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Music Training Influence on Cognitive and Language Development in 3 to 4 year-old Children

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Abstract

This research, a longitudinal study, aims to determine the effectiveness of formal music training on cognitive development of 3 to 4 year-old children from Head Start, with a special focus on language. For two years the experimental group (n = 80) received formal music classes for 20 minutes, three times a week. Early childhood non-music teachers were trained and mentored by music educators to teach music classes during their scheduled teaching time. Control group children (n = 133) did not receive formal music classes and their teachers did not receive music education training. The Child Observation Record (COR) from HighScope was used to assess child development. This assessment battery was administered six times during the study. The findings demonstrate that music training can make a significant difference in children's overall development, including the language domain.

Keywords: Music training, early childhood, cognitive development, language, preschool teachers.

Resumen

Esta investigación, un estudio longitudinal, pretende determinar el efecto del entrenamiento musical formal en el desarrollo cognitivo de niños de 3-4 años de Head Start, con especial atención al lenguaje. Durante dos años, un grupo experimental (n = 80) recibió clases formales de música de 20 minutos tres veces por semana. Los maestros no especialistas en música de estos niños fueron entrenados y tutorizados por educadores musicales expertos para impartir las clases de música durante el tiempo de enseñanza programado. Un grupo control (n = 133) no recibió clases formales de música y sus maestros no recibieron entrenamiento en educación musical. Para evaluar el desarrollo de los niños se utilizó el Registro de Observación de Niños (COR) de HighScope. Esta batería de evaluación se administró seis veces durante el estudio. Los resultados demuestran que el entrenamiento musical puede suponer una diferencia significativa en el desarrollo general de los niños, incluido el ámbito del lenguaje.

Palabras clave: Entrenamiento musical, infancia temprana, desarrollo cognitivo, lenguaje, maestros de educación infantil.

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Introduction

Music training improves brain functions and structures (Herholz & Zatorre, 2012; Levitin & Tirovolas, 2009; Patel, 2003, 2010; Schellenberg, 2004; Trainor, Shahin, & Roberts, 2009), including language processing (Besson & Schön, 2001; Patel & Iversen, 2007; Schlaug, Marchina, & Norton, 2009; Trollinger, 2003).

Substantial research supports the benefits of music training in language development (Koelsh et al., 2002; Moreno et al., 2011). Music education in early childhood is valuable for every child's language skills, which are mainly developed at around the age of five (Perlovsky, 2010). The age at which musical training is started can be a significant factor of this influence (Jentschke & Koelsch, 2009; Schellenberg, 2001). Therefore, music can facilitate expressive language in children with disabilities as well as in typical children (Corriveau & Goswami, 2009; Vitoria, 2005; Wan, Demaine, Zipse, Norton, & Schlaug, 2010). It can also help the development of receptive language in early childhood because the child can understand better the meaning of a word when it is experienced with a musical movement or a song (Pica, 2009). These early musical correlations improve verbal memory (Ho, Cheung, & Chan, 2003) and can additionally influence receptive language development of children at risk of developing language delays (Seeman, 2008). Along similar lines, children taking music lessons, as young as 6 years old, decode speech prosody faster than children with no music lessons (Thompson, Schellenberg, & Husain, 2004).

Because the preschool years are when "children take their first critical steps to learning to read and write" (National Association for the Education of Young Children, 1998, p. 32), it is necessary to develop appropriate strategies to diminish the possibility of further delays. Indeed, studies suggest that a child's oral language skills in preschool are predictors of future reading (Dickinson & McCabe, 2001; Hammer, Farkas, & Maczuga, 2010). Music training can be a successful strategy to have a positive impact on these skills because it allows children to practice school readiness skills (Brown, Benedett, & Armistead, 2010; Dixon, 2008). For instance, Anvary, Trainor, Woodside, and Levi (2002) found a strong relationship between the development of music skills, reading, and phonological awareness of 5-year-old children. Likewise, Herrera, Lorenzo, Defior, Fernández-Smith, and Costa-Giomi (2011) found that music training also influences the development of phonological awareness and naming speed in preschool children. In the same line, students with early and on-going musical training had a higher verbal mem-

ory than those who began later or discontinued the training (Franklin et al., 2008; Legg, 2009).

Despite findings about the benefits of music on cognition and language development, in general (Dankovicová, House, Crooks, & Jones, 2007; Koelsch, 2005; Patel, 2008; Perlovsky, 2012), and for early childhood education, specifically (Hannon & Trainor, 2007; Hyde et al., 2009; Levinowitz, 2009), music training programs that have been conducted are diverse, and not all of them involve benefits of music training led by classroom teachers. In some cases music training has been performed by musicians, in others by music educators from outside the school setting, and even in other cases by the researchers. Additionally, music training has been undertaken inside or outside the classroom context, as formal music training or as an extra-curricular activity, and its intensity or duration is also an element to take into account. Furthermore, research has typically focused on specific elements (pitch, rhythm, timbre, etc.) for music perception or production that have been introduced in music training, and the analysis of their effects on particular areas of child development (phonological processing skills, speech prosody, literacy, motor skills, etc.). These studies are required to further knowledge about the effects of music training on cognitive and language development but many of them are not focused on improving teaching competencies of teachers to be implemented in the classroom beyond the context of the research.

