

Effects of a Drums Alive® Kids Beats Intervention on Motor Skills and Behavior in Children With Intellectual Disabilities

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Abstract

Motor skill deficits, mainly in coordination, such as hand to eye, is one of many of the characteristics or symptoms of an intellectual disability. Therefore, exercise therapy, with coordinative elements as well as special approaches to education, is a necessary action to achieve optimal health outcomes; and, to influence the development of the affected children in the best possible way (Brault, 2010). Hence, the aim of this study was to examine the physiological, symptom specific and cognitive effects of a multi-modular Drums Alive Kids Beats® Intervention in children with diverse abilities. Children with intellectual disabilities, aged 13.9 ± 2.7 years of age, were divided into two separate intervention groups and either attended the conventional school physical education lessons (PEG); or, participated in additional Drums Alive® Kids Beats Intervention classes (DG) twice a week. To give perspective, before and after the assessments for the 7-week intervention program were conducted, the performance was measured using the German Motor Skill Test (DMT). Furthermore, the children's behavior and competencies were assessed by means of two questionnaires, the HKI and the VFE, as well as the Developmental Behavior Checklist (DBC), which monitors daily behavioral patterns. Results showed significant improvements of the DG in aerobic performance ($p=0.11$), coordination ($p=0.038$) & strength (0.015). Regarding the children's monitored behavior (DBC), the DG also showed significant

improvements ($p=0.007$) compared to the PEG. No significant changes were found in the competencies within each group and when measured against other groups. Findings of this study revealed that a sportive multi-modular drumming exercise program that combines endurance, strength training and highly coordinative movements, with emotional elements in an enriched environment, had significant effects on motor skill performance and behavior in children with intellectual disabilities.

Key Words: *Polyrhythmic, multi-modular, multidiscipline, enriched environment, sportive drumming, diverse abilities (a.k.a. special needs)*

Homo sapiens are the only species that can follow complex rhythmic patterns that afford synchronized group behaviors, such as singing, drumming, and dancing (Brown, 2011). In addition, they are also the only species that form cooperative alliances between groups that extend beyond consanguineal ties (Hagen, 2004). One way to form and strengthen these social bonds may be through music, specifically the kind of temporal and affective entrainment that music evokes from infancy (Phillips-Silver, Keller, 2012). In turn, these musical entrainment-based bonds may be the basis for homo sapiens' uniquely flexible sociality (Janata, 2003). If this is the case, then our evolutionary understanding of music is not simply reducible to the capacity for entrainment; but, rather music is the arena in which this and other capacities participate in determining evolutionary fitness. Music stimulates the brain's reward centers and as a result releases certain levels of dopamine, a neurotransmitter that mediates pleasure and is released during pleasurable situations and stimulates one to seek out those pleasurable activities (Diamond, 1964).

Recent discoveries by neuroscientists from Columbia University have led to a term called "anticipatory pleasure," which is the "synchronizing of music and movement through dance to activate the brain's sensory and motor circuits resulting in a "pleasure double play" (Krakauer, 2007). Although this term seems relatively easy to understand, Krakauer, a neurologist at Columbia University, suggested, "Scientists aren't sure why we like movement so much, but there's certainly a lot of anecdotal evidence to suggest we get a pretty big kick out of it. Maybe synchronizing music, which many studies have shown is pleasing to both the ear and brain, and movement—in essence, dance—may constitute the pleasure double play" (Krakauer, 2007). Dance may also be seen as an enriched environment. Examining cells involved in neuron survival, specifically cerebellar glia of rats, showed that synaptogenesis following motor-skill learning was associated with glial hypertrophy which was not the case of angiogenesis following exercise alone (Anderson et al., 1994). Interestingly, additional research revealed, "Universal emotions such as anger, sadness and happiness are expressed virtually

the same in both music and movement across most cultures” (Wheatley, 2012). Thus, the applicability of dance and music crosses all spectrums of learning, emotion, pleasure, sadness, enlightenment, enrichment and overall wellness.

Research suggests, “Music impacts our motor and emotional functions and is a powerful cue for storing and retrieving data” (www.pressreader.com, Music and Movement can Boost your Memory,” (2010). Thus, our brain has the ability to associate an event to a certain influence and many times music is that stimulus. Those influences are converted to memories and stored in dormancy until retrieved by a repeat of the stimuli that produced that particular association in the first place. An example would be an event that occurred during the playing of a certain song; and, each time that particular song would be heard thereafter, the brain would be subjected to that specific stimuli and, in turn, retrieve the emotion from that association.

Dr. Nina Kraus, PhD, Northwestern University, scientist, inventor, and amateur musician, studied the biology of auditory learning and strongly suggests that there is a relationship between neural response consistency and the ability to keep a beat. In addition, she has demonstrated that there is a link between the ability to maintain a rhythm and/or beat-synchronization and a significant improvement in reading and language skills to include neural encoding in speech development. These results suggested that physical fitness can counter the effects of aging in prefrontal and temporal areas, while motor activity is more likely to boost visual-motor coordination and visual-spatial integration (parietal areas) as well as motor response automatization, thus reducing the inhibitory cost supported by prefrontal areas (www.brainvolts.northwestern.edu, “Music and the Brain” n.d.).

