# Use of Music and Movement Therapy to help person with Autism

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## Abstract

Individual with autism usually appear physically normal but display motor and coordination deficit. Therefore, they need fine motor, gross motor and motor coordination skills training. A structured Music and Movement Therapy for individual with autism was developed and for the purpose of this study, the focus is to review the effect of the Music and Movement Therapy on motor and coordination skills of persons with autism. A total of 41 children and adolescents participated in the study and were divided into two groups. Group 1 comprised of 18 children (5 girls and 13 boys). The age of these children ranged from 2 to 10 years old. Meanwhile, Group 2 comprised of 23 adolescents (2 girls and 21 boys). The age of these adolescents ranged from 11 to 22 years old. A session of the Music and Movement Therapy was carried out weekly and two sets of Music and Movement Therapy module were used alternately for 10 months. Each Music and Movement Therapy session is for 45 minutes. A Motor and Coordination Performance Checklist was developed to enable the parents, facilitators and research assistant to evaluate the participants' skills averagely once a month for 10 months. T-test and descriptive analyses were conducted to examine any significant improvement and changes of the motor and coordination skills among the two groups. In this study, the children and adolescents with autism showed improvement in their motor and coordination skills after participating through the Music and Movement Therapy in this study.

**Keywords :** Children and adolescents with Autism, coordination skills, motor skills, Music and Movement Therapy,

## Introduction

Autism Spectrum Disorder (ASD) is commonly characterized by a range of unusual behavior and cognition, as well as social interaction and language communication skill impairments. Although motor and coordination impairments are pronounced and prevalent in autism (Fournier, Hass, Naik, Lodha, & Cauraugh, 2010; Jansiewicz et al. 2006; Ming, Brimacombe, & Wagner, 2007), they are not often considered as the key features of autism. Motor and coordination impairments can be present and apparent at early age (Brian et al., 2008; Teitelbaum, Teitelbaum, Nye, Fryman, & Maurer, 1998) and throughout adulthood (Fournier et al, 2010; Ming et al., 2007).

Parents are usually the first to notice autistic features in their child. In some cases, the infant seemed "different" from birth, unresponsive to people or focusing intently on one item for long periods of time, and displaying motor coordination abnormalities and postural instability. The first signs of autism can also appear in toddlers who seem to have been developing normally for a year or two after birth. Studies found that there are children who did not show signs of autism during the first 6-12 months after birth, but they started to show signs of autism such as declining social communication behavior and loss of social and communication skills starting from the second half

of the first year or beginning of the second year of life (Bryson et al, 2007; Ozonoff et al., 2010).

Persons with autism often show a wide range of impairments of sensory processing, repetitive behaviors, poor social and communication functions. Their motor function difficulties include motor planning, motor coordination, gross motor skills, and fine motor skills (Dewey, Cantell, & Crawford, 2007; Hauck & Dewey, 2001). Studies show that majority of the children with autism performed poorer relative to normative comparisons (Green et al., 2002; Green et al., 2009; Whyatt & Craig, 2012) on the Movement Assessment Battery for Children (Henderson, Sugden & Barnett, 2007). Empirical studies also showed that children with autism show deficits and abnormalities in eye-hand coordination (Green et al., 2002), praxis and imitation (Mostofsky et al., 2006; Dewey et al. 2007), and gestural performance such as gesture imitation and the ability to use tools (Dewey et al., 2007; Staples & Reid, 2010). A recent meta-analysis (Fournier et al., 2010) demonstrated that autism is associated with poor motor performance, arm movements, gait, posture, and balance.

Music and Movement Therapy is known to be one of the effective interventions for children with autism to improve their verbal and non-verbal communication skills (Staum, 2008; Whipple, 2004), motor skills and coordination (Alvin, 1976; Boxill & Chase, 2007), and also decrease autistic children's stereotypical behaviours (See, 2012; Pasiali, 2004; Thaut, 1984).

## Music and Movement Therapy

Music and Movement Therapy has been an established healthcare profession that uses music to address physical, emotional, behavioural, social, psychological, communicative, sensory-motor, and/or cognitive functioning of individuals of all ages (American Music Therapy Association, 2005). Music and Movement Therapy is also positively associated with a number of cognitive functions including spatial-temporal abilities (Hetland, 2000), visual-motor integration (Orsmond & Miller, 1999), selective attention (Hurwitz, Wolff, Bortnick, & Kokas, 1975), memory for verbal stimuli (Chan, Ho, & Cheung, 1998; Ho, Cheung, & Chan, 2003; Jakobson, Cuddy, & Kilgour, 2003; Kilgour, Jakobson, & Cuddy, 2000), reading ability (Butzlaff, 2000), and mathematical skills (Vaughn, 2000).