Moreover, most early childhood programs do not have a staff music educator. In many preschools, the classroom teachers are responsible for conducting musical activities (Nardo, Custodero, Persellin, & Fox, 2006; Siebenaler, 2006). Therefore, music courses for early childhood and elementary education majors are an essential component of music education (Koops, 2008). Many teachers use songs and movement activities on a daily basis and value music as an important tool for education, but they acknowledge that music teachers are better skilled to use these techniques (Hennessy, 2000; Holden & Button, 2006). These teachers appreciate the use of music in their classrooms (Kim & Choy, 2008; Lum, 2008) mostly because they understand music can have a positive influence in other academic areas (Hash, 2010). However, many teachers lack confidence in their singing skills and therefore avoid using music (Heyning, 2011; Siebenaler, 2006). Thus, in this longitudinal research early childhood non-music teachers were trained and mentored by music educators to teach music classes during their scheduled teaching time.

The purpose of this study was to investigate the effect of music

education on the cognitive development of preschool children, especially in the language domain. It was hypothesised that language development scores for the experimental group children who received formal music classes by trained preschool teachers would be higher than those for the control group.

Method

Participants

In this longitudinal study, participants were a selection of children from a Head Start program located in Puerto Rico. This study focused on children who stayed in Head Start continuously for two years. From the 1482 children that were enrolled in the program, the experimental group (n = 80) took formal music education classes consecutively for two years, and the control group (n = 133) did not participate in such classes. The experimental group was comprised of 42 males (52.5%) and 38 females (47.5%) with a mean age of 43 months at the beginning of the study. The students received twenty minutes of music education classes at least three times a week. The control group (n = 133), was comprised of 64 males (48.1%) and 69 females (51.9%) with a mean age of 42.2 months at the beginning of the data collection period. A t-test indicated that there were no significant differences in the mean age between the control and the experimental groups (t = –1.75, p = .081).

The control group was also in the Head Start program for two consecutive years. They did not receive formal music education, but did have a music component in their curriculum and their teachers sang songs in circle time and during transitions. Both the experimental and control groups were 99% Hispanic and their first language was Spanish. Eighty-two per cent had low socioeconomic status and their family income was less than $15,000 per year; 34% came from single-parent households, and 61% were on public assistance.

Instruments

Child Observation Record

To evaluate the performance of the children, the HighScope Spanish Version of the Children Observation Record [COR] (HighScope Educational Research Foundation, 2003) was used. This instrument is validated (Sekino & Fantuzzo, 2005). It includes 30 preschool development skills from six domains: *Initiative, social relations, creative representation, music and movement, language,* and *logical thinking*. Five statements describing the child's level of behaviour are listed under each domain area hierarchically.

Despertar Musical [Musical Awakenings]

The non-music teachers were trained to teach musical activities using the activity guide "Despertar Musical [Musical Awakenings]" (García, Hernández-Candelas, & Lugo, 2004), written for use with 3 to 5 year-old children by music and non-music teachers. It consists of 33 songs and rhymes with specific activities to develop musical abilities in young children. The guide uses the principles and approaches of Suzuki (1983), Gordon (2003), Standards for Prekindergarten by National Association for Music Education [NAfME] (MENC, 1994), Kodaly (Hein, 1992), and Dalcroze (1921). Each activity explores the skills of music through the use of songs, instruments, and movement. The song repertoire was purposely chosen to enhance aural discrimination skills: specifically, between binary, ternary, and compound meters; major, minor, and modal tonalities; dynamics; tempos; *audiation* (Gordon, 2003); and musical expressiveness. The songs and rhymes in the book are a combination of original pieces composed by the authors, traditional Puerto Rican songs, traditional international children's songs, and songs without words.

To facilitate the teachers' academic understanding, the "Despertar Musical" curriculum was aligned with the music education performance standards (Music Educators National Conference Committee on Performance Standards, 1996), the HighScope Preschool Curriculum (n. d.), and the Head Start goals (Lebron, 2006).

After training, classroom teachers incorporated music classes into their schedules. As in most early childhood programs, there was no music educator in the program. Classroom teachers are in need of substantial training in music (Hennessy, 2000; Holden & Button, 2006; Siebenaler, 2006). Thus, training integrated understanding and valuing musical development, planning, basic methodology for teaching music skills, and becoming an expressive teacher (Koops, 2008; Russell-Bowie, 2009).

Procedure

Teachers are required to take a minimum two-day training to implement the Children Observation Record [COR]. Based upon observations of the child, the observer chooses the statement under each element that best represents the highest level of behaviour characteristic of the child.

For both groups, this assessment battery was administered six times throughout the study in the following sequence: Pre-test (October), test 1 (February), test 2 (May), test 3 (October), test 4 (February), and post-test (May). For this study, the *language* domain was analysed as a whole

among the six domains. Language was analysed using the following categories: (1) *receptive language*; (2) *expressive language*; (3) *interest in reading activities*; (4) *demonstrating knowledge about books*; (5) *beginning to read stories and simple books*; and (6) *beginning to write*.

On the other hand, teacher training was developed by a team of Conservatory of Music of Puerto Rico faculty and initially consisted of a 25-hour course that included daily reflections; music theory introduction; instruction on how to use the "Despertar Musical" activity guide and repertoire; principles of early childhood music education in voice, instrument playing and movement; music education for children with disabilities; music education to enhance values; and teacher opportunities to perform music with drum circles, Orff instruments, and singing.

In addition to the initial training, three additional teacher training sessions were provided before each new semester began. The teacher training was designed to provide educational support to teachers in terms of their musical skills and music education planning. In addition to these one-day training sessions, each teacher received a total of 12 one-on-one mentorships from a professional music educator that were divided into six 30-minute visits per semester during the first year of the treatment period. These mentorship sessions consisted of 20 minutes of observations and 10 minutes of feedback on the teacher's performance.