Sportive drumming is an “aerobically centric, cerebrally focused, multi-modular, polyrhythmic musical expression of communication.” The protocols require the use of various drumming exercises performed in preferably an enriched environment to improve motor skills and overall health with the goal of creating a positive influence on concentration, learning, memory, cognitive functioning, academic performance, and social-emotional development. Additionally, modeling and patterning are essential elements of this pedagogical approach to learning and defined in sequence as follows, modelling is the manner in which specific movement patterns are practiced or imposed regularly as a way of improving, restoring, or stimulating muscular coordination, especially in brain damaged or disabled persons; and, patterning is a method of treatment or act of establishing a system or pattern of stimuli that will evoke a new set of desired responses. These processes have demonstrated positive results in retraining people with diverse abilities, specifically those who have suffered a brain injury or a birth related defect that disrupts normal sensory-motor activities and have reduced or eliminated preconceived boundaries that have previously

limited fitness program protocols and educational opportunities for those with diverse abilities.

Gimpel also suggested that a multidisciplinary (a.k.a. multi-modular) approach will not only contribute to a happier, more confident child, but also build a more flexible, sophisticated brain that allows for enhanced social skills and memory development (Gimpel, 2007). In addition, mental and physical brain exercise make permanent changes by raising concentrations of neurotransmitters that the synapses use for a more focused person (Gimpel, 2007). Multi-disciplinary methods involve drawing appropriately from multiple disciplines to redefine problems outside normal boundaries and reach solutions based on a new understanding of complex situations. One widely used application of this approach is in diverse ability populations and health care environments, where people are often looked after by a multi-disciplinary team that aims to address their complex clinical, physical, and educational needs. In order to capitalize on these capabilities and maximize the benefits of a program, specifically for the diverse ability population, more than just convenient data indicates that a multi-modular (a.k.a. multi-discipline) approach has been extremely beneficial when used as the foundation of an effective program that promotes physical, mental and emotional well-being. This stimulation, in the form of movement and sensory experiences during the early developing years, is necessary to achieve the precision of the mature brain (Cotman, 2002; Diamond, 1964; Gabbard, 1992; Gimpel, 2007; Greenough, 1992; Ratey, 2008).

Drumming as an Intervention

Kids Beats is an all-inclusive, multi-sensory program that provides a comprehensive approach to accommodate individual physiological, emotional and cognitive needs that support learning within the diverse ability population. It uses sportive drumming as a useful tool to help gain a healthy, happy, and productive perspective through a “No Limitation,” culturally based, brain and body fitness program that fosters creativity and builds self-esteem integrating kinesthetic awareness, neuro-muscular connections, cardiovascular conditioning, flexibility, strength, and wellness activities in an enriched environment. To fully understand the utility, power, and influence of drumming, Remo Belli, Founder and CEO, Remo, Inc., The Essence of Wellness, and arguably one of the world’s experts on drumming, 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.” He added the following comment: “The rhythm of life is a symphony and expression of our soul. When we drum, our inner voice resounds. Our energy raises, vitality improves and our emotions are exhilarated. Group drumming opens the doors of communication and allows us to speak where words often do not pass. Music, rhythm, and dance

enhance self-esteem, ensure a healthy workout, stimulate our minds, boost our creative potential, make us laugh, and connect us on many levels.” If there is ever a need to allow for expanded communication in all its forms, be it drumming, dance, rhythmical expression or movement, it is for those with diverse abilities or other intellectual limitations. This intriguing combination of motor movement, blended with auditory and visual feedback, facilitates greater engagement, encourages learning and enhances brain function. When people are engaged with the world around them, they are more prepared to interact with it, learn from it, and contribute to it. Drums Alive® Kids Beats is a vehicle that stimulates this engagement and addresses a variety of needs, such as:

1. Physical Needs—Improvement in fitness, health, and well-being on multiple levels
2. Cardiovascular endurance, muscular endurance, proprioception, balance, agility, posture, flexibility as well as improvements of fine and gross motors skills
3. Neurological needs—Promotion of hemispheric divergence through simultaneous activation in multiple regions of the brain.
4. Cognitive Needs—Improvements in concentration, consistency, and sensory awareness
5. Emotional Needs—Encourages children on the spectrum to control, regulate, and understand their emotions. Provides a healthy way to release stress and aggression.
6. Communication Needs—Drumming and movement are a valuable ways to communicate nonverbally and provide an opportunity to listen to others and contribute to the group dynamics and dialog. In a typical “call and response” exercise, children are able to understand the dynamics of conversation and may be able to offer a personal response to a question or

statement that was played on the drum rather than verbally responding

7. Social Needs—Drumming and movement provide a safe environment that helps children interact with others. In addition, it teaches children to listen, pay attention, turn-taking, sharing, and taking cues from one another. Everyone can drum and be part of a team.
8. Educational Needs—Drumming can reinforce speech, vocalizations, sounds and even help with sentence building. Kinesthetic learning activities that integrate drumming, rhythm and movement can make learning engaging and accessible. This helps activate and stimulate the hippocampus and thalamus for memory and learning.
9. Self-Actualization Needs—Drumming and movement boost self-esteem and provides an avenue where appreciation and acceptance are fostered. This helps children find peace within themselves and aids with coping skills and promotes a sense of happiness.

