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THE ROLE OF CONTEMPORARY DANCE IN EARLY SCHOOL-AGE MOTOR DEVELOPMENT

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ABSTRACT

This study investigated the contribution of contemporary dance to the motor development of pre-school children. The aim was to investigate how dance, as an activity that combines movement, rhythm and balance, affects children's motor coordination and their functional and physical abilities. Thirteen children (nine girls and four boys) aged 7 to 10 years participated in an eight-week contemporary dance programme, twice a week for one hour each session. Before and after the dance programme, their static and dynamic balance (stork stand test, tandem walk test, one-legged stand with eyes closed), motor coordination (ball catch and throw test, ball kick to target, jump rope test, movement sequence test) and speed-agility and reaction time (sprint test, shuttle run test, reaction time test, zigzag run test) were assessed. The results showed significant improvements between the two different time points in all tests of balance, motor coordination and speed-mobility and reaction time. It is concluded that dance is an effective tool for promoting motor development in young children.

Keywords: Dance, Motor Development, Children, Balance, Speed, Agility, Reaction Time, Coordination

1. INTRODUCTION

Motor development is the lifelong progressive change in motor behavior that occurs under conditions of interaction between the demands of an individual's actions, individual biological capabilities and environmental conditions Gallahue and Ozmun (1998). The classification of stages of motor development is based either on chronological age or on periods of schooling. However, as there are some shortcomings in relying on one or the other, a combination of the above criteria best contributes to a more complete interpretation of the developmental process The first major development of motor coordination and functional and physical abilities, as key parameters of motor development, is mainly found in the period from pre-

school to late school age. Additional, the age of 7 to 10 years (early school age) is the phase of major improvement in motor learning. It is characterised as a transitional period in which the first signs of maturation appear Kambas (2004).

In terms of motor learning, there is an improvement in motor control and functional skills, a rapid improvement in speed and endurance, but a slow improvement in strength, functional skills in jumping, throwing and catching, and differences in performance between boys and girls Nilsson (1984); Grosser (1991). Motor coordination and functional and physical abilities are the basis for children's active participation in physical activities, sports and everyday movements. Deficits in these areas can affect not only children's physical health, but also their self-confidence and overall development.

Dance as an art form affects the individual holistically, engaging the body and mind, and is a way of expressing and receiving kinesthetic information (Deans, 2016; Graham, 2008). It acts as a pedagogical tool, creating opportunities to explore and acquire knowledge through the body and senses, and through the retrieval of somatic information Aikat (2015); Duberg et al. (2016).

Dance, with its combination of rhythm, movement and expression, has been identified as one of the most powerful tools for promoting motor development in childhood, as it is considered very important for both health and well-being Gallahue and Ozmun (2012). Scientific research has shown that dance and other physical activities that combine different body movements improve neuromuscular connections and motor capacity Lakes et al. (2013). According to the dynamic systems theory of motor development Thelen and Smith (1994), learning new motor skills is the result of a continuous interaction between physical and environmental factors. Dance, because it requires coordination, adaptation and repetition, helps to improve these skills.

In particular, participation in dance programmes is associated with improvements in balance, coordination and speed of movement. Consistent with a study by Kiefer et al. (2011), children who participated in dance classes for 8 weeks showed significant improvements in balance and coordination compared to children who did not participate. Similarly, studies by Golomer et al. (1999) and Hugel et al. (1999) showed that participation in dance programmes was associated with better balance skills. Research showed that dance training led individuals to better develop their adaptive skills in dynamic balance and movement control. It has also been found that girls who are mainly involved in modern dance develop better static and dynamic postural stability than girls involved in other sports activities Marinkovic et al. (2022). Participation in a modern dance programme was found to have a positive effect on the transformation of morphological characteristics by increasing muscle mass and decreasing subcutaneous fat in girls aged 7 to 11 years, who also had greater muscle strength, muscular endurance and aerobic capacity at the end of a modern dance programme Ilić et al. (2024). A significant improvement in the gross motor skills of children aged 5 to 6 years occurred when they attended modern dance classes Andriyani et al., (2023).