The control group did not receive formal music classes. They also were tested six times during the same two academic years as the experimental group. Their teachers never received the training that the experimental group teachers did. However, their teachers did use traditional children songs for transitions and circle time in an informal manner as part of their regular HighScope curriculum without any scheduled musical activities.

Results

COR Domains

The assessment results of the COR domains (*initiative, social relations, creative representation, music and movement, language,* and *logical thinking*) by group were examined first. Table 1 shows the pre-test and post-test mean scores for both groups. Results for the pre-test show no statistical differences between groups in any of the COR domains. However, in post-test *t-tests* revealed significant differences between the control and experimental group in the following COR domains: *Creative representation,* $t(211) = 2.791$, $p = .006$; *music and movement,* $t(211) = 2.580$, $p = .011$; *language,*

Table 1

Mean (Standard Deviation), and Means Analysis in Groups across Time for COR Domains

COR Domains		Pre-test		Post-test	
		CG	EG	CG	EG
Initiative	*M*	2.47	2.39	4.62	4.74
	SD	(.77)	(.59)	(.47)	(.49)
	t	827		1.687	
	p	.409		.093	
Social Relations	*M*	2.54	2.49	4.63	4.69
	SD	(.78)	(.67)	(.48)	(.52)
	t	.489		.873	
	p	.625		384	
Creative Representation	*M*	2.37	2.28	4.52	4.74
	SD	(.78)	(.58)	(.59)	(.45)
	t	.936		2.791	
	p	.350		.006**	
Music and Movement	*M*	2.49	2.43	4.59	4.77
	SD	(.74)	(.63)	(.49)	(.45)
	t	.620		2.580	
	p	.536		.011*	
Language	*M*	2.05	1.97	3.99	4.27
	SD	(.59)	(.39)	(.52)	(.62)
	t	1.095		3.372	
	p	.275		001**	
Logical Thinking	*M*	1.93	1.86	4.05	4.48
	SD	(.66)	(.51)	(.68)	(.60)
	t	.819		4.590	
	p	.414		000***	

* $p < .05$. ** $p < .01$. *** $p < .001$.

Note. CG = Control Group; EG = Experimental Group.

$t(211) = 3.372$, $p = .001$; and *logical thinking*, $t(211) = 4.590$, $p = .000$. The experimental group scored higher in each of these domains, indicating a higher level of development.

Language Domain

In order to determine the effects of the musical treatment on children's language, 2-way ANOVAs were conducted for the treatment group (variables: control group, experimental group) for the test time (variables: pre-test, test 1, test 2, test 3, test 4, post-test) for Language as a domain.

The results, see Figure 1, showed significant effects for test time, $F(5, 207) = 1036.874$, $p = .000$, $\eta_p^2 = .831$; group, $F(1, 211) = 11.761$, $p = .001$, $\eta_p^2 = .053$; and a significant interaction between test time and group, $F(7, 418) = 5.276$, $p = .023$, $\eta_p^2 = .024$.

Bonferroni post-hoc contrasts indicated that children's performance for the time of evaluation variable showed statistically significant results for all times except between test 2 and test 3, $t = .169$, $p = .074$ (see Table 2).

On the other hand, the control group was different from the experimental group, $t = .190$, $p = .001$.

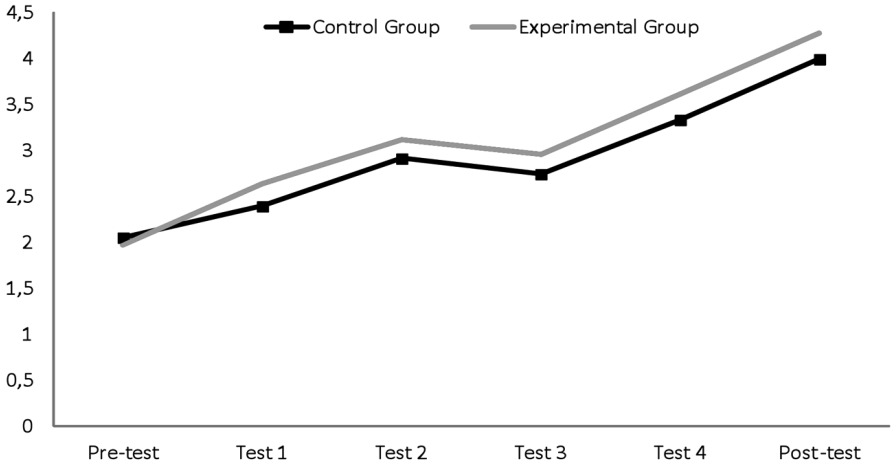

Figure 1. Mean scores in groups across test time for language domain.

Table 2

Bonferroni Post-Hoc Contrast across Test Time for Language Domain

	Bonferroni post-hoc contrasts
Language Domain	• Pre-test < Test 1 (t = .505, p = .000), Test 2 (t = 1.008, p = .000), Test 3 (t = .839, p = .000), Test 4 (t = 1.462, p = .000), Post-test (t = 2.118, p = .000) • Test 1 < Test 2 (t = .503, p = .000), Test 3 (t = .334, p = .000), Test 4 (t = .957, p = .000), Post-test (t = 1.613, p = .000) • Test 2 < Test 4 (t = .454, p = .000), Post-test (t = 1.110, p = .000) • Test 3 < Test 4 (t = .622, p = .000), Post-test (t = 1.279, p = .000) • Test 4 < Post-test (t = .656, p = .000)

Language Categories

Using a repeated measures test this study also examined results for all six categories of language found in the COR Spanish version: *receptive language*, *expressive language*, *interest in reading activities*, *demonstrating knowledge about books*, *beginning to read stories and simple books,* and *beginning to write*. The mean and standard deviation for each group across test time are shown on Table 3.