Methods

2.1 Subjects

The aim of this study was to examine the effects of a multi-modular Drums Alive® Kids Beats intervention on physical performance, behavior, cognitive, social and practical competencies. The participants, who were recruited from a special school for children with intellectual disabilities in Marienberg, Germany, showed developmental delays in multiple areas and/or intellectual disabilities. Data from 15 children aged 13.9 ± 2.7 years, four females and 11 males, have been analyzed. All pupils have been diagnosed with an intellectual disabilities or related developmental disability such as autism spectrum disorder. Table 1 shows the descriptive characteristics of all subjects and also within the

two groups (Intervention group (IG); Comparison group (CG)). Written informed consent was received from the legal guardians of all subjects.

2.2 Behavior and Competency Outcome Measures

Trained assessors, parents and schoolteachers assessed the participants within two days before and after the intervention as well as during the intervention phase.

The Heidelberg Competency Inventory (HKI). The HKI was used to assess the cognitive, social and practical competencies of the

Table 1
Descriptive Characteristics of the Subjects

Groups		Age in years	Weight in Kg	Height in cm	BMI
IG (Drums Alive)	Mean value	14.2	55.8	161	20.6
	SD	3.1	19.9	16	3.9
	N	10	10	10	10
CG (PE)	Mean value	13.4	47.9	157	19.1
	SD	1.7	15.3	10	4.7
	N	5	5	5	5
All subjects	Mean value	13.9	53.2	160	20.1
	SD	2.7	18.4	14	4.1
	N	15	15	15	15

Note: IG (Intervention Group), CG (Comparison Group), PE (Physical exercise), BMI (body weight/height²) units are Kg/m²

children before and after the interventions. The items had been completed by the parents of all participants. Data analyses included the separate evaluation of the three areas of competence (cognitive, social and practical) as well as the overall competency. Therefore, the median values have been determined because some of the items had not been processed, whereby comparisons by using the mean value didn't seem to be useful.



Behavior Questionnaire for Developmental Disabilities (VFL-L). The VFL-L was used to evaluate the effects on the children's behavior and emotions. The questionnaire consisted of 94 items and was completed by the school teachers before and directly after the intervention. Thereby, it has been made sure that the same teacher assessed the same child. For data analyses the sum of each of the five subscales as well as the total sum score were determined.

The Developmental Behavior Checklist (DBC-M). The DBC is an instrument to monitor children's behavior during the intervention phase. Five individual behavior patterns were identified for each child and have been monitored by the teachers on a daily basis. Each behavior pattern was assessed on a scale from 0=no problem to 2=very difficult today (see Table 2). At the end of each week, a sum of each behavior pattern was calculated, allowing the researchers to assess the behavioral development during the time of intervention.

No of points	Aggressive Behavior
0	...no problem today
1	...somewhat difficult today (moderate)
2	...very difficult today

2.3 Motor Skills Outcome Measures

To assess the effects on the participant's motor skills, the German Motor Skill Test (DMT) was used. The standardized test battery consisted of eight exercises (20m sprint, sit-ups, standing long jump, forward bend, jumping side-to-side, balancing backwards, press-ups, and 6 min run) to assess how far various dimensions of physical performance. For the present study, the press-ups have been replaced by medicine

ball shots because it would have been too difficult for most of the children to perform those. This exercise has been used in other research studies and standardised test batteries and is therefore a reliable test to assess the upper limb performance. (Elbatrawy, 2008; Kremer et al., 2001).

The test was carried out in the school's gymnasium and both groups (IG and CG) were tested separately on two different days. Before starting with the actual test tasks, the children performed a guided general warm up. Subsequently, the whole group completed the 20m-sprint. After a short break all the other tasks except for the 6m-run were performed on individual stations (see picture above). The children were given instructions for each task, followed by a practice trial, with most tasks performed twice with a recovery break in-between. At the end, all children performed the 6-minute-run together. One child in the intervention group could not attend the post-test because of illness; hence, that data was not included that in the evaluation of the DMT.