Music and Movement Therapy has been well-documented to facilitate motor improvements in persons with neurological impairments. A meta-analysis (De Dreu, Van der Wilk, Poppe, Kwakkel, & Van Wegen, 2012) was performed to examine the effects of music-based-movement therapy on patients with Parkinson's disease and found significant improvement on motor performance associating with gait and gait-related activities. Studies have also shown that music-based interventions are effective in the recovery of fine motor skills in stroke patients (Schneider, Schönle, Altenmüller, & Münte, 2007; Schneider, Münte, Rodriguez-Fornells, Sailer, & Altenmüller, 2010).

Music and Movement Therapy is one of the treatment interventions for children with autism as it enhances music understanding and pitch perception abilities (Heaton, 2003). Studies showed that children with autism prefer auditory stimuli that are presented in the form of music over other stimuli (Kolko, Anderson, & Campbell, 1980; Thaut, 1987). Most of the studies on Music and Movement Therapy had focused on addressing the social interaction and communication impairments (Corbett, Shickman, & Ferrer, 2008; Gattino et al., 2011; Lim, 2010) and behavioural issues (Pasiali, 2004; Rapp, 2007) of children with autism. Very few studies had examined the effect of music intervention on motor coordination skills of children with autism (Hardy & LaGasse, 2013). Many children with autism show significant gross motor impairments such as arm movements, gait, posture, and balance, as well as poor fine motor coordination such as finger squeezing/praxis and

eye-hand coordination. Manual exploration of various musical instruments such as guitar, castanet, drums, and shakers enable children with autism to exercise perceptual processes, and learn to relate tactile, visual, and auditory stimulation. Functional use of fingers and hands can be trained by playing musical instruments and the repeated movements in playing musical instruments help to improve their motor control and coordination (Alvin, 1976; Boxill & Chase, 2007). Movement to music can also aid in the integration of tactile/kinesthetic and auditory perception and the differentiation of self and non-self (Thaut, 1984). Action songs or rhythmical music that involve body rhythmic actions such as clapping, jumping or marching to music are believed to be able to help the children with autism develop facilitate gross motor skills, auditory-motor coordination and refine the body awareness/image of autistic children (Alvin, 1975). On a more complex level, perceptual learning sequences that combine pitch, loudness, and tempo, can train the child to respond to percussion instruments. In addition to that, stimulating musical environment also provide positive effect on motor coordination and perceptual motor development, as well as on general motor skills.

The therapeutic effects of Music and Movement Therapy are well-documented. However, there is no specific study done to evaluate the effectiveness of Music and Movement Therapy in helping persons with autism to develop their motor and coordination skills. This study sets out to evaluate the effectiveness of a Music and Movement Therapy in developing and training the motor and coordination skills of children and adolescents with autism. A Motor and Coordination Performance Checklist was developed specifically to enable the parents, facilitators and research assistant to evaluate the children and adolescents.

## Objective

The purpose of this study is to examine the use of Music and Movement Therapy in training and improving motor and coordination skills amongst children with autism.

## Methods

A combination of qualitative and quantitative methods was used in this study. The participants were observed and evaluated over a 10-month period using a Motor and Coordination Performance Checklist that was developed specifically for this study. The motor and coordination performance of the children and adolescents were evaluated by the parents, facilitators and research assistant once a month, at every last session of the months. The checklist employed the Likert rating scale with 6 scales ranging from “not applicable” to “being able to perform very well without prompting”. From the data collected over 10 months, a descriptive analysis was done. T-test were also conducted to explore changes from the entry month, the fifth month and the tenth month of the study and to explore any significant difference within the group.

## Participants

This study was conducted at a centre providing teaching-learning for children with autism in Penang, Malaysia. This centre has about 60 children and adolescents that ranged from 3 to 24 years old.

All the participants of this study have been diagnosed with mild to severe spectrum of autism. The total number of children and adolescents who participated in this Music and Movement Therapy was 41 whereby 34 of them were boys (82.9%) and seven were girls (17.1%). The participants were divided into two groups according to their chronological age. Group 1 comprised of 18 younger children (5 girls and 13 boys) with age ranged from 2 to 10 years old while Group 2 comprised of 23

adolescents (2 girls and 21 boys) with age ranged from 11 to 22 years old.

