

The Effects of a Drums Alive® Kids Beats Intervention on the Physical Performance and Motor Skills of Children with Developmental Delays

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Abstract

The objective of this original pilot study was to determine if the Drums Alive® Kids Beats intervention could provide statistically significant improvements to physical and motor skill performance on participants with Developmental Delays (DD) using the Dusseldorf Motor-Proficiency-Test for children (MOT 4-6) model. The researchers selected the research-based Drums Alive Kids Beat intervention because of its multidisciplinary methodology that in previous studies demonstrated positive effects on physiological, psychological, neurological, educational, rhythmical, and socio-emotional literacy. Facilitators used standardized Drums Alive approved lesson plans and equipment to conduct the intervention through a battery of music, movement and drumming-centered exercises and activities. The 30 participants were German students between 4.9 and 10.2 years of age, without any inclusion or exclusion characteristics, who were divided into three groups consisting of two intervention groups: IG Kindergarten (IG Kinder), IG Elementary (IG Elem) with varied physical, social, and emotional DD that affected gross and fine motor skills, movement, coordination, and behavioral control; and, a Control Group (CG) that had normal physical and motor skill development (**Table 1**). The results of the study suggested that the Drums Alive Kids Beats intervention provided statistically significant improvements in physical and motor skill performance in children with DD, namely, 24% improvement (IG Kinder),

14% (IG Elem) vice a minor 4% improvement (CG). Of note, during this study to measure physical capability pre- and post-intervention, the facilitators noticed significant improvements in behavior in both IG groups; therefore, they chose to conduct a collateral study to measure six behavioral domains which will be documented in a future publication to demonstrate the exclusive relationship between the Drums Alive Kids Beats intervention and improvement in behavior.

Keywords

Multidisciplinary, Music, Movement, Drumming, Developmental Delay, Behavior

1. Introduction

Children from around the world manifest Developmental Delays (DD) in many ways that impact physical and motor skill capability, self-confidence, social competence, and self-esteem. Early Childhood Education curricula and the scientific literature emphasize the need to promote the development of motor skills during the early years of education because it is an indispensable component of cognitive development. In addition, working the body is a necessary part of developing the mind for learning and subsequent academic performance [1]. Observing, assessing, and documenting the abilities and skills of each child is an essential foundation for planning, implementing, and shaping developmental processes which will result in targeted continuous, individual, and optimum support specific to unique personal needs and abilities [2]. However, studies seldom reflect the necessary view and connection between the relationships between different components of preschool gross and fine motor skills and subsequent performance on different academic competencies, which is more pronounced in the special needs and DD community [1].

Physical educators have long held the view that early interventions are essential to aid social and emotional development in children with DD. Physical exercise is not only vital for overall health and wellness, but it also positively influences concentration, memory, and classroom behavior, and it has a reducing effect on self-stimulators and negative emotional behaviors in children [3]. Erickson, Hilman, and Kramer suggest that a targeted Physical Activity (PA) program, especially in children with DD, results in higher fit and more active preadolescent children that statistically demonstrate greater hippocampal and basal ganglia volume, white matter integrity, efficient patterns of brain activity, superior cognitive performance, and scholastic achievement [4]. Wright and Sugden share a similar view, as they stress that a structured PA program is not only about physical training but should also consider students' cognitive, emotional, and social development. They also argue that these programs should include learning fundamental movements, games, and sportive skills that are structured

to learn about positive social behaviors [5].

Amnon Gimpel strongly encourages a multidisciplinary approach because it will contribute to a happier and more confident child, as well as build a more flexible, sophisticated brain for enhanced social skills and memory development [4]. Movement is an important part of a multidisciplinary approach to improve executive function and is essential to learning as it integrates and anchors new information into our neural networks, and every time we move in an organized manner, full brain activation and integration occurs and the door to learning opens [6]. Multidisciplinary approaches also include the use of music. Ryan Judd, a board-certified Music Therapist said, “we all know how powerful music can be in our own lives and in the lives of our children, but why is music so compelling and captivating? What exactly is it about music that makes it a great way to connect with and help children with special needs?” He provides the following reasons; it is motivating, multisensory, processed in both hemispheres of the brain, non-verbal communicative, bonding, and powerful. Nina Kraus, a Hugh Knowles Professor of Communication Sciences and Neurobiology, Founder, and head of Northwestern’s Auditory Neuroscience Laboratory, studied the biology of auditory learning and strongly suggested that there is a relationship between neural response consistency and the ability to keep a beat [7]. Additionally, the ability to feel and express a steady beat is fundamental and positively affects both sports skills and musical performance, as well as speech flow and motor skills. In addition, children’s timing has been found to be positively related to children’s overall school achievement, as well as mathematics and reading achievement; self-control; and gross-motor skills” [8].

