atypical for these children who were seen in the

outpatient setting. For example, one child who always had excessive energy with constant movement during 1:1 occupational therapy intervention became exhausted during one movement experience of the group program, initiating lying on the floor and stating, "this is hard." Three of the children who were usually seen in the primary researcher's clinic stayed on task for longer periods of time and demonstrated improved attention and an increased ability to follow directions in the MOVER program than in their traditional occupational therapy sessions. This was demonstrated by their ability to mirror the movements made by the primary researcher and to stay involved in each activity without individual redirection and/or cues

Discussion

Results from the sign tests of each subcategory of the TOSSA showed significant increases in concentration strength ($p = .002$), detection strength ($p = 0.002$), and total time tolerated ($p = 0.008$) as well as a significant decrease in response inhibition ($p = 0.018$). Each category also showed a large effect size, with the median of the pre-test scores being significantly different from the median of the post-test scores. While the scores in areas of concentration, detection, and time tolerance present with a large positive effect, scores in response inhibition show a large negative effect.

The presence of music within the children's environment most likely played a vital role in their increased attention and participation. The rhythmic patterns in music can increase physical arousal including accelerating breathing and quickening pulse rates as well as elicit socioemotional reactions for mood enhancement (Fenske, 2012). Also, musical selections with strong beats stimulate the brain repetitively and cause impulses in the brain to follow the rhythm, with the quicker beats encouraging increased concentration and alertness (Saarman, 2006). Relating to the PEO model, the combination of the vestibular and proprioceptive movements and the group setting with rhythmic auditory stimuli provided an experience that promoted increased attention and involvement for optimal occupational performance.

Regarding the lower response inhibition scores of the TOSSA assessment, Scalzo et al. (2016) examined the effect of attention diversion on response inhibition, finding that directing one's attention away from an appealing stimulus assists with inhibiting impulsive responses. Therefore, since all the participants' concentration levels increased significantly, it is understandable that their response inhibition scores became lower. Scalzo et al. (2016) found that with increased focus (in this case as the children were listening to the auditory beeps), individuals may become hypervigilant and impulsive. This would further explain why the children with increased attention often hit the space bar too early.

All four of the participants who had a history of NAS showed significant improvement in concentration strength, detection strength, and total time tolerating the attention examination along with the other participants who did not have a history of

prenatal drug exposure. Each of these children also showed a significant decrease in response inhibition which was consistent with the other participants. These results show that children with NAS can benefit from participation in group-based movement-to-music program, and the primary researcher recommends that future researchers focus on implementing the MOVER Program with a group of children whose inclusion criteria require a prior diagnosis of NAS or documented history of prenatal drug exposure.

Qualitative results collected from the field notes, reflexive journal, and peer debriefing also showed that the participants were able to demonstrate improved attention and behavior within the overlap of the PEO model components. For example, within the rhythmic, group-based atmosphere, all children actively participated in each movement intervention without individual re-directive cues needed for song completion. The primary researcher observed active engagement of the participants including sustained eye contact, movements that correctly mirrored the primary researcher, the children remaining on their assigned carpet squares, and their ability to move in time with the rhythmic pulse. During the vestibular and proprioceptive movement experiences which were based on the Ayres sensory integration framework, the children demonstrated improved age-appropriate social skills and behaviors including the ability to take turns, to copy other participant's movements, to follow adult directions, and to both transition to/from and terminate various activities without demonstrating anxiety or issues with maladaptive sensory behaviors. The children appeared to have the maximal attention when participating in vestibular and proprioceptive activities such as bouncing on large exercise balls, jumping on the trampoline, rolling up in the sleeping bag, and mirroring animal yoga poses. Not only did the children demonstrate increased attention and improved social behaviors during song selections that had strong rhythmic beats, but also the children demonstrated optimal participation during tasks that incorporated tactile input via props (e.g., utilizing rhythm sticks and "boomwhacker" tubes which were played along with the rhythms themselves). These findings are consistent with the results of a study by Lockhart (2017) who found that rhythmic auditory stimuli and proprioceptive input are both processed in the cerebellum, and both forms of input impact attention and self-regulation. Once again confirming the effectiveness of the PEO model, Lockhart (2017) found that the combination of proprioception through body movement (occupation) and rhythmic auditory input (environment) further enhances neural activity in the cerebellum, optimizing outcomes relating to behavior, attention, and sensory integration functioning.

Overall, the results found a highly significant correlation between participation in the MOVER program and improved attention. All nine participants demonstrated improved scores in concentration strength and detection strength, and all of the children who did not complete the entire time frame of the pre-test (eight minutes) tolerated longer test times during the posttest. Ultimately, the primary investigator was able to confirm the efficacy of the PEO model through which the children were able to actively participate in each intervention until completion without individual redirection and to remain engaged in adult-directed activities without getting hurt, quitting, or demonstrating an externalized maladaptive sensory behavior. The participants were able to be involved in an activity that was a novelty experience for them and were able to interact with similar-aged peers in a safe and appropriate manner.

Limitations

The primary limitation of this study was the primary researcher's schedule, requiring the MOVER program to be implemented during the winter season. The program's time frame fell between January and February, East Tennessee's peak influenza season (Nelson, 2018). Therefore, flexibility in the schedule was provided to accommodate for the possibility that one session was missed due to sickness, transportation difficulties, forgetfulness, or weather-related issues. Each session had between 12 and 14 total participants; however, only nine were able to attend

the minimum of four sessions. An outcome measure limitation was the TOSSA's 8-minute time limit for test-taking tolerance. While the short time frame of the test was a favorable aspect in the selection of this assessment tool for usage in this study, the inability for a participant to attempt taking the test for a longer period limited the ability for the children to improve in that category. Luckily, all participants either improved in their timing or stayed at the 8-minute mark. Also, the duration of the program was short, with an implementation period of four weeks between the pre-test and the post-test administrations. The sessions were held one time per week, and there was not a time gap long enough for the participants to sufficiently change long-term attention issues.