The analyses of children's scores in the *receptive language* category showed significant effects for test time, $F(5, 207) = 478.058$, $p = .000$, $\eta_p^2 = .694$; and no main effects, $F(1, 211) = 2.049$, $p = .154$, $\eta_p^2 = .010$, or interaction by group, $F(7, 418) = 1.997$, $p = .159$, $\eta_p^2 = .009$. Performance on this category improved in each subsequent test (see Table 4).

Children's scores in the *expressive language* category were analysed in a similar way. The results showed significant main effects for test time, $F(5, 207) = 703.955$, $p = .000$, $\eta_p^2 = .769$; and group, $F(1, 211) = 4.692$, $p = .031$, $\eta_p^2 = .022$; but not for interaction, $F(7, 418) = 3.332$, $p = .069$, $\eta_p^2 = .016$. Bonferroni post-hoc contrasts showed that results were different for all times of evaluation, except between test 2 and test 3 (see Table 4). Also, post-hoc comparisons revealed that children in the experimental group outperformed those in the control group, $t = .181$, $p = .031$.

The results of the analyses of *interest in reading activities* category are very similar to the ones reported above. They showed significant effects by test time, $F(5, 207) = 598.754$, $p = .000$, $\eta_p^2 = .739$; and by group, $F(1, 211) = 14.478$, $p = .000$, $\eta_p^2 = .064$. No interaction effect was found, $F(7, 418) = 1.404$, $p = .237$, $\eta_p^2 = .007$. All comparisons were

Table 3

Mean (and Standard Deviation) in Groups across Test time for Language Categories

Language categories	Group	Pre-test	Test 1	Test 2	Test 3	Test 4	Post-test
Receptive language	CG	2.63 (.95)	3.08 (.95)	3.71 (.99)	3.44 (.94)	4.11 (.79)	4.47 (.71)
	EG	2.46 (.67)	3.30 (.70)	3.83 (.89)	3.56 (.99)	4.25 (.86)	4.68 (.65)
Expressive language	CG	2.29 (.95)	2.60 (1.06)	3.15 (1.11)	3.00 (.97)	3.70 (.90)	4.60 (.66)
	EG	2.09 (.73)	2.84 (.90)	3.44 (1.01)	3.26 (.93)	4.04 (.89)	4.78 (.62)
Interest in reading activities	CG	2.21 (.86)	2.59 (.86)	3.27 (1.02)	3.03 (.98)	3.79 (.90)	4.20 (.82)
	EG	2.19 (.68)	3.03 (.84)	3.66 (.90)	3.34 (.93)	4.13 (.86)	4.53 (.75)
Demonstrating knowledge about books	CG	1.91 (.67)	2.29 (.65)	2.85 (1.00)	2.68 (.88)	3.32 (.94)	4.25 (.79)
	EG	1.93 (.52)	2.56 (.76)	3.10 (.95)	2.93 (.94)	3.63 (1.05)	4.60 (.74)
Beginning to read stories and simple books	CG	1.50 (.62)	1.72 (.58)	2.00 (.64)	1.91 (.60)	2.26 (.67)	4.00 (.93)
	EG	1.41 (.50)	1.90 (.41)	2.08 (.50)	2.04 (.66)	2.46 (.84)	4.30 (1.00)
Beginning to write	CG	1.78 (.59)	2.10 (.59)	2.53 (.77)	2.38 (.66)	2.83 (.70)	2.47 (.81)
	EG	1.76 (.60)	2.21 (.54)	2.65 (.75)	2.66 (.81)	3.20 (.72)	2.73 (1.05)

Note. CG = Control Group; EG = Experimental Group.

statistically significant for test time (see Table 4). Children in the experimental group outperformed those in the control group, $t = .294$, $p = .000$.

The same results were obtained for the *demonstrating knowledge about books* category. Results showed significant effects for test time, $F(5, 207) = 822.157$,