## Music and Movement Therapy Module

The Music and Movement Therapy was developed by the researcher with music therapists, music teachers and special education teachers tailored to the needs of person with autism. Two sets of Music and Movement Therapy module (Set 1 and Set 2) were developed and used to train and develop motor and coordination skills of children and adolescents with autism. These two sets of Music and Movement Therapy modules incorporate the use of different musical media to achieve the goals. Musical instruments were used to work on a range of motions, hand grasp strength and control while the act of singing assisted in the maintenance and improvement of oral motor skills and pulmonary functioning. There are nine sequences with nine songs for each set of the Music and Movement Therapy module. In each set, there are greeting; hand actions; body movement; dance routines;use of certain instruments such as cloth, bean bag, casternet, and ribbon wand for certain songs; and singing which are specifically designed to meet the needs of these children.

The two sets of Music and Movement Therapy modules were used over 10 months. During the first eight months of the study, Set 1 was used every week in the odd months while Set 2 was used every week in the even months. In the last two months, Set 1 and Set 2 were used alternately each week. The length of each of the music therapy module was about 45 minutes.

## Motor and Coordination Performance Checklist

A Motor and Coordination Performance Checklist was developed in line with the study's goals. The motor and coordination skills that were assessed include: (a) gross motor skills; (b) fine motor skills; and (c) coordination skills. The parents were trained to use the Motor and Coordination Performance Checklist. The parents, facilitators and research assistant evaluated the child's or adolescent's motor and coordination skills averagely once a month, during every last session of the month. If the child or adolescent displayed any or all of the motor and coordination skills stated in the checklist, it was noted down by the parent, facilitator and research assistant. The scale given to the participant was confirmed by all three individuals involved.

The checklist used Likert scales ranging from 0 – 5 [0 = Not applicable; 1 = Not able to control self at all (with physical prompt); 2 = Poor (self control with gestural and physical prompt); 3 = Average (self control with verbal and gestural prompt); 4 = Good (self control with verbal prompt); 5 = Very good (able to control self without prompting) , The parents, facilitators and research assistant will rate the child or adolescents as not applicable if they did not display the specific motion or skill. The details of the Motor and Coordination Performance Checklist are presented in Table 1.

**Table :** Details of Motor and Coordination Performance Checklist

| Sub-Categories/Items | Rating Scales Used |
|---|---|
| **(a) Gross Motor Skills**<br>• able to march<br>• able to hop<br>• able to clap<br>• able to skip<br>• able to jump<br>• able to knock objects/body parts<br>• able to shake objects/body parts<br><br>**(b) Fine Motor Skills**<br>• able to tap<br>• able to swing<br>• able to point<br>• able to twist<br><br>**(c) Coordination Skills**<br>• able to perform movements with alternate hands<br>• able to perform movements with alternate legs<br>• able to perform cross movements<br>• able to perform movements with one hand and one leg<br>• able to use equipment(s) given | (a) "0" – Not Applicable<br>(b) "1" - not able to perform movements at all (need physical prompt)<br>(c) "2" – poor motor and coordination skills (able to perform movements with gestural and physical prompt)<br>(d) "3" – average motor and coordination skills (able to perform movements with verbal and gestural prompt)<br>(e) "4" – good motor and coordination skills (able to perform movements with verbal prompt)<br>(f) "5" – very good motor and coordination skills (able to perform movements without prompting)<br>(g) "N/A" – Not Applicable |

## Results

### *Descriptive Analysis*

In the first section, data was analyzed using descriptive analysis. The parents, facilitators and research assistant evaluated each participant once a month, over 10 months.

A comparison of the motor and coordination skills of the two groups (Group 1 and Group 2) of persons with autism at the start and at the end of the therapy was conducted to identify if there were any improvements among the participants in their motor and coordination skills after they underwent the Music and Movement Therapy. Eight scales showing improvement or regression in these skills were identified, namely: (i) improving one scale (↑1); (ii) improving two scales (↑2); (iii) improving three scales (↑3); (iv) regressing one scale (↓1); (v) regressing two scales (↓2); (vi) regressing three scales (↓3); (vii) no changes/sustain (N/C); and (viii) not applicable (N/A).

The analysis was based on the number of participants who showed improvement by one scale, two scales and three scales; those who showed regression by one scale, two scales, and three scales; those who showed no changes/ sustain; or those who were not applicable. The calculation of the percentage of the participants for each specific motion or skill was based on the scales of improvement, regression, no changes/ sustain, or not applicable that the participants displayed for that specific motion or skill.

The results of the motor and coordination skills change are presented in Table 2, Table 3 and Table 4.