2.4 Interventions

The subjects were assigned by the school teachers to either the intervention group (IG) or the comparison group (CG). The IG conducted two Drums Alive® (Kids Beat sessions) and additionally two conventional physical exercise (PE) classes per week, over the duration of seven weeks. The CG performed three PE classes a week only. The PE classes were carried out by the school teachers and included the regular key areas of the current curriculum, which were running, jumping and throwing at the time of the intervention. Drums Alive® Kids Beats combines cognitive experiences with simple dynamic movements and drumming on a fitness (stability) ball. Rhythm exploration is also a strong component of the program. The intervention, which consisted of a warm up, main phase and cool down also included strength based, team-oriented and relaxing exercises. Therefore, the Drums Alive® Kids Beats intervention adopted a holistic approach, based on the children's needs.

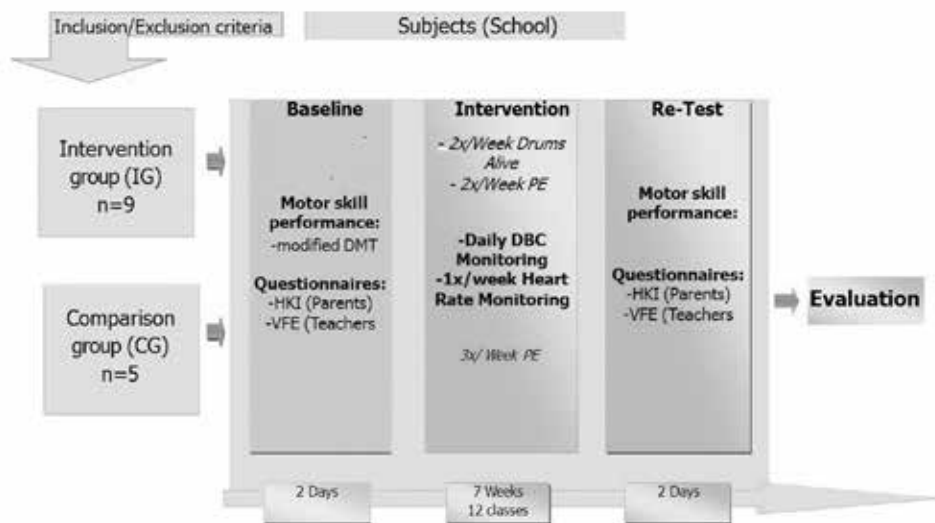


Figure 1. Schematic Study Design



2.5 Statistical Analyses

For all participants, descriptive statistics were performed. The DMT, as well as, the Behavior Questionnaire for Developmental Disabilities were analysed by using either the *t*-Test for dependent samples or the Wilcoxon-Test, with a

95% confidence interval. Regarding the Heidelberg Competency Inventory (HKI) the median values of each competency as well as the total competency were determined and assessed for differences by using the sign test, which was also used for the Developmental Behavior Checklist (DBC). For the DBC, determining a daily value per characteristic, which was calculated from the relation of the weekly sum, the number of monitored days and the number of assessed behaviour patterns, was used to evaluate the daily behaviour.

Results

3.1 Developmental Behaviour Checklist (DBC)

Figure 2 shows the results of the DBC scoring over the intervention time of seven weeks with weekly measurements. The y-axis (TW/E) shows the DBC score which is calculated from the relation of the weekly sums, the number of days on which the children have been observed as well as the number of observed behaviour patterns. The table below presents mean values as well as standard deviation in brackets and p-values. Each behaviour pattern was assessed on a scale from 0/no problem in behaviour today to 2/behaviour is very difficult today. The intervention group demonstrated a non-significant improvement in the individual behaviour patterns, whereas the comparison group showed a slight decline over time. At the end of the intervention in week 7, the difference between the two groups was significant ($p=0.007$) which means that the Drums Alive® intervention had a significantly better effect on the observed behaviour patterns after seven weeks than the conventional exercise intervention.

3.2 The Heidelberg Competency Inventory (HKI)

The following figure represents the results of the overall competency pre to post test in both groups in the form of boxplots. The y-axis represents the test scores and the lower the score the better the outcome. There have been no significant changes regarding the overall competency, neither in the intervention group nor in the control group. The separate evaluation of the three areas of competence (social, cognitive & practical competence) did not show any significant changes either. All values remained mainly unaffected by both interventions.

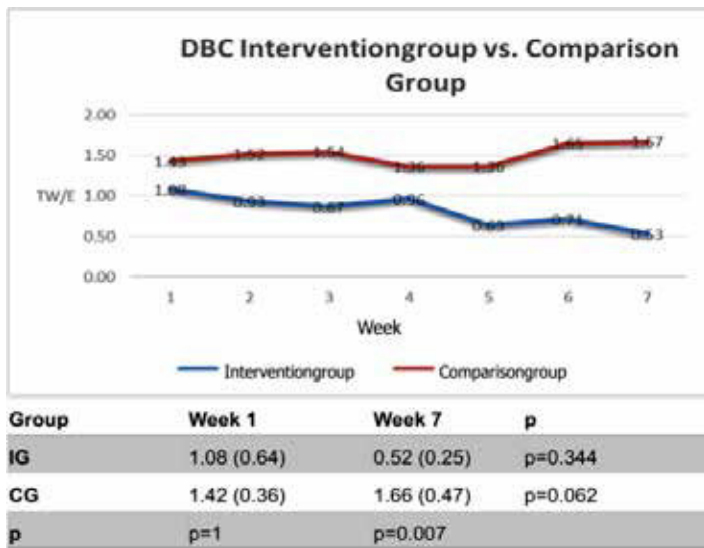


Figure 2. Results of the Developmental Behaviour Checklist (TW/E is the score value in the DBC)