Table 4

Bonferroni Post-Hoc Contrast across Test Time for Language Categories

Language categories	Bonferroni post-hoc contrasts
Receptive language	• Pre-test from Test 1 (t = .644, p = .000), Test 2 (t = 1.219, p = .000), Test 3 (t = .952, p = .000), Test 4 (t = 1.634, p = .000), Post-test (t = 2.024, p = .000) • Test 1 from Test 2 (t = .575, p = .000), Test 3 (t = .308, p = .004), Test 4 (t = .990, p = .000), Post-test (t = 1.379, p = .000) • Test 2 from Test 3 (t = .267, p = .035), Test 4 (t = .416, p = .000), Post-test (t = .805, p = .000) • Test 3 from Test 4 (t = .682, p = .000), Post-test (t = 1.071, p = .000) • Test 4 from Post-test (t = .389, p = .000)
Expressive language	• Pre-test from Test 1 (t = .529, p = .000), Test 2 (t = 1.104, p = .000), Test 3 (t = .945, p = .000), Test 4 (t = 1.678, p = .000), Post-test (t = 2.498, p = .000) • Test 1 from Test 2 (t = .574, p = .000), Test 3 (t = .416, p = .000), Test 4 (t = 1.149, p = .000), Post-test (t = 1.969, p = .000) • Test 2 from Test 4 (t = .574, p = .000), Post-test (t = 1.394, p = .000) • Test 3 from Test 4 (t = .733, p = .000), Post-test (t = 1.553, p = .000) • Test 4 from Post-test (t = .820, p = .000)
Interest in reading activities	• Pre-test from Test 1 (t = .610, p = .000), Test 2 (t = 1.268, p = .000), Test 3 (t = .985, p = .000), Test 4 (t = 1.758, p = .000), Post-test (t = 2.165, p = .000) • Test 1 from Test 2 (t = .657, p = .000), Test 3 (t = .374, p = .000), Test 4 (t = 1.148, p = .000), Post-test (t = 1.555, p = .000) • Test 2 from Test 3 (t = .283, p = .009), Test 4 (t = .491, p = .000), Post-test (t = .897, p = .000) • Test 3 from Test 4 (t = .773, p = .000), Post-test (t = 1.180, p = .000) • Test 4 from Post-test (t = .407, p = .000)
Demonstrating knowledge about books	• Pre-test from Test 1 (t = .503, p = .000), Test 2 (t = 1.054, p = .000), Test 3 (t = .883, p = .000), Test 4 (t = 1.549, p = .000), Post-test (t = 2.503, p = .000) • Test 1 from Test 2 (t = .551, p = .000), Test 3 (t = .380, p = .000), Test 4 (t = 1.046, p = .000), Post-test (t = 2.000, p = .000) • Test 2 from Test 4 (t = .496, p = .000), Post-test (t = 1.449, p = .000) • Test 3 from Test 4 (t = .666, p = .000), Post-test (t = 1.619, p = .000) • Test 4 from Post-test (t = .954, p = .000)
Beginning to read stories and simple books	• Pre-test from Test 1 (t = .357, p = .000), Test 2 (t = .583, p = .000), Test 3 (t = .519, p = .000), Test 4 (t = .908, p = .000), Post-test (t = 2.696, p = .000) • Test 1 from Test 2 (t = .227, p = .000), Test 4 (t = .552, p = .000), Post-test (t = 2.339, p = .000) • Test 2 from Test 4 (t = .325, p = .000), Post-test (t = 2.112, p = .000) • Test 3 from Test 4 (t = .389, p = .000), Post-test (t = 2.176, p = .000) • Test 4 from Post-test (t = 1.787, p = .000)
Beginning to write	• Pre-test from Test 1 (t = .387, p = .000), Test 2 (t = .820, p = .000), Test 3 (t = .751, p = .000), Test 4 (t = 1.241, p = .000), Post-test (t = .823, p = .000) • Test 1 from Test 2 (t = .433, p = .000), Test 3 (t = .364, p = .000), Test 4 (t = .855, p = .000), Post-test (t = .437, p = .000) • Test 2 from Test 4 (t = .422, p = .000) • Test 3 from Test 4 (t = .491, p = .000) • Test 4 from Post-test (t = .418, p = .000)

p = .000, η_p^2 = .796; and group, $F(1, 211)$ = 12.132, p = .001, η_p^2 = .054; but not for interaction, $F(7, 418)$ = 2.804, p = .095, η_p^2 = .013. All post-hoc comparisons for the variable time of evaluation showed statistically significant results for all times, except between test 2 and test 3, t = .170, p = 1.000. Children from the control group scored lower than the experimental group, t = .239, p = .001.

The analyses of children's scores in the *beginning to read stories and simple books* category showed significant main effects for test time, $F(5, 207)$ = 1004.184, p = .000, η_p^2 = .826; and group, $F(1, 211)$ = 6.938, p = .009, η_p^2 = .032; as well as interaction test time by group, $F(7, 418)$ = 4.577, p = .034, η_p^2 = .021. Bonferroni post-hoc differences were significant in the majority of the test time but not for the comparisons among the test 3 and the tests 1 and 2 (see Table 4). Experimental group outperformed the control group, t = .133, p = .009.

The analyses in the *beginning to write* category showed significant effects for test time, $F(5, 207)$ = 198.221, p = .000, η_p^2 = .484; group, $F(1, 211)$ = 10.098, p = .002, η_p^2 = .046; and the interaction test time by group, $F(7, 418)$ = 6.268, p = .013, η_p^2 = .029. The post-hoc comparisons for variation time of evaluation not were different for all test time (see Table 4). Children from the control group scored lower than the experimental group, t = .186, p = .002.

Discussion

Results indicate that continual formal music education can enhance early childhood development across most Child Observation Record battery domains. Statistically significant differences were observed particularly in *creative representation, music and movement, language,* and *logical thinking* domains. Although both the control and experimental groups COR scores increased over time, the experimental group's scores were consistently higher. These findings are similar to other researchers' studies, which concluded that music could impact cognitive domains (Hannon & Trainor, 2007; Herholz & Zatorre, 2012; Hyde et al., 2009; Patel & Iversen, 2007; Schellenberg, 2001) and specially language development (Anvari et al., 2002; Besson & Schon, 2001; Jentschke & Koelsch, 2009; Patel & Iversen, 2007; Schellenberg, 2004).

With respect to the Language domain, were showed significant differences in all tests from the beginning of the treatment except from test 2 to test 3. In a practical sense this means that, while students were participating in musical activities including singing, chanting, playing instruments, and

understanding musical concepts such as slow or fast, they were also developing language skills. Thus, according to Perlovsky (2010) and Levinowitz (2009), the outcomes of the current study suggests that formal music instruction can support cognitive change and language development, which is a very valuable skill for every young child. Interestingly, between test 2 and test 3 there were no significant differences. The reason for this might be that between those tests there was a four-month recess from school. Students most likely did not receive any classes over the summer recess and therefore their development was negatively impacted.

After test 3, significant differences were observable all through the post-test. The increase of student's scores might be associated with the fact that the students were older and therefore more mature and also that by the second year the quality of music teaching was higher because teacher were already more experienced in the subject. Having confidence in their teaching skills and a strong assumption that music support academic skills might have also influenced the teacher's performance (Hash, 2010). This could have impacted many of the teachers' teaching style, leading them to integrate music across the curriculum from the beginning of the second year and therefore influencing children's performance.