**Table 2:** Target Motor and Coordination Skill Change (Gross Motor)

| Items | Group | Scales of Change | | | | | | | Total |
|---|---|---|---|---|---|---|---|---|---|
| | | ↑1 | ↑2 | ↑3 | ↓1 | ↓2 | ↓3 | N/C | |
| Able to march | G1 | 12 | | | | | | 6 | 18 |
| | G2 | (66.7) | | | | | | (33.3) | (100) |
| | Total | 17 | | | | | | 6 | 23 |
| | | (73.9) | | | | | | (26.1) | (100) |
| | | 27 | | | | | | 14 | 41 |
| | | (65.9) | | | | | | (34.1) | (100) |
| Able to hop | G1 | 11 | 1 | | | | | 6 | 18 |
| | G2 | (61.1) | (5.6) | | | | | (33.3) | (100) |
| | Total | 15 | 1 | | | | | 7 | 23 |
| | | (65.3) | (4.3) | | | | | (30.4) | (100) |
| | | 24 | 2 | | | | | 15 | 41 |
| | | (58.5) | (4.9) | | | | | (36.6) | (100) |

| Items | Group | Scales of Change | | | | | | | Total |
|---|---|---|---|---|---|---|---|---|---|
| | | ↑1 | ↑2 | ↑3 | ↓1 | ↓2 | ↓3 | N/C | |
| Able to clap | G1 | 9 | 2 | | | | | 7 | 18 |
| | G2 | (50.0) | (11.1) | | | | | (38.9) | (100) |
| | Total | 20 | | | | | | 3 | 23 |
| | | (87.0) | 2 | | | | | (13.0) | (100) |
| | | 28 | (4.9) | | | | | 11 | 41 |
| | | (68.3) | | | | | | (26.8) | (100) |
| Able to skip | G1 | 10 | 2 | | | | | 6 | 18 |
| | G2 | (55.5) | (11.2) | | | | | (33.3) | (100) |
| | Total | 13 | | | | | | 10 | 23 |
| | | (56.5) | 2 | | | | | (43.5) | (100) |
| | | 21 | (4.9) | | | | | 18 | 41 |
| | | (46.3) | | | | | | (48.8) | (100) |
| Able to jump | G1 | | | | | | | | 18 |
| | G2 | | | | | | | | (100) |
| | Total | | | | | | | | 23 |
| | | | | | | | | | (100) |
| | | | | | | | | | 41 |
| | | | | | | | | | (100) |
| Able to knock objects/body parts | G1 | | | | | | | | 18 |
| | G2 | | | | | | | | (100) |
| | Total | | | | | | | | 23 |
| | | | | | | | | | (100) |
| | | | | | | | | | 41 |
| | | | | | | | | | (100) |
| Able to shake objects/body parts | G1 | | | | | | | | 18 |
| | G2 | | | | | | | | (100) |
| | Total | | | | | | | | 23 |
| | | | | | | | | | (100) |
| | | | | | | | | | 41 |
| | | | | | | | | | (100) |

The Motor and Coordination Performance Checklist has three sub-categories such as gross motor, fine motor, and coordination skills. Table 2 shows the motor and coordination skill change for gross motor skills. Under the gross motor category, there are seven items such as (a) able to march; (b) able to hop; (c) able to clap; (d) able to skip; (e) able to jump; (f) able to knock objects/body parts; and (g) able to shake objects/body parts.

**(a) Able to March:** Twelve children (66.7%) out of the 18 children in Group 1 showed a one scale improvement in the ability to march. Six children (33.3%) showed no changes. In Group 2, 17 adolescents (73.9%) out of the 23 adolescents showed a one scale improvement in the ability to march. Six adolescents (26.1%) showed no changes.

**(b) Able to Hop:** In Group 1, 11 children (61.1%) out of the 18 children showed a one scale improvement in the ability to hop, and one child (5.6%) showed two scales improvement. Six children (33.3%) showed no changes. Fifteen children (65.3%) out of the 23 adolescents in Group 2 showed a one scale improvement in the ability to hop, and only one adolescent (4.3%) showed two scales improvement. Seven adolescents (30.4%) showed no changes.

**(c) Able to Clap:** Nine children (50.0%) out of the 18 children in Group 1 showed a one scale improvement in the ability to clap, and two children (11.1%) showed improvement of two scales. Meanwhile, seven children (38.9%) showed no changes. In Group 2, 20 adolescents (87.0%) out of the 23 children showed a one scale improvement in the ability to clap. Meanwhile, three adolescents (13.0%) showed no changes.