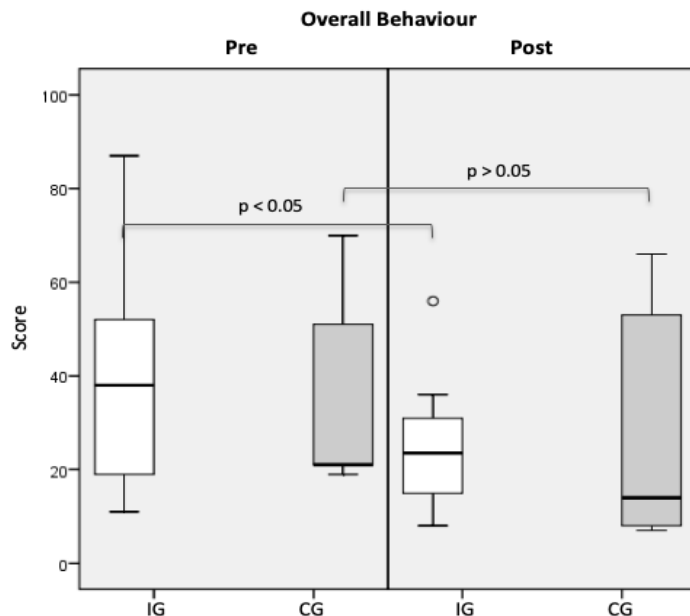


Figure 4. Comparison of the total behaviour score pre-to post-intervention in both groups (IG=Intervention Group, CG=Comparison Group)

3.3 Behaviour Questionnaire for Developmental Disabilities (VFL-L)

Figure 4 shows the total behaviour scores (all behaviour sub-category scores taken together) for both groups pre- to post-intervention. The y-axis represents the achieved score. A lower score means a better outcome. There has been a significant improvement ($p=0.08$) in the intervention group compared to the comparison group that had no significant changes pre to post intervention ($p=0.345$). The differences between the groups were non-significant. Hence, there are no statistically significant advantages of one intervention over the other although the intervention group has shown significant improvements.

Figure 5 below represents the results of the subcategories of the VFE-L. Again; a lower score means a better outcome. The intervention group showed significantly lower scores after the intervention in the categories “Anxiety” ($p=0.016$), “Disruptive behaviour” ($p=0.036$) and “Self Absorbed Behaviour” ($p=0.01$). There were slightly lower scores in all categories in the comparison group but these changes were non-significant. Although there are better improvements in the intervention group there have been no significant differences between the groups, which means that none of the interventions has significant advantages over the other intervention.

3.4 German Motor Skill Test (DMT)

The following table shows the results of the motor skill test with the mean values as well as the standard deviation in brackets, the p -values pre to post test and between

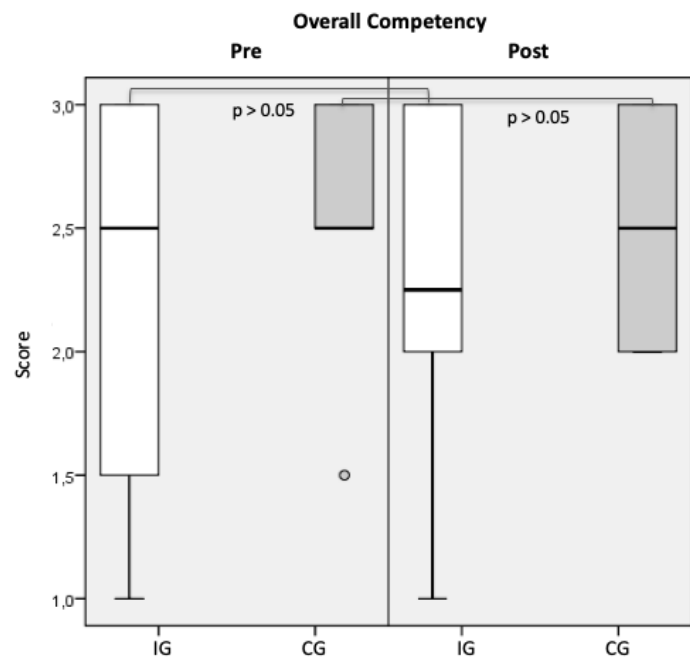


Figure 3. Comparison of the Overall competency score pre- and post-intervention in both groups (IG=Intervention Group, CG=Comparison Group)

