ORIGINAL ARTICLE

How is the rhythmic ability of preschool children affected by the implementation of a music-movement program?

Pollatou Elisana[1], Pantelakis George[2], Agdiniotis Ilias[3], Mpenta Nikoleta[3], Zissi Vasiliki[1], Karadimou Konstantina[1]

[1] University of Thessaly, [2] Democritus University of Thrace,

Abstract

Rhythm and music can be very significant for a person's development, especially during the early years of life. This study's aim was to examine the rhythmic ability of 180 preschool children before and after the implementation of a music-movement program. A group of 90 children (45 boys and 45 girls) attended a 6-week intervention program, including two 45-minute lessons per week, whereas the other 90 children (control group) did not attend any kind of program. The High/Scope Rhythmic Analysis Test (Weikart, 1989) was used for the evaluation of **rhythmic ability before and after the implementation of the rhythmic program. Girls** surpassed greatly the boys in total score in both measures ($p< 0.01$), and the experiment group surpassed significantly the control group in the final measure ($p<0.001$). It can be concluded that as long as suitably designed and structured musical movement program- with whole body exercises and games accompanied by rhythmic and musical stimuli- contribute to the progress of the rhythmic ability of pre-schoolers, it's beneficial to be included in their formal education.

Keywords: *music, rhythmic movements, preschool children*

Introduction

Rhythm is an essential attribute for each kinetic activity (Cabbard, 1992) and it is also recognized as an important factor that affects human development, performance and learning motor skills. Gallahue (1996) argues that when movement is based on rhythm, children are able to perform fundamental tasks with greater dexterity, as well as to develop greater kinetic abilities. The movements' rhythmic component aids this development. Huff (1972) argues that 'rhythm is time energy patterns as perceived through the senses of hearing, eyesight and kinesthisis.' The concept of rhythm has been less straightforward to define and can be viewed either as a serial pattern of durations or the perceived temporal organization of that pattern (McAuley, 2010). Rhythmic ability is defined as the ability to synchronize body movements with a physical acoustic or musical stimulus (Rose, 1995). Weikart (1989) states that innate rhythmic ability is revealed through participation in movement activities which require a precise response to a stimulus.

Exposure to a music movement program, suitable for infants and children, increases rhythmic ability (Zachopoulou, Derri, Chatzopoulos & Ellinoudis, 2003). For preschool children, music contributes to the cultivation of their ability of

[1] Address for correspondence: Pollatou Elisana, assistant professor, Department of Physical Education & Sport Science, University of Thessaly, Trikala, 42100, Greece, e-mail: epolatou@pe.uth.gr

aesthetic perception and to the development of their psychomotor and emotional state (Tsapakidou, Zachopoulou & Zografou, 2001) and the acquisition of skills by creating a pleasant kinetic learning environment. During kinetic performance music and rhythm contribute to the simplification of movement perception and to the synchronization of movement with musical stimulus (Karageorgis & Terry, 1997). Music and rhythm also effect positively the kinetic precision (Martin & Ellerman, 2001). In addition, rhythmic accompaniment contributes to the improvement of performing kinetic activities (Tsapakidou et al., 2001), as well as static and movement skills compared to exercises with playful format (Derri, Tsapakidou, & Zachopoulou, 2001).

A review of international literature shows that during infancy, there is a correlation between rhythmic capacity and proficiency in language and reading (Haines, 2003). The systematic exposure of children to an environment that stimulates their perception of music helps them to improve their spatial and temporal reasoning (Rausher & Zupan, 2000). The music-acoustic ability of children of this age is significantly improved by systematic training (Blessedel, 1991).

After taking under consideration the effect of rhythmic ability in learning and performing motor skills, this investigation studied the rhythmic ability of children who did or did not attend music- movement intervention programs. The small amount of researches conducted in Greece regarding this issue, either refer to older children (Pollatou, Liapa, Digelidis, & Zachopoulou, 2005) or do not include the implementation of an intervention program (Agdiniotis, Pollatou, Gerodimos, Zisi, Karadimou & Yiagoudaki, 2009; Pollatou, Karadimou, & Gerodimos, 2005). The present research explores the use of rhythmic intervention programs in executing any kind of movements and how this approach could reinforce children's kinetic skills and potential.