**(d) Able to Skip:** In Group 1, 10 children (55.5%) out of the 18 children showed a one scale improvement in able to skip, and two children (11.2%) showed two scales improvement. Six children (33.3%) showed no changes. Thirteen adolescents (56.5%) out of the 23 adolescents in Group 2 showed a one scale improvement in able to skip. Ten adolescents (43.5%) showed no changes.

**(e) Able to Jump:** Six children (33.3%) out of the 18 children in Group 1 showed a one scale improvement in the ability to jump, two children (11.1%) showed a two scales improvement, and one child (5.6%) showed three scales improvement. Meanwhile, nine children (50.0%) showed no changes. In Group 2, 16 adolescents (69.6%) out of the 23 adolescents showed a one scale improvement in the ability to jump. Seven adolescents (30.5%) showed no changes.

**(f) Able to Knock Objects/Body Parts:** In Group 1, 11 children (61.1%) out of the 18 children showed a one scale improvement in the ability to knock objects/body parts, and only one child (5.6%) showed three scales improvement. Six children (33.3%) showed no changes. Nineteen adolescents (82.6%) out of the 23 adolescents in Group 2 showed a one scale improvement in the ability to knock objects/body parts, and only one adolescent (4.3%) showed two scales improvement. Three adolescents (13.1%) showed no changes.

**(g) Able to Shake Objects/Body Parts:** Nine children (50.0%) out of the 18 children in Group 1 showed a one scale improvement in the ability to shake objects/body parts, one child (5.6%) showed improvement of two scales, and one child (5.6%) showed three scales improvement. Meanwhile, seven children (38.8%) showed no changes. In Group 2, 19 adolescents (82.6%) out of the 23 adolescents showed a one scale improvement in the ability to shake objects/body parts, and only one adolescent (4.3%) showed two scales improvement. Three adolescents (13.1%) showed no changes.

**Table 3:** Target Motor and Coordination Skill Change (Fine Motor)

| Items | Group | Scales of Change | | | | | | | Total |
|---|---|---|---|---|---|---|---|---|---|
| | | ↑1 | ↑2 | ↑3 | ↓1 | ↓2 | ↓3 | N/C | |
| Able to tap | G1 | 10 | 2 | | | | | 6 | 18 |
| | G2 | (55.6) | (11.1) | | | | | (33.3) | (100) |
| | Total | 19 | 1 | | | | | 3 | 23 |
| | | (82.6) | (4.3) | | | | | (13.1) | (100) |
| | | 29 | 3 | | | | | 9 | 41 |
| | | (70.7) | (7.3) | | | | | (22.0) | (100) |
| Able to swing | G1 | 9 | 2 | | | | | 7 | 18 |
| | G2 | (50.0) | (11.1) | | | | | (38.9) | (100) |
| | Total | 15 | 1 | | | | | 7 | 23 |
| | | (65.2) | (4.4) | | | | | (30.4) | (100) |
| | | 24 | 3 | | | | | 14 | 41 |
| | | (58.5) | (7.3) | | | | | (34.2) | (100) |
| Able to point | G1 | 9 | 2 | | | | | 7 | 18 |
| | G2 | (50.0) | (11.1) | | | | | (38.9) | (100) |
| | Total | 17 | 1 | | | | | 5 | 23 |
| | | (74.0) | (4.3) | | | | | (21.7) | (100) |
| | | 26 | 3 | | | | | 12 | 41 |
| | | (63.4) | (7.3) | | | | | (29.3) | (100) |
| Able to twist | G1 | 10 | 1 | | | | | 7 | 18 |
| | G2 | (55.5) | (5.6) | | | | | (38.9) | (100) |
| | Total | 13 | 2 | | | | | 8 | 23 |
| | | (56.5) | (8.7) | | | | | (34.8) | (100) |
| | | 23 | 3 | | | | | 15 | 41 |
| | | (56.1) | (7.3) | | | | | (36.6) | (100) |

Table 3 shows the target motor and coordination skill change for fine motor skills. Under the fine motor category, there are four items such as (a) able to tap; (b) able to swing; (c) able to point; and (d) able to twist.

**(a) Able to Tap:** Ten children (55.6%) out of the 18 children in Group 1 showed a one scale improvement in the ability to tap, and two children (11.1%) showed two scales improvement. Six children (33.3%) showed no changes. In Group 2, 19 adolescents (82.6%) out of the 23 adolescents showed a one scale improvement in the ability to tap, and only one adolescent (4.3%) showed two scales improvement. Three adolescents (13.1%) showed no changes.