Students from the experimental group also scored higher than the control group, in the majority of occasions, in each language category. In terms of the children at-risk population, the significant differences for *receptive language* support Seeman's (2008) showing that music classes could specifically influence receptive language by helping students' self-esteem and increasing the understanding of language.

The *expressive language* category results also showed that the experimental group outscored significantly the control group at all times but from test 2 to test 3. Looking at the items from the expressive language COR section, this means that by the end of the study more students from the experimental group were able to create songs. Since using creativity is the second NAfME standard for music education (MENC, 1994) and was included among the musical activities during the study therefore, it seems logical to conclude that music education can be beneficial to develop creative language skills as well. The use of music in the development of expressive language is well-documented (Wan et al., 2010) and the current study supports it as well.

Regarding literacy skills, it has been shown that the oral language skills of preschool children are predictors of future reading (Dickinson & McCabe, 2001; Hammer et al., 2010). This also might have

influenced *interest in reading activities* scores as well as the scores for *beginning to read stories and simple books* and *demonstrating knowledge about books*. This reinforces the findings of previous studies, which suggest that formal music education that integrates singing and playing an instrument from an early age helps the child's brain to be ready for reading (Dixon, 2008). Additionally, it supports the findings of Herrera et al. (2011), which suggest that early interventions using music are a key component in the development of reading.

For the last Language category, *beginning to write,* it is interesting to note that although the music activity guide used, "Despertar Musical", did not include any activities related to the category, were found significant differences between groups. However, the results for both groups were lower than for the rest of the categories. The reason for this might be related to the developmental readiness to write of the children.

In conclusion, these findings demonstrate that music training can make a critical difference in a child's overall development, especially in terms of language. Teaching music skills to preschool students can help them with their receptive, expressive language skills, to become interested in books, and to begin to read. Children for this study were students of Head Start, so these results are more relevant because they belong to at-risk population (low socio-cultural status, low income families, single-parent households, public assistance, etc.). Thus, music training has been effective in the development of children at-risk (Brown et al., 2010; Seeman, 2008). Teachers, administrators, and parents should integrate music education on a daily basis.

In addition to the above, training of teachers for this study addressed making up for their lack of training in music education (Nardo et al., 2006), the need to be trained intensively (Siebenaler, 2006), and the need to increase their level of self-confidence when performed musical activities (Hennessy, 2000; Holden & Button, 2006). These findings can be interpreted as a reflection of the developmental process of the quality of music teaching in their classrooms. It also shows that non-music teachers can teach basic musical skills in the classroom if they are previously trained. The music training program developed, "Despertar Musical", was aligned with the music education performance standards (Music Educators National Conference Committee on Performance Standards, 1996), the HighScope Preschool Curriculum (n. d.), and the Head Start goals (Lebron, 2006). Thus, it was a training program tailored to the musical activities that are necessary to develop in the classroom from the preschool curriculum.

Teachers were able to successfully work consistently on music skills at least three times a week with their children and by doing that their students improved in all domains. It can be assumed then that after receiving training and mentoring, teachers gained more understanding of their own musicianship and ability to teach (Koops, 2008). Therefore, their teaching quality improved over time and consequently, their students' scores increased as they improved their music teaching skills.

One of the limitations of this study is that only results from the COR assessment battery are analysed. It would have been interesting to use a different test and compare the results in order observe any possible differences between tests. A future recommendation is to use COR in a similar study but also to add other battery tests such as the Kaufman Assessment Battery for Children. Another limitation of the study is that during the two-year study children were moved to different classrooms with different teachers, which may have affected some children's results. Also, there was no control over teacher's enthusiasm, level of engagement or commitment. Different teachers had different views about the influence of music in their classrooms.

Further research is recommended with music teachers developing the training program to compare results on experimental and control group with those of this study. One last suggestion might be to conduct a similar study and observe the correlation between the music teacher's performance and student scores.

References

Anvari, S., Trainor, L. J., Woodside, J., & Levy, B. A. (2002). Relations among musical skills, phonological processing, and early reading ability in preschool children. *Journal of Experimental Child Psychology, 83*(2), 111-130. doi: 10.1016/S0022-0965(02)00124-8

Besson, M., & Schön, D. (2001). Comparison between language and music. *Annals of the New York Academy of Sciences, 930*, 232-258. doi: 10.1111/j.17496632.2001.tb05736.x

Brown, E., Benedett, B., & Armistead, E. (2010). Arts enrichment and school readiness for children at risk. *Early Childhood Research Quarterly*, *25*(1), 112-124. doi: 10.1016/j.ecresq.2009.07.008

Corriveau, K. H., & Goswami, U. (2009). Rhythmic motor entrainment in children with speech and

language impairments: Tapping to the beat. *Cortex, 45*(1), 119-130. doi: 10.1016/j.cortex.2007.09.008

Dalcroze, J. (1921). *Rhythm, music and education*. New York: G. P. Putnam's Sons.