Method

Participants

This study included 180, 5-6 years old children, from one Greek public kindergarten school. These children were organized in eight groups-classrooms of 22-24 students each. Four of these groups (90 children) were randomly selected to form the intervention group while the other four groups (the rest 90 children) formed the control one. The intervention group attended a 6-week music movement program including two 45-minute lessons per week. At the same period, the control group, did not participate in any music-movement program. During the time of the investigation none of the children, participating in this study, had any prior experience with music or attended any kind of out of school music-movement activity. Their families belong to the Greek typical middle social class.

Measurement

The High/Scope Rhythmic Competence Analysis Test (Weikart, 1989) was used for the evaluation of the children's rhythmic ability. The test is designed in order to evaluate a person's ability to perform a series of exercises with a kinetic constant rate. The test concludes six kinds of movements that the individual is asked to perform. Following the rhythm of a metronome, the individual must synchronize these movements in two different tempos, 120 and 130 beats per minute. The evaluation test includes a three level scale (0, 1, 2). The movement skills include a) simultaneously tapping hands to thighs in a seated position, b) alternately tapping hands to thighs in a seated position, c) marching steps from a seated position, d) marching steps from an upright position, e) walking forward, and f) walking backward. The maximum score for each of the six movements was four points (two points for each beat). Children were tested individually after they had been familiarized with the nature of the tasks and the testing environment. To aid analysis of the movements, the children were videotaped. Two trained observers/data collectors, who they were not part of the intervention and they were blind as to the group assignments of the children, scored the movements twice (1st time live & 2nd by video) and agreed with 90% intra-observer reliability and 85% inter-observer reliability. At the end of the training procedure, the children were asked if they enjoyed the program with a three level scale ('No, Yes, A lot')

Training Procedure

The musical movement program included whole body exercises and games accompanied by rhythmic and musical stimuli. Each teaching unit contained rhythmic values of half (𝅗𝅥), quarter (♩) and eighth (♪), with each one corresponding to a specific body movement category (i.e., large, heavy steps for the 𝅗𝅥, walking for the ♩, running for the ♪) and all units accompanied by the respective arm movements. The children matched each rhythmic value to a physical whole body movement, and gradually, they were following the rhythm while moving around the space. At the same time, they experimented with several percussion instruments that imposed the beat of their movements. After recognizing and interpreting the rhythmic values, the children were asked to move in more complex sequences (i.e., ♪ ♪ ♩ 𝅗𝅥), making a rhythmic motif in a 4/4 rhythm. Constructed paperboards with the depiction of each value (𝅗𝅥 - giant walking, ♩ - woodcutter, ♪-dwarf) enabled the children's recognition of each rhythmic value. The children were also taught to observe a quarter pause (𝄽), where they had to remain still for one count. The program was administered by outside interventionists, specially educated in rhythmic-music programs. All activities were accompanied by music stimuli, exactly adjusted to the rhythmic ones. Generally, through a playful and pleasant environment, this experience educated the children about rhythmic movement.

Statistical Analysis

SPPS 11 was used for the statistical analysis. A 3-way, 2 x 2 x 2 (group x gender x measurement) analysis of variance (ANOVA) with repeated measures was used in the last factor to identify significant differences between and within these two groups before and after the intervention.

Results

The means and standard deviations of the High/Scope Rhythmic Competence Analysis Test score pre- and post-test according to sex and group are shown in Table 1. The 3-way analysis of variance revealed significant main effects for the measure ($F_{1,176}$=457.85, p<0.001), the group ($F_{1,176}$=10.20, p<0.01) and the sex ($F_{1,176}$=22.13, p<0.001).

Table 1. Means and standard deviations of the High/Scope Rhythmic Competence Analysis Test score pre- and post-test, for boys and girls, and for the experimental and control group.

