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The Effect of Physical and Music Education in the Development of Motor Skills in Children between Six and Eight Year-Olds in an Inclusive Environment

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Introduction and Theoretical Framework

Music and physical education are two disciplines that have a large impact on the development of a child. A child that is physically active exhibits fewer problems with obesity and chronic high-risk diseases (World Health Organization, 2002) and is more prone to keep active during adolescence (Lopategui, 2000). Similarly, recent research studies show that early musical education helps children to develop their affective and cognitive potentials, and helps them avoid attention deficit disorders (Hanser, 2000) and neurological language disorders (Palac and Grimshaw, 2006). Both discipline develop similar motor, visual, and cognitive skills (Turner, M. 1998). For example, sports require children to develop coordination, stamina, agility, speed, reaction time and concentration (Del Río, 1990; Ojeda, 2005; Pangrazi & Dauer, 2007). The same skills are also developed in order to increase/foster musicianship (Eerikäinen, Lamont, & Knox 2008). Even though the main objective of these disciplines is not to develop future professionals in the areas, all children should have the opportunity to decide whether they desire to become a musician or an athlete. Their talent must be developed in the same way other disciplines do. For a physical educator it is important to develop in children a strong skill base, game sense, and tactical awareness at the elementary level (Haworth and Bailey, 2009). The same happens in music education., children that have good early music education have higher possibilities to become a professional musician.

Integration in the classroom has been recently an important subject in the field of education (Jacobs, 1989, 1997). Therefore, since both music and physical education share similar skills, it seems logical to research on the integration of both disciplines. In the research paper *Effects of an Integrated Physical Education/Music Program in Changing Early Childhood Perceptual-Motor Performance,* Judy Brown (1981) analyzed how the specific music education methodologies of Dalcroze and Kodaly had an impact on perceptual-motor development. The results indicated that the integration was successful and beneficial to all children. Zachopoulou, Tsapakidou and Derri, (2004) found in a similar empirical research that a developmentally appropriate music and movement program could positively affect jumping and dynamic balance (balance during movement) of young children. This integration helps to make classes more joyful as Greci (1997) assured that music could make the physical education more attractive to children. In this way, music helps children work and develop motor skills more playfully (Sariscsany, 1991). Music involves many skills ranging from the emotional to the physical dimensions. As Nelson (2009) expressed, dance and music helps to develop physical endurance, and coordination in all children. It also helps athletes to understand movement from a different perspective. Music integration helps physical education teachers to

understand musical forms and to develop content standards used in many states of the United States such as the California State Department of Education (2006). Examples are rhythmic skills for students from kindergarten to third grade.

- Perform motor skills (locomotor, non-locomotor and manipulative) to a steady beat
- Clap in time to a simple, rhythmic beat
- Create or imitate movement in response to rhythms and music
- Demonstrate a smooth transition between even-beat locomotor skills and uneven beat locomotor skills in response to music or an external beat
- Perform rhythmic sequences related to simple folk dance or ribbon routines
- Perform with a partner rhythmic sequence related to simple folk dance or ribbon routines

All of the above standards coincide with the National Standards of Music Education (MENC, 1994). Children also develop better sense of rhythm through movement (Wang, 2008). The movements can inspire the sense of rhythmic concepts for children.

On the cognitive side, both music and physical education help the development of the brain. Music trains the brain for higher forms of thinking, and physical exercise is good for the heart, increasing nerve connections facilitating the process of learning (Begley, 1996). Also, Greenough and Green (1981) showed that people who engage in emotional, cognitive, and physical activities develop according to their age. In this respect, both music and physical education are implicit. Music also helps organize movement coordination (Crowley, 1992). As Warner (1990) pointed out, the main basic musical knowledge/concepts for young children are steady beat, tempo, melody, and volume. The development of steady beats help children to increase body coordination and related physical abilities (Weikart, 2003).

Problem

Does the integration of the physical education and music education programs impact the development of locomotor and musical skills in children between six and nine years old?