Dankovicová, J., House, J., Crooks, A., & Jones, K. (2007). The relationship between musical skills, music training, and intonation analysis skills. *Language and Speech, 50*(2), 177-225. doi: 10.1177/00238309070500020201

Dickinson, D., & McCabe, A. (2001). Bringing it all together: The multiple origins, skills, and environmental supports of early literacy. *Learning Disabilities Research and Practice, 16*(4), 186-202. doi: 10.1111/0938-8982.00019

Dixon, S. D. (2008). Language is everywhere! Universally designed strategies to nurture oral and written language. *Young Exceptional Children, 11*(4), 2-12. doi: 10.1177/1096250608320283

Franklin, M., Moore, K., Yip, C., Jonides, J., Rattray, K., & Moher, J. (2008). The effects of musical training on verbal memory. *Psychology of Music, 36*(3), 353-365. doi: 10.1177/0305735607086044

García, G., Hernández-Candelas, M., & Lugo, S. (2004). *Despertar musical* [Musical awakenings]. San Juan, Puerto Rico: Conservatorio de Música de Puerto Rico [Conservatory of Music of Puerto Rico].

Gordon, E. (2003). *A music learning theory for newborn and young children*. Chicago: GIA.

Hammer, C. S., Farkas, G., & Maczuga, S. (2010). The language and literacy development of Head Start children: A study using the family and child experiences survey database. *Language, Speech & Hearing Services in Schools, 41*(1), 70-83. doi: 10.1044/0161-1461

Hannon, E. E., & Trainor, L. J. (2007). Music acquisition: Effects of enculturation and formal training on development. *TRENDS in Cognitive Sciences, 11*(11), 466-472. doi: 10.1016/j.tics.2007.08.008

Hash, P. M. (2010). Preservice classroom teachers' attitudes toward music in the elementary curriculum. *Journal of Music Teacher Education, 19*, 6-24. doi: 10.1177/1057083709345632

Hein, M. (1992). *The legacy of Zoltán Kodály: An oral history perspective*. Budapest: International Kodály Society.

Hennessy, S. (2000). Overcoming the red-feeling: The development of confidence to teach music in primary school amongst student teachers. *British Journal of Music Education, 17*(2), 183-196. doi: 10.1017/S0265051700000243

Herholz, S. C., & Zatorre, R. J. (2012). Musical training as a framework for brain plasticity: Behavior, function and structure. *Neuron, 76*(3), 486-502. doi: 10.1016/j.neuron.2012.10.011

Herrera, L., Lorenzo, O., Defior, S., Fernández-Smith, G., & Costa-Giomi, E. (2011). Effects of phonological and musical training on the reading readiness of native and foreign Spanish-speaking children. *Psychology of Music, 39*(1), 68-82. doi: 10.1177/0305735610361995

Heyning, L. (2011). "I can't sing!" The concept of teacher confidence in singing and the use within their classroom. *International Journal of Education & the Arts, 12*(13). Re-

trieved from http://www.ijea.org/v12n13/

HighScope Educational Research Foundation (n. d.). *HighScope preschool curriculum*. Retrieved from https://secure.highscope.org/Content.asp?ContentId=1

HighScope Educational Research Foundation (2003). *Preschool Child Observation Record for 2 1/2 to 6 Year Olds*. Ypsilanti, MI: HighScope Press.

Ho, Y., Cheung, M., & Chan, A. S. (2003). Music training improves verbal but not visual memory: Cross-sectional and longitudinal explorations in children. *Neuropsychology, 17*(3), 439-450. doi: 10.1037/0894-4105.17.3.439

Holden, H., & Button, S. W. (2006). The teaching of music in the primary school by the non-music specialist. *British Journal of Music Education*, *23*(1), 23-38. doi: 10.1017/S0265051705006728

Hyde, K. L., Lerch, J., Norton, A., Forgeard, M., Winner, E., Evans, A. C., & Schlaug, G. (2009). The effects of musical training on structural brain development. A longitudinal study. *Annals of the New York Academy of Sciences, 1169*, 182-186. doi: 10.1111/j.1749-6632.2009.04852.x

Jentschke, S., & Koelsch, S. (2009). Musical training modulates the development of syntax processing in children. *NeuroImage*, *47*(2), 735-744. doi: 10.1016/j.neuroimage.2009.04.090

Kim, J., & Choy, D. (2008). Learning to toot your own horn: Preservice teachers integrating music into a childhood classroom. *Journal of Research in Childhood Education, 22*(4), 405-424. doi: 10.1080/02568540809594636

Koelsch, S. (2005). Neural substrates of processing syntax and semantics in music. *Current Opinion in Neurobiology*, *15*(2), 1-6. doi: 10.1016/j.conb.2005.03.005

Koelsch, S., Gunter, T., Cramonet, D., Zysset, S., Lohman, G., & Friederici, A. (2002). Bach speaks: A cortical "language-network" serves the processing of music. *NeuroImage, 17*(2), 956-966. doi: 10.1006/nimg.2002.1154

Koops, L. (2008). Using a musicianship portfolio as assessment of music and education course objectives in a "Music for elementary teachers" course. *Journal of Music Teacher Education, 18*(1), 39-54. doi: 10.1177/1057083708323144

Lebron, N. (2006). *Alineación del currículo de "HighScope" con Despertar Musical: experiencias claves de música y movimiento* [HighScope the Music and Movement preschool key experiences and curriculum alignment with the Musical Awakenings activity guide]. Unpublished manuscript. San Juan, Puerto Rico: Conservatorio de Música de Puerto Rico.