		Pre test			Post test		
		N	M	SD	N	M	SD
Control group	Boys	45	14.11	*2.24*	45	14.47	*1.88*
	Girls	45	15.80	*1.91*	45	15.93	*1.96*
	Total	90	14.96	*2.24*	90	15.20	*2.05*
Experimental group	Boys	45	14.40	*2.16*	45	16.47	*1.85*
	Girls	45	15.47	*1.91*	45	17.64	*1.72*
	Total	90	14.93	*2.10*	90	17.06	*1.87*

A significant group X measure interaction ($F_{1,176}$=288.23, p<0.001) is shown in Figure 1. Breaking down this interaction revealed a similar performance by the two groups during the pre-test ($F_{1,179}$=0.005, p>0.05) and a significantly higher performance by the experimental group at the post-test evaluation ($F_{1,179}$=45.04, p<0.001).

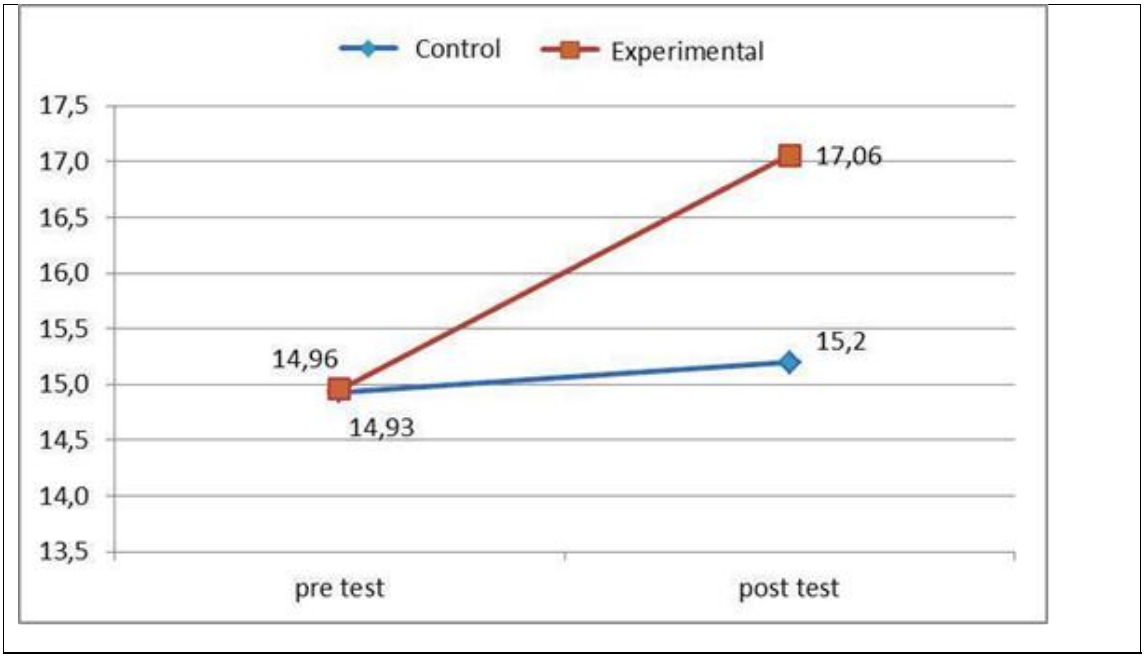

Figure 1. The significant group X measure interaction.

The group X measure interaction was not significant regarding sex ($F_{1,176}$=0.25, p>0.05). Girls in total performed significantly better than boys in the pre-test evaluation ($F_{1,179}$=20.11, p<0.001) and in the post-test evaluation ($F_{1,179}$=22.87, p<0.001). Additionally, all the children referred that they enjoyed the program a lot.