Lastly, to fully understand the comprehensive utility, power, and influence of drumming, Remo Belli—Founder and CEO of Remo, Inc.—said, “It’s time to stop thinking of the drum as just a musical instrument. Start thinking of it as a unifying tool for every family, a wellness tool for every retiree, and an educational tool for every classroom” [9]. Research regarding drumming as exercise has been made accessible by classifying it as an aerobic and sometimes anaerobic activity [10]. Karl Bruhn, known as the Father of the Music-Making and Wellness Movement, said, “Without the obstacle of a challenging learning curve, group drumming offers an enjoyable, accessible and fulfilling activity from the start for young and old alike.” He continues, “Drumming has great acceptance cross-culturally and is inclusive, regardless of age or ability. Therefore, drumming could be used as a medium to introduce a wider population to exercise and additional therapeutic protocols” [9].

2. Methods and Materials

Intervention

Researchers used the Drums Alive Kids Beats program as the intervention which included specific Drums Alive approved handclapping games, choreographies, movement patterns, drumming exercises, speech patterning and modeling.

Table 1. Participants (Age, Weight, Height, Avg, Std Dev).

Group	Num of subjects	Age (Years)	Avg	Std Dev	Weight (Pounds)	Avg	Std Dev	Height (Inches)	Avg	Std Dev
IG Kinder	12	5.10 - 6.6	5.89	0.59	42.32 - 70.32	48.33	8.29	42.91 - 51.18	46.58	2.65
IG Elem	10	6.6 - 10.2	7.83	1.11	45.85 - 127.64	65.58	23.75	44.09 - 51.18	51.41	3.75
Control	8	4.7 - 6.1	4.78	1.48	36.15 - 49.82	39.03	7.17	41.33 - 48.03	40.00	3.76

Note: The varied DD for the IG Groups were transgressive behavior, ADHD, ADD, autism, anger management, visual acuity, and lack of self-esteem.

Participants used equipment consisting of an exercise stability ball and holder, drumsticks, and a musical CD with varying tempos, cultural drumming patterns and time signatures labeled Drums Alive Kids Beats, vol 1. The intervention was integrated into the daily morning and/or afternoon PA class schedule of events and conducted twice a week for 45 - 60 minutes for one month. The facilitators used a combination of routine physical fitness exercises, *i.e.*, jumping jacks, etc., as well as beat keeping drumming exercises on a stability ball, choreographies that focused on crossover, up and down, back to front, and side to side movements to emphasize fine and gross motor skills, jumping ability, balance, proprioception, spatial awareness, hand to eye coordination, rapidity of movement, and movement dexterity. The participants were allowed to fully understand and practice the intervention protocols and take “time out” to decompress or correct any events that may have caused overstimulation.

3. Discussion

Researchers conducted this study as a school entry examination therefore indispensable in curative education as a diagnostic tool for children with motor deficits. The evaluation instrument for this study was the MOT 4-6, (Table 2) because task comprehension, concentration ability, and the readiness for active cooperation were present, and standardized procedures for motor skills could be applied [11]. Although the MOT 4-6 had 18 exercises, the first exercise was un-scored and used as a warmup; therefore, only 17 skills were evaluated. These 17 skills were divided into seven subdivision categories that evaluated specific abilities within the overall scoring, such as: physical dexterity and coordination (skills 7, 11, 14, 16, and 18); fine motor dexterity (skills 3, 4, and 10); balance (skills 2, 8, 12, 17, and 18); reaction (skills 6 and 13); bounce (skills 15 and 18); speed (skills 3, 5, and 7); and movement control (skills 9 and 10). Each motor skill was awarded a range of 0 - 2 points based on performance using a combination of ability and time needed to complete the skill. The scores were awarded as follows: 0—inability to perform the skill; 1—ability to perform the skill with minimum proficiency and/or longer than time allotted; 2—ability to perform the skill and within the allotted time. The maximum score was 34 points (17 skills × 2 max points per skill), and the minimum score was 0 points. The testing time to complete the MOT 4 - 6 skills was 20 to 25 minutes. The room in which the test was conducted was at least 12 feet by 18 feet. The equipment used for the testing

Table 2. MOT 4 - 6 evaluation skills.