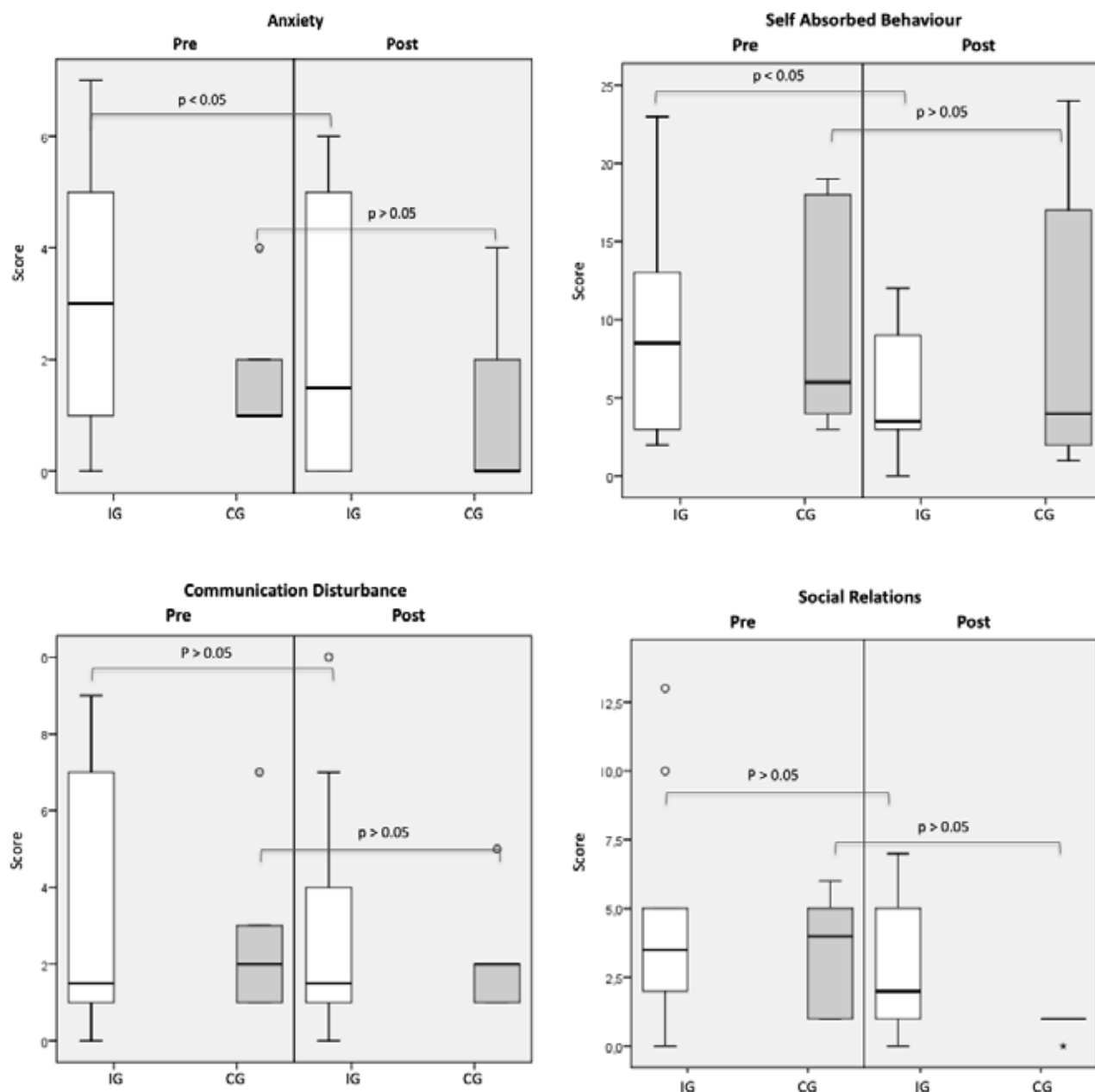


Figure 5. Comparison of the subcategory scores pre- to post-intervention in both groups (IG=Intervention Group, CG=Comparison Group)

the groups. There have been significant improvements in the intervention group in five of the eight performed tasks, whereas the comparison group doesn't show any significant differences after the intervention. Again; although there have been significant improvements in the intervention group and none in the comparison group, the difference between both interventions was non-significant. Hence, none of the interventions has statistically significant advantages over the other intervention. The only exception is the task "Forward Bend" where differences between groups could be shown in the pre-test as well as in the post-test with the comparison group performing better flexibility. This cannot be explained by an effect of one or the other intervention, as the difference has already existed before the start of the intervention. Also,

as shown in table above none of the groups has improved its performance significantly after the intervention.