Discussion

The results showed significant main effects regarding measure, group, and sex, as well as interaction between group and measure (p<0.05). During the testing of rhythmic capacity, girls greatly exceeded boys in the total score of the test in both measurements (p<0.001). In the initial measurement, the two groups did not differ significantly, but in the final count, the experimental group significantly exceeded the control group (p<0.001). Furthermore, regarding the influence of gender on rhythmic ability of children, this investigation found significant statistical differences between boys and girls, a theoretical position that Kambas, Ageloussis, Gourgoulis, Barbas & Antoniou (2000) and Mitchel (1994) support. They argued that girls performed better than boys, which may be caused by the use of different measuring devices. Agdiniotis et al. (2009) studied rhythmic ability in preschool-aged children related to motor activities accompanied by music or not. Girls that performed kinetic activities, with considerable musical accompaniment, exceeded the boys in 120 and in 130 beats. Previous investigations by Kuhlman and Schweinhart's (1999) led to diverse results, where was found that boys and girls do not differ in spatial-temporal kinetic response to rhythmic stimulus. Pollatou et al. (2005) examined whether there are differences regarding music skill, rhythmic ability and motor performance between boys and girls at age 5. The results revealed no significant gender differences in musical aptitude and gross motor skills performance, whereas girls

outperformed boys in four of the six movements of rhythmic ability test. In another study, Pollatou et al. (2005) studied the rhythmic ability of 125 high school students engaged in motor activity accompanied or not by music. Pupils who performed kinetic activities that were not accompanied by music showed less ability than students who performed kinetic activities accompanied by music.

Similar conclusions were reached by the investigations of Zachopoulou et al. (2003). These studies studied whether a 10-week, active musical program, based on the approach of Orff and Dalcrose, can affect the level of rhythmic ability of 72 preschool-aged children. They used the High/Score Beat Competence Analysis test, and the results showed significant effects for an active musical program in all rhythmic themes used in the research.

Pollatou & Hatzitaki (2001) examined the effects of a specially designed music-movement program, concerning rhythmic and active education, on the development of the fundamental motor skills of 22 preschool children. For a period of eight weeks, the experimental group (12 children) performed musical and kinetic activities, while the control group followed the nursery program. The results showed that the rhythmic and active program can develop preschool children's basic kinetic skills, which are needed for successful future performance in athletic abilities. Zachopoulou, Tsapakidou and Derri (2004) compared the effects of a developmentally appropriate music and kinetic program, and the effects of an appropriate physical education program, lasting two months, on the development of jumping ability and dynamic balance in 90 children, aged 4 to 6 years. The experimental group improved substantially their performance, showing that a developmentally appropriate musical activity program can positively impact jumping ability and dynamic balance in young children.

The element of rhythm involved in fundamental dexterity helps children understand and perform these movements (Gallahue, 1996). Because all sporting activities involve rhythmic elements (Martin & Ellerman, 2001), the early exposure of children to rhythmic and music cultivation could potentially provide the groundwork for subsequent engagement with sports as recreation during adulthood. Children's exposure in various music-movement activities can ameliorate and enrich their ability to react successfully in different temporal stimuli. Physical education teachers, in an effort to avoid tedium and their pupils' lack of interest, could incorporate these types of programs in early childhood. This alternative way of teaching should be aimed, on the one hand, at a deeper understanding of the skills that are used so that the movements flow and are coordinated (Butterfield & Loovis,1994). On the other hand, this teaching method should create a pleasant atmosphere aimed toward the education of children, physically, spiritually and mentally.

Music in kinetic activities contributes to the development of rhythmic capacity. It would be optimistic to hope that physical education teachers would acquire an elementary music education so that they could implement rhythmic education as an alternative means of teaching and creating an attractive learning process. The fact that there are no surveys examining such teaching methods shows

that further research is necessary to support the results of this investigation. Additionally, future research could examine the impact of such intervention programs in the development of the linguistic or mathematic ability of preschool children.

References

Agdiniotis, I., Pollatou, E., Gerodimos, V., Zisi, V., Karadimou, K., & Yiagoudak,i F. (2009). Relationship between rhythmic ability and type of motor activities in preschool children. *European Psychomotricity Journal*, *2*(1), 24-34.

Butterfield, S. & Loovis, M. (1994). Influence of age, sex, balance, and sport participation on development of kicking by children in grades K-8. *Perceptual and Motor Skills, 79*, 691-697.