Methodology

This investigation entailed the evaluation of five locomotor skills: walking, running, skipping, sliding, and jumping. A quantitative pre and posttest were developed to measure the whole body tempo awareness level (speed: slow and fast for each one of the skills, except for jumping, which used steady beats).

Varied music from the Puerto Rican folk style and European classical repertoire were used.

Participants

Twenty-eight (n=28) students from two multiage classrooms (six to eight years old) of first and second graders from the Elementary Laboratory School of the University of Puerto Rico participated in this study. The control group had fourteen students (seven girls and seven boys) and the experimental group had fourteen students (eight boys and six girls). Two students of the control group (14.3%) are also inscribed in special education and none with an ADHD diagnostic. Six of the fourteen students of the experimental group (42.9%) participate in the special education program. Fifty per cent (three of six) of these participants have an ADHD diagnostic.

Pre and post-test
Control and experimental groups moved to the rhythm of a two-minute recording of a combination of three pieces in three different tempos –fast, moderate, and slow.

- *Capullito de Alhelí, R. Hernández,* moderate tempo, Puerto Rican folk piece
- *Largo from the Winter, Vivaldi Four Seasons,* slow tempo, Italian Barroque piece
- *Trepak dance, from the Nutcracker Suite, Tchaikovsky,* fast tempo, Russian dance

The children moved to the rhythm performing four locomotive skills: *running, walking*, *skipping*, and *sliding*– in the different tempos.

Pre and posttest description
For this investigation, five tests were constructed to measure the skills of students in the control and experimental groups. The skills were running, walking, sliding, alternating stepping and skipping, and jumping, and each test contained five sub skills assessed according to this scale: Excellent = 5; Good = 4; Average = 3; Poor = 2; and Very poor = 1 (see Table 1 below). A maximum of 25 points and a minimum of five points were accumulated for each test.

Table 1: Measured skills in pre and posttests, (Gallahue, & Donnelly, 2003)

Walk	Run	Skip	Slide	Jump
Legs Alternate heel-toe action Smooth and even transfer of weight Movement starts with the toes pushing against the floor. Movement ends with the heel landing on the floor.	**Legs** Body weight distributed on the front part of the foot; not on heels for short running races (sprints) Landing with the heels and pushing with the toes in long slower-speed races Knees flexed	**Legs** Forward step and hop on the same foot while the opposite knee is lifted upward Rhythmic coordination of movements when alternating legs	**Legs** Trail leg lands adjacent to lead leg upon contact. Legs do not cross when sliding laterally Knees flexed	**Legs** Knees flexed Pushing with the front part of the foot in the take off Forceful extension at the hips. Knees, and ankles
Hips Swing the legs from the hips.	**Hips** Swing the legs from the hips Lift knees.	**Feet** Take off and land with the front part of the foot. One step forward and hop at the same time. Make a vertical little hop.	**Hips** Hips are flexed with abduction and adduction movement pattern.	**Landing** Flex the knees to cushion the impact with the floor.
Torso Straight torso Upright head Visual focus is straight ahead. Keep relaxed.	**Torso** Slight trunk lean Keep head looking forward	**Torso** Slight trunk forward lean	**Torso** Slight trunk forward lean Head moves sideways and forward toward the direction of the movement.	**Torso** Flex the torso, knees, and ankles to widen the area over which the takeoff force will be produced.
Arms Arms swing freely in opposition with leg action.	**Arms** Arms swing freely in opposition with leg action. Flex elbows.	**Arms** Arms swing slightly upward and forward. Arms movement is rhythmic but reduced when transferring the body weight.	**Arms** Arms are not used to keep balance.	**Arms** Arms swing backwards and forward; downward and upward to help jumping.

Walk	Run	Skip	Slide	Jump
Strides Keep feet Straight Steps should not be excessively large.	**Strides** Push with the metatarsus not with a flat foot. Keep a consistent pace.	**General** Low flight pattern. Pattern tends to be more vertical than horizontal.	**Strides** Push with the metatarsus not with a flat foot. Keep a consistent pace.	**General** Coordinate the movement impulse of the different parts of the body and feet simultaneously.