Discussion

In spite of the recent availability of research regarding exercise in children, the effects of physical activity are less understood in children with disabilities. There is a diversity of disabling conditions which provides a challenge in generalizing information gathered on a population of children (or even research on other disabilities) and applying it to a specific child or group of children. A broad spectrum of abilities and limitations exists within the category "disability" that precludes a standardized, experimentally-based examination; therefore, careful consideration should be taken

Table 3

Results of the DMT with Mean Values, Standard Deviation Shown in Brackets and the *p* Values within (Right Column) and between Groups (below)

Medicine ball shot	Distance (m) Pre	Distance (m) Post	P-value
IG	4.9 (1.79)	4.8 (1.52)	p=0.583
CG	3.5 (1.43)	3.36 (1.24)	p=0.431
<i>P-value</i>	p=0.162	p=0.098	
Sit ups	(No. Of Sit ups) Pre	(No. Of Sit ups) Post	
IG	18.11 (7.06)	22 (6.08)	p=0.015
CG	17 (2.82)	19 (4.47)	p=0.176
<i>P-value</i>	p=0.947	p=0.348	
Standing long jump	Distance (m) Pre	Distance (m) Post	
IG	1.46 (0.46)	1.52 (0.42)	p=0.032
CG	1.22 (0.34)	1.24 (0.28)	p=0.728
<i>P-value</i>	p=0.325	p=0.220	
6-minute-Run	Distance (m) Pre	Distance (m) Post	
IG	1008 (189.48)	1079.56 (184.71)	p=0.11
CG	1021.20 (97.45)	971.80 (137.20)	p=0.500
<i>P-value</i>	p=0.888	p=0.279	

Table 4

Results of the German Motor Skill Test (Mean Values, Standard Deviation and *p*-Values)

20-m Sprint	Time(Sec.) Pre	Time(Sec.) Post	P-value
IG	4.28 (0.81)	4.15 (0.61)	p=0.491
CG	4.3 (0.7)	4.3 (0.79)	p=1.00
<i>P-value</i>	p=0.98	p=0.711	
Balancing backwards	(No. of Steps) Pre	(No. of Steps) Post	
IG	24.22 (10.75)	29.67 (10.42)	p=0.045
CG	24.4 (11.63)	28.2 (9.09)	p=0.135
<i>P-value</i>	p=0.977	p=0.797	
Jumping side to side	(No. of Jumps) Pre	(No. Of Jumps) Post	
IG	23.77 (9.23)	27.16 (11.65)	p=0.038
CG	18.9 (4.6)	19.8 (5.39)	p=0.221
<i>P-value</i>	p=0.295	p=0.212	
Forward bend	(cm) Pre	(cm) Post	
IG	-1.58 (6.36)	-1.83 (5.87)	p=0.633
CG	-20.2 (3.4)	-19.7 (6.51)	p=0.686
<i>P-value</i>	p=0.003	p=0.004	

to guard against the extrapolation of adult to children's data when applied to children with disabilities; and, any attempt to investigate the effect of exercise must evaluate the effect of the disability on normal physical and psychosocial growth and development. However, as complex as it may be to gather substantive data and demonstrate a congruency of applicability to all situations, it is plausible to form a valid position on the positive effects that exercise has on children with diverse abilities.

level in the behavioral disciplines tested. Therefore, exercise therapy, with coordinative elements, such as those applied by the Drums Alive® Kids Beats program, seemed to be an important intervention for these patients and could be used as a versatile medium to introduce a wider population to this type of therapeutic exercise.

According to a ground-breaking controlled study conducted in 2000 by researchers at the Mind-Body Wellness Center in Meadville, Pennsylvania, and the Loma Linda Uni-

For many of the diverse ability population, the disabilities they experience often require special approaches to education or other accommodations (Brault, 2011). To review, a comprehensive, independent study was conducted to evaluate the effects of the Drums Alive Kids Beats sportive drumming exercise program, with its associated multi-modular disciplines (dance, movement, music, rhythm, modeling, and patterning) to generate positive effects in motor and cognitive skills, as well as behavior and learning with respect to those with diverse abilities. In this context, drumming, dancing and music have been important and essential forms of communication since mankind evolved. Evidence strongly suggests that drumming has great acceptance, not only cross-culturally; but, also across social-economic barriers and has the unique ability to encompass everyone regardless of age or ability. As stated throughout this publication, the results and findings provided research based evidence that the Drums Alive® Kids Beats Intervention, with all its methodology, demonstrated that a sportive drumming exercise program that combined endurance, strength training, cognitive exercises and highly coordinative movements, with emotional elements in an enriched environment, provided significant therapeutically proven improvements for a majority of the participants. Results indicated a significant uptick in the disciplines of coordination and endurance within the DMT. The control group showed a mild level of improvement in all the motor abilities and a moderate