Within this study, convenience sampling was utilized due to the increased number of children within the primary researcher's outpatient clinic who met the inclusion criteria as well as due to timing and limited funds. While the study would have been strengthened if there had been a control group of children who had not received the therapeutic movement-to-music intervention, this was a pilot study that investigated the impact of a newly-created program, and it was the most appropriate to test the same group at two separate times in order to see if the program impacted the participants' attention. Also, Schwartz et al. (1997) explains that in the realm of clinical research, asking participants to avoid a resource or intervention that has been well-documented as health-enhancing can be both inappropriate and unethical.

Conclusions and Clinical Implications

This study has clinical implications for the use of movement-to-music intervention with children with attention deficits. Within this study, not only did all the children demonstrate highly significant improvements with attention components including concentration, detection of stimuli, and total time tolerating the test stimuli, but also several of the participants' caregivers reported seeing positive behavioral changes in their children (including improved sensory modulation and increased age-appropriate social interaction) after participation. Therefore, the primary researcher predicts that the MOVER program will be useful for occupational therapists to implement as they seek to use creative and multi-faceted occupation-based interventions within pediatric practice settings for increasing their clients' abilities to maintain the attention, self-regulation, and social behaviors needed for occupational performance. It is also predicted this intervention program will be replicated globally in the future with a larger number of children for increased validity.

Ultimately, the results of this study have several implications for occupational therapy service delivery in both school-based and outpatient pediatric settings. After participation in the MOVER program, several qualitative concepts were observed in regard to attention and behavior. For example, due to the participants' caregivers reporting issues with attention and sensory-related behaviors (which was part of the inclusion criteria), the primary researcher had initially expected the children to be inattentive and to have difficulty following directions within the dance space; however, all children participated in each session with seemingly minimal distractibility. This is most likely due to the optimal overlap of the PEO model in which the children (person) were participating in therapist-guided, sensory-based movement experiences (occupation) to rhythmic auditory stimuli within a group context (environment). This also implies that with proper opportunities for movement within an engaging atmosphere, these children can attend and learn more effectively. In addition, the MOVER program activities included social components, which is something that children tend to enjoy. Results of this study also implicated that the utilization of rhythmic music as a motivating stimulus for participation in tasks could be effective in both therapy-based and school-based practices. Results from the primary researcher's observations showed that the children lost attention during the transitions between interventions which were the only times of the session during which the music was not playing. The music itself acted as a form a redirection. From this concept, perhaps therapists and teachers should consider utilizing rhythm/music during prolonged

tasks or during activity transitions in order to maintain children's interest and attention.

As demonstrated in this study, therapists working with children who have attention deficits should incorporate proprioception, vestibular movement, and tactile experiences with rhythmic stimuli at the beginning of their sessions in order to promote the optimal attention and behavior needed for occupational performance. The occupational therapists would not be required to have expertise in dance, but they would need to know how to incorporate heavy vestibular and proprioceptive components to rhythmic pulses. Therapists should also consider a child's movement opportunities when observing maladaptive sensory behaviors and attention deficits during sessions. Therapists should attempt to find if movement is beneficial to help with these nonproductive behaviors before assuming the children's problems arise from defiance or lack of interest in instructed tasks. This study also provides positive implications for the utilization of group intervention within community-based occupational therapy practice and suggests that groups may also be effective within the school-based setting.

In regard to policy, the results of this study justify the requirement for more proprioceptive and vestibular experiences within children's daily routine, especially for those children who have attention deficits. The Tennessee State Board of Education (2005) espouses that elementary school students in Tennessee must have a minimum of 130 minutes of physical activity within each five-day week of school in addition to their allotted physical education class. This amounts to approximately 26 minutes of movement per day. However, without adequate "wiggle time," children often initiate movement and behaviors that cause them to be misdiagnosed with ADHD (Strauss, 2016). Perhaps, the results of the MOVER study could contribute to increased movement times during the day for elementary school aged children. The results of this study may possibly convince teachers and school administrators to identify the importance for more frequent movement opportunities outside of recess and scheduled physical education, especially for children who have attention deficits and sensory behaviors. These movement breaks could even be placed in a child's individualized education plan (IEP) in order to promote increased attention and improved sensory behaviors for occupational performance within the academic environment

Future Research

Future research is necessary to further validate how sensory-related behaviors could be affected by program participation. In future studies, several possible directions or program adaptations could be considered. Within a replication of this study, program and outcome measure modifications could be made to gather more vital research information such as how much sleep the children received prior to participation and/or what foods comprised the participants' diets. Another recommendation for future research would be the inclusion of more total participants. This increased sample size would strengthen the outcome of this study. Future research based on the MOVER program could also require the inclusion criteria to involve a history of NAS or documented prenatal drug exposure. This could increase the generalizability of the study to this specific growing population. Other possibilities for future studies could include: (a) increasing the frequency of sessions within the same time frame, (b) recruiting participants who are older, and/or (c) extending the duration of sessions. Hassan et. al (2006) explain that pilot studies, whether they show significant results or not, are essential in laying the groundwork for future research. Since there was highly significant improvement in the children's attention after only four 60-minute sessions in this study, one could imagine that a longer treatment period could yield even better results.

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