Blesedell, D. (1991). *A study of the effects of two types of movement instruction on the rhythm achievement and developmental rhythm aptitude of preschool children.* Doctoral dissertation, Temple University, UMI' s Dissertation Abstracts database.

Cabbard, C. (1992). *Lifelong motor development*. Duduque, I A: William G. Brown Publishers.

Gallahue, D. (1996). *Developmental Physical Education for Today's Children*, 3rd edition. Dubuque, IA: Brown & Benchmark

Derri, V., Tsapakidou A., Zachopoulou, E., & Gini, V. (2001). Complexity of rhythmic ability as measured in preschool children. *Perceptual and Motor Skills, 92*, 777-785.

Haines, C. (2003). Sequencing, coordination and rhythm ability in young children. *Child, Care, Health & Development, 29*(5), 395-409.

Huff, J. (1972). Auditory and Visual perception of rhythm by performers skilled in selected motor activities. *Research Quarterly*, *43*(2), 197-207.

Kambas, A., Ageloussis, N., Gourgoulis, V., Barbas, I. & Antoniou, P. (2000). The effect of age and sex in motor coordination abilities in preschool children. *Physical Activity & Quality of Life, 1*, 51-56 (e-journal in Greek).

Karageorgis, C. & Terry, P. (1997). The psychophysical effects of music in sport and exercise: A review. *Journal of Sport Behaviour, 20*, 54-68.

Kuhlman, K. & Schweinhart, L. (1999). *Timing in Child Development*. Ypsilanti, MI: High/Scope Educational Research Foundation.

Martin, K. & Ellermann, U. (2001). Rhythmische Vielseitigkeitsschulung. *Thessaloniki* : Salto. (in Greek)

McAuley, J.D. (2010). Tempo and Rhythm. In M.R. Jones et al. (eds.), Music Perception, Springer Handbook of Auditory Research 36, DOI 10.1007/978-1-4419-6114-3_6, pp 165-199. Springer Science+Business Media, LLC.

Oreb, G. & Kilibarda, S. (1996). The role of rhythmic abilities in dance. *Kinesiology*, *28*(1), 58-63.

Pollatou, E., Karadimou, K., & Gerodimos, V. (2005). Gender differences in musical aptitude, rhythmic ability and motor performance in preschool children. *Early Child Development and Care, 175*(4), 361-369.

Pollatou, E., Liapa, E., Diggelidis, N., & Zachopoulou, E. (2005). Measure of rhythmic ability in high school students who are involved in motor activities accompanied or not by music. *Inquiries in Sport & Physical Education*, *3,1*, 22-28.(e-journal)

Pollatou, E. & Hatzitaki, V. (2001). The influence of a rhythmical-motor activity program on the development of fundamental motor skills in pre-school children. *Journal of Human Movement Studies, 40*, 101-113.

Rausher, F. & Zupan, M.A. (2000). Classroom Keyboard Instruction Improves Kindergarten Children's Spatial- Temporal performance: A Field Experiment. *Early Childhood Research Quarterly, 15*(2), 215-228.

Rose, S. E. (1995). *The effects of Dalcroze eurhythmics on beat competency performance skills of kindergarten, first, and second grade children.* Doctoral dissertation, University of North Carolina at Greensboro.

Tsapakidou, A., Zachopoulou, E., & Zografou, M. (2001). Early young children's behavior during music and movement program. *Journal of Human Movement Studies, 41*, 333-345.

Weikart, P.S. (1989). Teaching movement and dance. Ypsilanti, Michigan: High/Scope Press.

Weikart, P. & Carlton, E. (1995). *Foundations in Elementary Education Movement.* Ypsilanti, MI, High/Scope Press.

Zachopoulou, E., Derri, V., Chatzopoulos, D., & Ellinoudis, T. (2003). Application of Orff and Dalcroze activities in preschool children: Do they affect the level of rhythmic ability? *The Physical Educator, 60*(2), 50-56.

Zachopoulou, E., Tsapakidou, A. & Derri, V. (2004). The effects of a developmentally appropriate music and movement program on motor performance. *Early Childhood Research Quarterly, 19*, 631-642.