Legg, R. (2009). Using music to accelerate language learning: An experimental study. *Research in Education, 82*(1), 1-12. doi: 10.7227/RIE.82.1

Levinowitz, L. (2009). *Research findings on the Music Together® preschool program model*. Retrieved from http://www.musictogether.com/file.aspx?id=1661

Levitin, D. J., & Tirovolas, A. K. (2009). Current advances in the cognitive neuroscience of music. *Annals of the New York Academy*

of Sciences, 1156, 211-231. doi: 10.1111/j.1749-6632.2009.04417.x

Lum, C. (2008). Beyond music lessons: Subject teachers' use of music in the classroom. *Research Studies in Music Education, 30*(2), 139-158. doi: 10.1177/1321103X08097504

Moreno, S., Bialystok, E., Barac, R., Schellenberg, E. G., Cepeda, N. J., & Chau, T. (2011). Short-term music training enhances verbal intelligence and executive function. *Psychological Science*, *22*(11), 1425-1433. doi: 10.1177/0956797611416999

Music Educators National Conference (1994). *National Standards for Arts Education*. Reston, VA: MENC.

Music Educators National Conference Committee on Performance Standards (1996). *Performance standards for music: Strategies and benchmarks for assessing progress toward the national standards, grades PreK-12*. Reston, VA: MENC.

Nardo, R. L., Custodero, L. A., Persellin, D. C., & Fox, D. B. (2006). Looking back, looking forward: A report on early childhood music education in accredited American preschools. *Journal of Research in Music Education, 54*(4), 278-292. doi: 10.1177/002242940605400402

National Association for the Education of Young Children (1998). Learning to read and write: Developmentally appropriate practice for young children: A joint position statement of the International Reading Association and the National Association for the Education of Young Children. *Young Children, 53*(4), 30-46.

Patel, A. D. (2003). Language, music, syntax and the brain. *Nature Neuroscience, 6*(7), 674-681. doi: 10.1038/nn1082

Patel, A. D. (2008). Music as a transformative technology of the mind. *Paper presented at Music: Its Evolution, Cognitive Basis, and Spiritual Dimensions*. Cambridge University, Sept 18-20, 2008. Retrieved from http://vesicle.nsi.edu/users/patel/Patel_2008_Templeton_Essay.pdf

Patel, A. D. (2010). Music, biological evolution, and the brain. In M. Bailar (Ed.), *Emerging disciplines* (pp. 91-144). Houston, TX: Rice University Press.

Patel, A. D., & Iversen, J. R. (2007). The linguistic benefits of musical abilities. *Trends in Cognitive Sciences*, *11*(9), 369-372. doi: 10.1016/j.tics.2007.08.003

Perlovsky, L. (2010). Musical emotions: Functions, origins, evolution. *Physics of Life Review, 7*(1), 2-27. doi: 10.1016/j.plrev.2009.11. 001

Perlovsky, L. (2012). Cognitive function of music. Part I. *Interdisciplinary Science Reviews, 37*(2), 131-144. doi: 10.1179/0308018812Z.00000000010

Pica, R. (2009). Make a little music. *Young Children, 64*(6), 74-75. Retrieved from http://www.naeyc.org/files/yc/file/200911/LeapsandBoundsWeb1109.pdf

Russell-Bowie, D. (2009). What me? Teach music to my primary class? Challenges to teaching music in primary schools in five countries. *Music Education Research*, *11*(1), 23-36. doi: 10.1080/14613800802699549

Schellenberg, E. G. (2001). Music and nonmusical abilities. *Annals of the New York Academy of Sciences, 930*, 355-371. doi: 10.1111/j.1749-6632.2001.tb05744.x.

Schellenberg, E. G. (2004). Music lessons enhance IQ. *Psychologi-*

cal Science, 15(8), 511-514. doi: 10.1111/j.0956-7976.2004.00711.x

Schlaug, G., Marchina, S., & Norton, A. (2009). Evidence for plasticity in white-matter tracts of patients with chronic Broca's Aphasia undergoing intense intonation-based speech therapy. *Annals of the New York Academy of Sciences, 1169*, 385-394. doi: 10.1111/j.1749-6632.2009.04587

Seeman, E. (2008). *Implementation of music activities to increase language skills in the at-risk early childhood population*. Chicago: Saint Xavier University.

Sekino, Y., & Fantuzzo, J. (2005). Validity of the Child Observation Record: An investigation of the relation between COR dimensions and social-emotional and cognitive outcomes in Head Start children. *Journal of Psychoeducational Assessment, 23*(3), 242-260. doi: 10.1177/073428290502300304

Siebenaler, D. (2006). Training teachers with little or no music background: Too little, too late? *Update: Applications of Research in Music Education, 24*(2), 14-22. doi: 10.1177/87551233060240020102

Suzuki, S. (1983). *Nurtured by love: The classic approach to talent education*. Miami: Warner Bros.

Thompson, W. F., Schellenberg, G., & Husain, G. (2004). Decoding speech prosody: Do music lessons help? *Emotion, 4*(1), 46-64. doi: 10.1037/1528-3542.4.1.46

Trainor, L. B., Shahin, A. J., & Roberts, L. E. (2009). Understanding the benefits of musical training: Effects on oscillatory brain activity. *Annals of the New York Academy of Sciences*, *1169,* 133-142. doi: 10.1111/j.1749-6632.2009.04589

Trollinger, V. (2003). Relationships between pitch-matching accuracy, speech fundamental frequency, speech range, age, and gender in American English-speaking preschool children. *Journal of Research in Music Education, 51*(1), 78-94. doi: 10.2307/3345650

Vitoria, J. R. (2005). Educación musical y desarrollo psicolingüístico de personas con necesidades educativas especiales. *Revista de Psicodidáctica, 10*(2), 17-26. doi: 10.1387/Rev Psicodidact.187

Wan, C., Demaine, K., Zipse, L., Norton, A., & Schlaug, G. (2010). From music making to speaking: Engaging the mirror neuron system in autism. *Brain Research Bulletin, 82*(3-4), 101-108. doi: 10.1016/j.brainresbull.2010.04.010

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