Evaluated Skill	Description of Skill
1 Jump in/out of Hoop on Floor	Jump in/out of hoop on floor (warm-up only; not scored)
2 Forward Balance	Balance forward over a strip of carpet lying on the floor
3 Dotted (Tapping)	Tap as many points (dots) on a sheet of paper as possible in a given time
4 Picking up Cloth with Toes	Pick up cloth on the floor with toes and hold (both feet)
5 Jumping Over Rope (Sideways)	Jump sideways over a rope lying on the ground as often as possible in a given time
6 Catching a Stick	Catch a stick with the hand as quickly as possible that is dropped by the test leader
7 Placing Tennis Balls in Boxes	Three tennis balls are to be placed one after the other from one box into another as quickly as possible
8 Backwards Balance	Balance backward over a strip of carpet lying on floor
9 Target Throwing	Tennis ball thrown from 10 feet onto a target
10 Collecting Matches	There are 20 matches to the left and right of a matchbox that is to be placed in the box one after the other with both hands at the same time
11 Winding through A Vertical Hula Hoop	Wind through a hula hoop without touching it and only the feet are allowed to touch the ground
12 One-Legged Jump into Hoop	Jump into a hoop on the ground with one leg; hold for five seconds
13 Catch a Ring	Catch a ring thrown from a certain distance
14 Jumping Jacks	Perform Jumping Jacks for 10 seconds
15 Jumping Over a Rope	Jump over a rope (two different heights)
16 Rolling on Longitudinal Axis	Perform a complete roll around the longitudinal axis (both directions) while fully extending the body
17 Standing Up & Sitting Down with a Ball	While holding a ball above the head with both hands, stand up from cross-legged position and sit down again
18 Jump into a Hoop	Jump in and out of hoop with a 180° turn

is annotated in **Table 2**, and the intervention was a combination of Drums Alive approved drumsticks, buckets, stability balls and music. Researchers encountered several challenges and limitations during the study. One such challenge consisted of the testing time required per participant. The official testing time was planned for 20 to 25 minutes, but participants often took longer than expected due to the considerable number of skills, especially with children who had more profound DD. An aggravating factor for many children was the varying levels of difficulty understanding the skills and directions due to linguistic differences and/or other physical, social, and emotional challenges. Additionally, due to competing class schedules, some participants completed the interventions and testing in the morning and some in the afternoon, which could have affected the outcomes due to different energy levels and the proximity of lunch. Future research studies should secure a consistent environment, including class design, location of room, and time of day. During the study, it became apparent that some of the intervention protocols, movements, exercises, and activities favored

some of the MOT 4 - 6 skills more than others. For example, physical dexterity and coordination skills improved through the varied musical, choreography, and drumming patterns; fine motor dexterity through hand and finger drumstick movement exercises; and speed through up and down, back to front and side to side movement patterns. In contrast, the results in bounce, balance, and reaction were not as compelling because the protocols that were initially thought as sufficient were determined to be lacking the emphasis on movements that would improve those specific post-test results. When this result was identified, researchers made no modifications or adaptations to any protocol or intervention to maintain the integrity of the testing and validity of the results.