**(b) Able to Swing:** In Group 1, nine children (50.0%) out of the 18 children showed a one scale improvement in the ability to swing, and two children (11.1%) showed two scales improvement. Seven children (38.9%) showed no changes. Fifteen adolescents (65.2%) out of the 23 adolescents in Group 2 showed a one scale improvement in the ability to swing, and only one adolescent (4.4%) showed two scales improvement. Seven adolescents (30.4%) showed no changes.

**(c) Able to Point:** Nine children (50.0%) out of the 18 children in Group 1 showed one scale improvement in able to point, and only two children (11.1%) showed two scales improvement. Seven children (38.9%) showed no changes. In Group 2, 17 adolescents (74.0%) out of the 23 adolescents showed a one scale of improvement in the ability to point, and only one adolescent (4.3%) showed two scales improvement. Five adolescents (21.7%) showed no changes.

**(d) Able to Twist:** In Group 1, 10 children (55.5%) out of the 18 children showed a one scale improvement in the ability to twist, and only one child (5.6%) showed two scales improvement. Seven children (38.9%) showed no changes. Thirteen adolescents (56.5%) out of the 23 adolescents in Group 2 showed a one scale improvement in the ability to twist, and only two adolescents (8.7%) showed two scales improvement. Eight adolescents (34.8%) showed no changes.

**Table 4:** Target Motor and Coordination Skill Change (Coordination)

| Items | Groups | Scales of Change | | | | | | | Total |
|---|---|---|---|---|---|---|---|---|---|
| | | ↑1 | ↑2 | ↑3 | ↓1 | ↓2 | ↓3 | N/C | |
| Able to perform movements with alternate hands | G1 | 10 | 1 | | | | | 7 | 18 |
| | G2 | (55.6) | (5.6) | | | | | (38.8) | (100) |
| | Total | 14 | 1 | | | | | 8 | 23 |
| | | (60.9) | (4.3) | | | | | (34.8) | (100) |
| | | 24 | 2 | | | | | 15 | 41 |
| | | (58.5) | (4.9) | | | | | (36.6) | (100) |

| Items | Groups | Scales of Change | | | | | | | Total |
|---|---|---|---|---|---|---|---|---|---|
| | | ↑1 | ↑2 | ↑3 | ↓1 | ↓2 | ↓3 | N/C | |
| Able to perform movements with alternate legs | G1 | 11 (61.1) | 1 (5.6) | | | | | 6 (33.3) | 18 (100) |
| | G2 | 13 (56.6) | 1 (4.3) | | | | | 9 (39.1) | 23 (100) |
| | Total | 24 (53.7) | 2 (4.9) | | | | | 15 (41.4) | 41 (100) |
| Able to perform cross movements | G1 | 12 (66.7) | 1 (5.6) | 1 (5.6) | | | | 4 (22.1) | 18 (100) |
| | G2 | 13 (56.6) | 1 (4.3) | | | | | 9 (39.1) | 23 (100) |
| | Total | 25 (61.0) | 2 (4.9) | 1 (2.4) | | | | 13 (31.7) | 41 (100) |
| Able to perform movements with one hand & one leg | G1 | 10 (55.6) | 1 (5.6) | 1 (5.6) | | | | 6 (33.2) | 18 (100) |
| | G2 | 15 (65.3) | 1 (4.3) | | | | | 7 (30.4) | 23 (100) |
| | Total | 25 (61.0) | 2 (4.9) | 1 (2.4) | | | | 13 (31.7) | 41 (100) |
| Able to use equipment(s) given | G1 | 9 (50.0) | 4 (22.2) | | | | | 5 (27.8) | 18 (100) |
| | G2 | 14 (60.9) | 1 (4.3) | | | | | 8 (34.8) | 23 (100) |
| | Total | 23 (56.1) | 5 (12.2) | | | | | 13 (31.7) | 41 (100) |

Table 4 shows the target motor and coordination skill change for coordination. Under the coordination category, there are five items such as (a) able to perform movements with alternate hands; (b) able to perform movements with alternate legs; (c) able to perform cross movements; (d) able to perform movements with one hand or one leg; and (e) able to use equipment(s) given.

(a) Able to Perform Movements with Alternate Hands: Ten children (55.6%) out of the 18 children in Group 1 showed a one scale improvement in the ability to perform movements with alternate hands, and only one child (5.6%) showed two scales improvement. Seven children

(38.8%) showed no changes. In Group 2, 14 adolescents (60.9%) out of the 23 adolescents showed a one scale of improvement in the ability to perform movements with alternate hands, and only one adolescent (4.3%) showed two scales improvement. Eight adolescents (34.8%) showed no changes.