versity School of Medicine in Loma Linda, California, the benefits from drumming aren't just psychosocial; but, have been proven to boost the immune system's ability to defend the body against foreign intrusion; and, in a positive way, alters a response to multiple stressors (www.researchgate.net, "Recreational music-making modulates the human stress response: A preliminary individualized gene expression strategy [2005]). Additional research has shown that participation in group drumming is a "recreational music-making activity that builds social-emotional assets consistent with a positive youth development approach" (Ho, Tsao, Bloch, & Zeltzer, 2011). From the simple drum circle consisting of a few participants to the more complex drumming experience using multiple percussion instruments, group drumming has been shown to encourage empowerment, unify groups, and exceed group synergistic expectations. A group drumming experience is led by a facilitator whose role is to maximize a sense of community through rhythmic dialogue. It is inclusive, non-verbal, universal, and does not require previous experience for participation. Furthermore, group drumming is culturally relevant; and, is an integral part of diverse cultures, and supports the value of collectivism shared by non-European-based cultures.

Previous to the current study conducted using the Drums Alive® Kids Beats intervention program, very little had been documented on any sportive drumming program and the effects it has on motor skills and behavior in children with diverse abilities. The testing was conducted under strict protocols using the following to validate the research: a Behavior Questionnaire for Developmental Disabilities (VFL-L), the Developmental Behavior Checklist (DBC-M), interventions, statistical analyses, the Heidelberg Competency Inventory (HKI), a comparison of the subcategory scores pre- to post-intervention in both groups, and the German Motor Skill Test. The Drums Alive® Kids Beats program, which is the original and researched based brain and body drumming fitness and wellness program that has been implemented around the world since 2001, endorses Dr Gimpel's theory and applies a multi-disciplinary approach (dance, movement, music, rhythm, modeling and patterning) to build a more flexible and sophisticated brain and improve social skills and memory development. The protocol includes musical sportive drumming intervention methodology using oversized exercise (a.k.a. stability balls), drumsticks, and incorporated movement through dance elements and strength training. In addition, by providing inspiring music and an enriched environment, the experience adds an emotional element resulting not only in evidence-based improvements in all aspects of health and wellness, but also allows the researched populations to literally drum out their emotions and aggressions. The objective is to create a learning environment without a competitive atmosphere, teach simple, culturally based choreography and rhythms, promote creative experimentation and self-expression, ensure various healthy possibilities by

providing safe but effective physical exercise, encourage participation regardless of ability, and provide orientation for the participants by offering structures and rituals.

Application of the Drums Alive® Kids Beats Program

A safe and successful Drums Alive® Kids Beats program and its utility in the diverse ability population depends on the instructor's application of sound instructional principles and practices as well as understanding the desired learning objectives used to develop the research protocols and subsequent positive results. Additionally, following the American Council of Exercise guidelines will help provide the instructor with a sound foundation of these principles and practices. The Drums Alive® programming suggests paying special attention to:

- Safety First! Promote safety on all levels and periodically review general safety rules for teaching a movement program, as well as, following the safety precautions for teaching a Drums Alive Kids Beats® class
- Know your audience, execute proper form, and utilize safe, yet effective, movement and rhythmical skills for all levels of abilities
- Be prepared for medical emergencies (emergency contact numbers, evacuation procedures, overstimulation protocols, CPR, defib kit, etc.)
- Use appropriate equipment or modifications and reinforce its proper care and usage (Refer to the Drums Alive® website for information on proper equipment)
 - Recommend approved "Anti-Burst Stability Ball." Size of the ball and holder is dependent the class that is taught as well as the height of each participant
 - Use good quality drumsticks and check condition each time before use
 - Use modifications to drumsticks if needed (i.e., pool noodles, foam insulator tubes, foam grips on drumsticks or any creative use of a safe striking device)
 - Use a solid ball holder to maintain a good foundation and avoid tipping during workout (bucket, step riser, basket, etc.)
- Provide an enriched environment that is conducive for learning, self-expression; and, a breakout room to desensitize and soothe, if needed
- Use appropriate music and be mindful of the volume and tempo
 - Some students may be sensitive to loud music; so, recommend a volume level between 85 dBA – 90 dBA
 - You may need to use music with slower tempo or slow the tempo of the music (using pitch control)

- Adagio (slow and stately—literally, “at ease”—tempo is 66 – 76 bpm)
- Allegro tempo (fast, quickly, and bright—tempo is 120 – 168 bpm)
- Modify the drumming or movement patterns (e.g. instead of drumming on every beat, drum once on every two beats)
- Songs or music over 100 bpm need to be monitored carefully and adapted or modified based upon capability
- Be prepared and teach used suggested Kids Beats “Class Design” and execute good class delivery and sound teaching skills, including audio, visual and technique cues
- USE KIND WORDS —this applies to the students, assistants, and teachers
- Remind everyone to use “GENTLE HANDS AND FEET” (e.g., “keep hands and feet to themselves.”)
- Remind everyone to LISTEN AND FOLLOW DIRECTIONS but to HAVE FUN!
- Provide time for WATER BREAKS or REST AND RELAXATION BREAKS

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