Each student performed the corresponding exercise, and the teacher filled the assessment sheet according to the student's performance of each skill. This process was carried out before implementing the integration of the music and physical education programs (pretest) and after its implementation (posttest).

Treatment

For a period of eight weeks, the experimental group of children performed activities developed to enhance both musical and locomotor skills. The level of development of locomotor skills was analyzed. The musical elements integrated in activities were pitch range, and rhythm: steady beat and tempo, timber, form, creativity, and expressivity. About thirty activities were developed; the following are some examples:

1. Pitch range- Students performed high – low movements according to the pitch range of the music to which they were listening. They were listening to a Puerto Rican children's song in two ranges: high and low.
2. Steady beat- Students jumped to a steady beat on a floor ladder while listening to the drum.
3. Tempo- Students moved creatively to different styles and speeds of music including: Puerto Rican, world and classical music.
4. Timber- Children changed motor movements according to the timber sounds they listened to (violin, piano, flute playing, etc.).
5. Form- Children explored and created various dance routines in the elementary musical forms ABA, AABA, ABCA, etc.
6. Expressivity and creativity- Children performed original dances while they explored how to perform different dynamics with instruments.
7. Reading music- Children jumped on the lines and spaces of a five staves painted mat.

Results

In this research, pre and posttest arithmetic means and variances were calculated for the five skills. Tests t with a $p < 0.05$ level were used to determine whether

the differences between the arithmetic means were statistically significant. In cases where the comparison was within the same group, that is, scores were obtained from the experimental or the control group pre and posttests, the t test was applied for dependent groups. When control and experimental group scores were analyzed, the t test was applied for independent groups ($p < 0.05$).

Pretest scores of both groups were compared to determine whether the groups started with differences in mastering the skills measured in this study. Although the control group scores showed higher arithmetic means, initial significant differences were found when applying the t test only in the sliding and running skills (see Table 2.1).

Table 2.1: Arithmetic means and differences between the experimental and control groups' pretest scores

Skills	***Pretest arithmetic mean Experimental group (N = 14)***	***Pretest arithmetic mean Control group (N = 14)***	***Differences between pretest arithmetic means of Control and Experimental groups***	***T test results (p < 0.05)***
Walking	23.43	23.86	0.43	0.11
Running	23.00	23.57	0.57	0.13
Skipping	21.93	22.14	0.21	0.30
Sliding	21.64	23.36	1.72	0.00
Jumping	21.93	22.86	0.93	0.02

The analysis of control and experimental groups' scores showed differences in favor of the experimental group. The arithmetic means in the scores of the experimental group for the five posttests were higher than the arithmetic means obtained by the control group. The difference was significant in the skipping skill ($p = 0.00$) (see Table 2.2).

Table 2.2: Arithmetic means and differences between the experimental and control groups' posttest scores

Skills	***Posttest arithmetic mean Experimental group (N = 14)***	***Posttest arithmetic mean Control group (N = 14)***	***Differences between posttest arithmetic means of Control and Experimental groups***	***T test results (p < 0.05)***
Walking	24.50	24.07	0.43	0.07
Running	24.14	23.79	0.35	0.13
Skipping	23.57	22.64	0.93	0.00
Sliding	23.64	23.43	0.21	0.26
Jumping	23.57	23.00	0.57	0.07

Increases were observed in the arithmetic means of both groups' (control and experimental) scores in walking, running, skipping, sliding, and jumping post-measured skills when compared to those obtained in the pre-measurement (see Tables 2.3, 2.4, and Chart 1.1). In addition, there were statistically significant increases in the arithmetic means of the experimental group post-measurement scores when compared to those obtained in the five skill pretests of walking, running, jumping, skipping, and sliding (see Table 2.3). On the other hand, when comparing the control groups pre and-posttests scores, there were no statistically significant increases (see Table 2.4).