(b) **Able to Perform Movements with Alternate Legs:** In Group 1, 11 children (61.1%) out of the 18 children showed a one scale improvement in the ability to perform movements with alternate legs, and only one child (5.6%) showed two scales improvement. Six children (33.3%) showed no changes. Thirteen adolescents (56.6%) out of the 23 adolescents in Group 2 showed a one scale improvement in the ability to perform movements with alternate legs, and only one adolescent (4.3%) showed two scales improvement. Nine adolescents (39.1%) showed no changes.

(c) **Able to Perform Cross Movements:** 12 children (66.7%) out of the 18 children in Group 1 showed a one scale improvement in the ability to perform cross movements, one child (5.6%) showed two scales improvement and one child (5.6%) showed three scales improvement. Four children (22.1%) showed no changes. In Group 2, 13 adolescents (56.6%) out of the 23 adolescents showed a one scale of improvement in the ability to perform cross movements, and only one adolescent (4.3%) showed two scales improvement. Nine adolescents (39.1%) showed no changes.

(d) **Able to Perform Movements with One Hand or One Leg:** In Group 1, 10 children (55.6%) out of the 18 children showed a one scale improvement in the ability to perform movements with one hand or one leg, only one child (5.6%) showed two scales improvement, and one child (5.6%) showed three scales improvement. Six children (33.2%) showed no changes. Fifteen adolescents (65.3%) out of the 23 adolescents in Group 2 showed a one scale improvement in the ability to perform movements with one hand or one leg, and only one adolescent (4.3%) showed two scales improvement. Seven adolescents (30.4%) showed no changes.

(e) **Able to Use Equipment(s) Given:** Nine children (50.0%) out of the 18 children in Group 1 showed a one scale improvement in the ability to use equipment(s) given, and four children (22.2%) showed two scales improvement. Five children (27.8%) showed no changes. In Group 2, 14 adolescents (60.9%) out of the 23 adolescents showed a one scale improvement in the ability to use equipment(s) given, and only one adolescent (4.3%) showed two scales improvement. Eight adolescents (34.8%) showed no change.

*T-Test*

In the second section, t-test was conducted to examine if there was significant changes in the skills within the group. Lastly, mean was performed to identify if there is a significant improvement in this skills within the group over time.

**Table 5:** The t-Test of Target Motor and Coordination Skills for the First Month, the Fifth Month and the Tenth Month in Group 1

| | Test Value = 0 | | | | |
|---|---|---|---|---|---|
| | | | | 95% Confidence Interval of the Difference | |
| | t | df | Sig. (2-tailed) | Lower | Upper |
| First Month | 8.115 | 17 | .000 | 1.5879 | 2.7038 |
| Fifth Month | 10.321 | 17 | .000 | 2.1851 | 3.3080 |
| Tenth Month | 10.946 | 17 | .000 | 2.2984 | 3.3960 |

Table 5 shows the results of the t-Test in the motor and coordination skills for Group 1 in the first month, the fifth month and tenth month. The results show that there is a significant change within Group 1 on motor and coordination skills at the first month ($t=8.115$, $p<.001$), the fifth month ($t=10.321$, $p<.001$) and the tenth month ($t=10.946$, $p<.001$).

**Table 6: The Mean Differences for Target Motor and Coordination Skills for the First Month, the Fifth Month and the Tenth Month in Group 1**

| Group 1 | Mean | N | Std. Deviation |
|---|---|---|---|
| First Month | 2.1458 | 18 | 1.12193 |
| Fifth Month | 2.7465 | 18 | 1.12897 |
| Tenth Month | 2.8472 | 18 | 1.10360 |

Table 6 shows the mean differences in Group 1 over the three months. There is an increasing mean in the Group 1's motor and coordination skills from the first month ($M=2.1458$), the fifth month ($M=2.7465$) and the tenth month ($M=2.8472$). This shows that the children in Group 1 had improved in their target motor and coordination skills over the 10 months.

**Table 7:** The t-Test of Motor and Coordination Skills for Group 2 for the First Month, the Fifth Month and the Tenth Month

| | Test Value = 0 | | | | |
|---|---|---|---|---|---|
| | | | | 95% Confidence Interval of the Difference | |
| | t | df | Sig. (2-tailed) | Lower | Upper |
| First Month | 14.240 | 22 | .000 | 2.3588 | 3.1630 |
| Fifth Month | 16.001 | 22 | .000 | 2.6632 | 3.4564 |
| Tenth Month | 16.930 | 22 | .000 | 2.7756 | 3.5505 |

Table 7 shows the results of the t-Test in the motor and coordination skills for Group 2 in the first month, the fifth month and the tenth month. The results show that there is a significant change within Group 2 on the motor and coordination skills for the first month ($t=14.240$, $p<.001$), the fifth month ($t=16.001$, $p<.001$) and the tenth month ($t=16.930$, $p<.001$).