4. Results of the MOT 4 - 6

Despite the perceived normal advantage that age, height, and weight of the participants may have played, the overall results in posttest of the two IG groups vice the CG groups were statistically significant, thus, providing the evidence that the Drums Alive Kids Beats intervention was the sole reason for the compelling increase in improvements of skills for the IG groups. Per the data garnered by the facilitators and statistically evaluated by a third party, the control group, demonstrated a 4.02% improvement in ability to complete the MOT 4 - 6 skills without any access to the Drums Alive Kids Beats Intervention. This improvement is considered normal due to the participants having time to practice and repeating the same battery of skills for the pre- and post-intervention. In comparison, the IG Kinder and IG Elem, who were provided the protocols of the Drums Alive Kids Beats Intervention, demonstrated statistically significant improvements between 14% - 24% for the overall scoring during the MOT 4 - 6 (Figure 1), with varying levels scoring from statistically significant to minor for

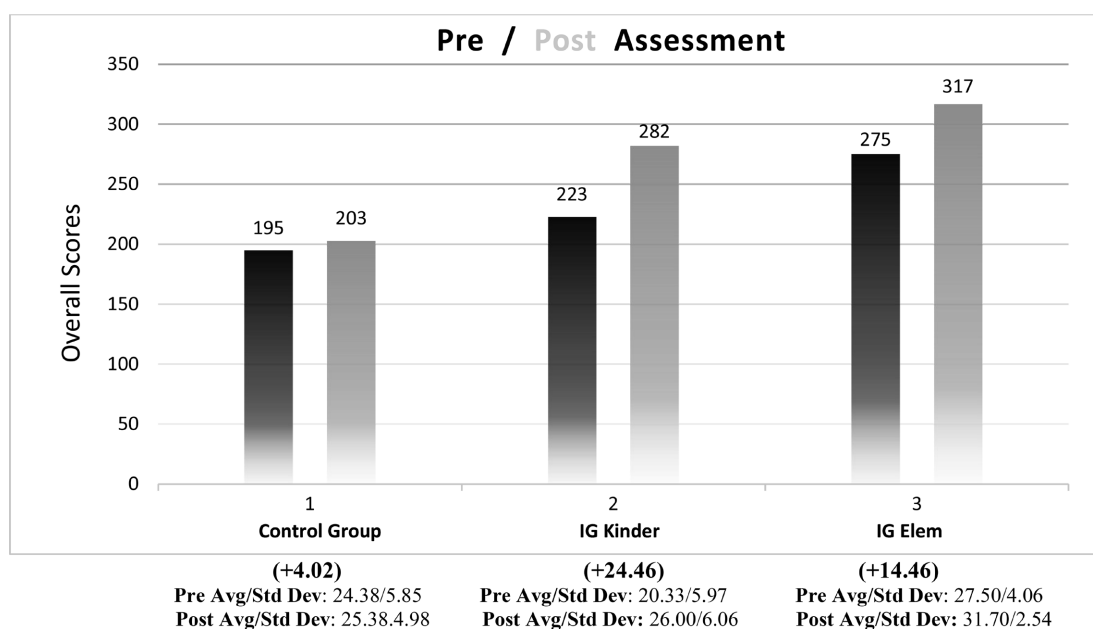


Figure 1. Results of the MOT 4 - 6 (Control Group, IG Kinder, IG Elem).

the seven subdivisions of skills. Additionally, the p-values consistently ranged from 0.10 to 0.01 for all testing which supports the minimizing of randomness and arbitrary results.

5. Summary

This study was successful in meeting the goals of determining if the Drums Alive Kids Beats intervention could provide statistically significant improvements to physical performance and motor skills of participants with DD as measured against a Control Group without diagnosed DD using the MOT 4 - 6 evaluation model. The protocols included specific Drums Alive approved equipment, games, activities, choreographies, music, movement, and drumming exercises to simultaneously stimulate physical and cognitive capability. The overall results that measured the two IG groups vice the CG groups were statistically significant; thus, demonstrated the evidence that the Drums Alive Kids Beats intervention was the sole reason for the compelling increase in improvements of skills for the IG groups. Additionally, during the facilitation of the intervention, the researchers noticed a major improvement in behavior; so, they decided to conduct a collateral study that measured six domains which will be reflected in future research relating to Drums Alive Kids Beats and behavior. Lastly, the desired integrity throughout the facilitation and the results demonstrated that this type of intervention could provide a benchmark for DD class design, planning and programming; however, future studies would benefit from by minimizing the number of DD, expanding testing time and ensuring intervention methodology satisfies all the measured subdivision of tasks.

Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

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