Table 2.3: Arithmetic means and differences between the experimental group pre and posttest scores

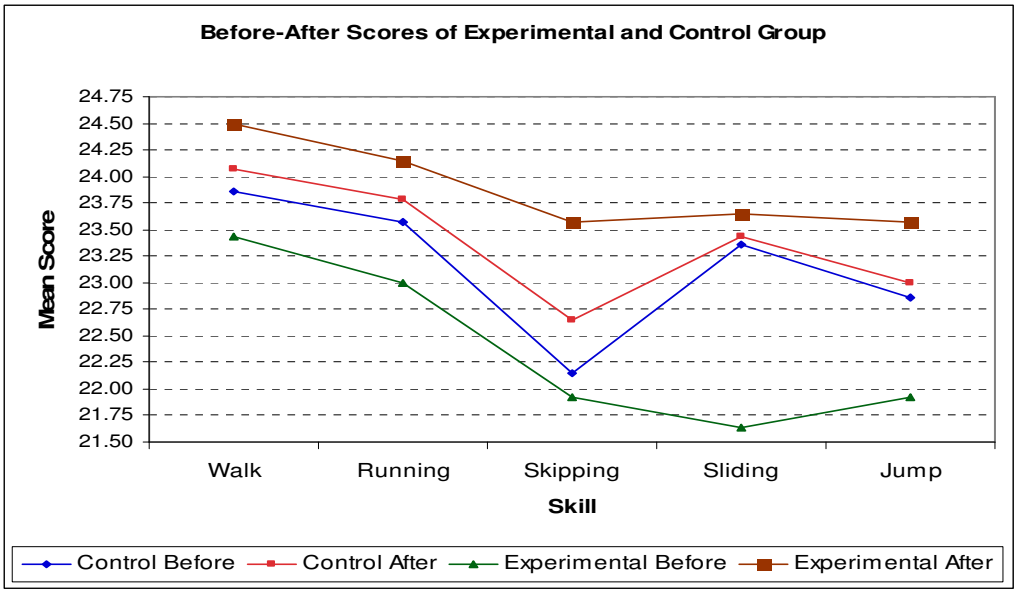
Skills	***Pretest arithmetic mean Experimental group (N = 14)***	***Posttest arithmetic mean Experimental group (N = 14)***	***Differences between pre and posttest arithmetic means of Experimental group***	***T test results (p < 0.05)***
Walking	23.43	24.50	1.07	0.00
Running	23.00	24.14	1.14	0.00
Skipping	21.93	23.57	1.64	0.00

Sliding	21.64	23.64	2.00	0.00
Jumping	21.93	23.57	1.64	0.00

Table 2.4: Arithmetic means and differences between the control group pre and posttest scores

Skills	***Pretest arithmetic mean Control group (N = 14)***	***Posttest arithmetic mean Control group (N = 14)***	***Differences between pre and posttest arithmetic means of Control group***	***T test results (p < 0.05)***
Walking	23.86	24.07	0.21	0.14
Running	23.57	23.79	0.22	0.25
Skipping	22.14	22.64	0.50	0.06
Sliding	23.36	23.43	0.07	0.34
Jumping	22.86	23.00	0.14	0.34

Graphic 1.1: Arithmetic means and differences between the experimental and control groups' pre and posttest scores



Conclusions

Control group walking, running, skipping, sliding, and jumping pretest scores showed higher arithmetic means compared to the experimental group ($0.21 \leq \overline{X}$ control $- \overline{X}$ experimental ≤ 1.72). However, posttest scores of both groups showed differences favoring the experimental group ($0.21 \leq \overline{X}$ experimental $- \overline{X}$ control ($\overline{X}$ x exp. = 28.57) ≤ 0.93). The arithmetic means of the experimental group scores for the five posttests were higher than the arithmetic means obtained in the control group ($\overline{X}$ control =23.39). In the skill of skipping, the difference was significant ($\overline{X}$ experimental $- \overline{X}$ control = 0.50; P=0.06).

In addition, statistically significant increases were found in the arithmetic means of the experimental group post-measurement scores when compared to those obtained in the walking, running, jumping, skipping, and sliding skills pretests. On the other hand, when comparing the pre and posttests scores of the control group, there were no statistically significant increases. These results could indicate that the participants' mastering of the skills is an effect of the treatment.

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