**Table 8:** The Mean Differences for Target Motor and Coordination Skills for the First Month, the Fifth Month and the Tenth Month in Group 2

| Group 2 | Mean | N | Std. Deviation |
|---|---|---|---|
| First Month | 2.7609 | 23 | .92983 |
| Fifth Month | 3.0598 | 23 | .91710 |
| Tenth Month | 3.1630 | 23 | .89600 |

Table 8 shows the mean differences in Group 2 over the three months. There is an increasing mean in the Group 2's motor and coordination skills from the first month (M=2.7609), fifth month (M=3.0598) and tenth month (M=3.1630). This shows that the adolescents in Group 2 had improved their motor and coordination skills over the 10 months.

## Discussion and Conclusion

The overall results from this study confirmed the effectiveness of Music and Movement Therapy in developing and training the gross motor, fine motor and coordination skills of persons with autism.

The study findings indicate that about 62.73% of the children and 75.77% of the adolescents with autism showed improvement in their gross motor skills after they underwent the Music and Movement Therapy. 66.7% of the children from Group 1 and 73.9% of the adolescents from Group 2 showed improvement in the ability to march; 61.1% of the children from Group 1 and 65.3% of the adolescents from Group 2 showed improvement in the ability to hop; 50.0% of the children from Group 1 and 87.0% of the adolescents from Group 2 showed improvement in the ability to clap; 55.5% of the children from Group 1 and 56.5% of the adolescents from Group 2 showed improvement in the ability to skip; 69.6% of the adolescents from Group 2 showed improvement in the ability to jump; 61.1% of the children from Group 1 and 88.6% of the adolescents from Group 2 showed improvement in the ability to knock objects/body parts; 50.0% of the children from Group 1 and 82.6% of the adolescents from Group 2 showed improvement in the ability to shake objects/body parts. These findings indicate that the Music and Movement Therapy is effective in training gross motor skills among persons with autism.

The findings also show that in total about 62.5% of the children and 75% of the adolescents with autism, majority of the children and adolescents with autism showed improvement in their fine motor skills after they underwent the Music and Movement Therapy. There were 55.6% of the children from Group 1 and 82.6% of the adolescents from Group 2 showed improvement in the ability to tap; 50.0% of the children from Group 1 and 65.2% of the adolescents from Group 2 showed improvement in the ability to swing; 50.0% of the children from Group 1 and 74.0% of the adolescents from Group 2 showed improvement in the ability to point; and 55.5% of the children from Group 1 and 56.5% of the adolescents from Group 2 showed improvement in the ability to twist.

These findings also clearly indicate that the Music and Movement Therapy is effective in training fine motor skills among children with autism.

In addition, the music and movement therapy helped 68.96% of the children and 64.36% of the adolescents with autism with their coordination skills. 61.2% of the children from Group 1 and 65.2% of the adolescents from Group 2 showed improvement in the ability to perform movements with alternate hands; 66.7% of the children from Group 1 and 60.9% of the adolescents from Group 2 showed improvement in the ability to perform movements with alternate legs; 77.9% of the children from Group 1 and 60.9% of the adolescents from Group 2 showed improvement in the ability to perform cross movement; 66.8% of the children from Group 1 and 69.6% of the adolescents from Group 2 showed improvement in the ability to perform movements with one hand or one leg; and 72.2% of the children from Group 1 and 65.2% of adolescents from the Group 2 showed improvement in the ability to use the equipment given. These findings again confirm that the music and movement therapy is an effective tool in training coordination motor skills among children and adolescents with autism.

A detailed t-test analysis was done to see if the children and adolescents with autism showed changes in the motor and coordination skills within Group 1 and Group 2. All the children in Group 1 and adolescents in Group 2 showed significant changes in motor and coordination skills over the three months.

This study may serve as a model to develop more models for future studies that can be used as intervention to develop and train motor and coordination skills of persons with autism. The direction of the future study may focus on developing music and movement therapy modules for larger samples or across ages to find out whether similar findings can be concluded.

In conclusion, this study has shown that children and adolescents with autism could attain improvement in their gross motor, fine motor and coordination skills through the music and movement therapy, and thus, implying that the motor and coordination skills of the persons with autism can be developed and trained.

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