Intervention programmes for motor activities, play and dance have been shown to be effective in developing basic motor skills and thus cognitive development in kindergarten and primary school children Becker (2013) ; Zachopoulou et a;. (2004); Shoval et al. (2015); Venetsanou and Kambas (2004); Wang (2004). Finally, studies such as Piek et al. (2008) confirmed that dance activities help to improve motor function, while research by Vernetta et al. (2020) concluded that dance helps to improve reaction and speed of movement through tasks that require quick decision making and changes of direction.

The practical implications, both in the field of physical education and dance and in the general educational process and development of children, are considered important, as they can be used by professionals involved in children's motor development, such as teachers, coaches and child psychologists. Physical education and dance teachers can use the research findings to design and implement dance programmes that focus on improving specific dimensions of motor development. Similarly, coaches can integrate dance into children's sports programmes, particularly in high-level sports. Child psychologists can also recommend dance as a means of improving the motor development, self-confidence and social integration of children with learning difficulties.

Based on the above, the aim of this study is to investigate the effect of contemporary dance on the motor development of children aged 7-10 years, focusing on static and dynamic balance, motor coordination, speed, agility and reaction time.

2. METHODOLOGY

Thirteen children, 9 girls and 4 boys, aged 7 to 10 years, participated in the study. They were students at a dance school and were involved in contemporary dance. 10 of them had previous dance experience, while 3 of them had just started. The children were selected according to the following criteria: 1) to include children between the ages of 7 and 10 to ensure that they were at a similar developmental stage, 2) to be physically healthy with no diagnosed motor or neurological disorders that could affect the measurements. Prior to the implementation of the programme, parental consent was obtained for the participation of their children.

Description of the instruments

The instruments were selected based on their reliability and validity as documented in previous research.

The following tests were used to measure balance.

Stork Stand Test: The child started by standing upright with both feet together. The hands were either placed at the waist or outstretched to the side for balance. Then one leg (the one most comfortable for the child) was lifted and the sole of the foot was placed (90°) on the inside of the opposite knee. The time started as soon as the child lifted the leg and had to stay in that position for as long as possible. Time stopped if the child lost balance and stepped on the lifted leg, moved the supported leg, or changed the position of the lifted leg. Three attempts were made with a 1-minute rest between attempts and the best time in seconds was recorded Clarke et al. (2019).

Tandem walk test: The child stood at one end of a 4-metre line (made of paper tape) with one foot in front of the other (in a straight line). His hands were at his side or at his waist. He walked slowly along the line, putting one foot directly in front of the other. The heel of the front foot had to touch the toes of the back foot with each step. The aim was to reach the end of the line without losing balance. The test stopped if the child stepped out of line or spread his feet too far apart. The number of successful steps was recorded. Three trials were performed with a 1-minute break between trials Fucuda (2019).

One-leg stand with eyes closed: The child started by standing upright with their hands at their waist. The child then had to lift one leg (whichever was most comfortable), bend it to a 90° angle, place it on the knee of the supporting leg and maintain balance in this position for as long as possible with eyes closed. The time

started when the eyes were closed and stopped when the child pressed the bent leg to the floor, opened the eyes or moved the supporting leg. In this test, there was also a person near the child for safety and support in case the child lost balance. The test was performed 3 times and the best time was recorded. Three trials were performed with a 1-minute rest between trials Fucuda (2019).

The following tests were used to measure motor coordination.

Ball catch test: The child stood upright behind a predetermined line, 2 m from the researcher, with his legs slightly apart and his arms ready to receive. The experimenter threw a small rubber ball at him with moderate force. The child tried to catch the ball with both hands. Three trials were performed with a 1-minute break between trials. Ten attempts were made in each trial and successful catches were recorded. The number of the most successful attempt was recorded Corbin and Lindsey (1994).

Ball throw test: The child stood behind the line holding the small rubber ball and threw it at a specific target, placed opposite him at a distance of 2 metres. The ball had to hit the target. The child made 10 attempts, and the correct throws were recorded. The number of the most successful attempt was recorded Corbin and Lindsey (1994).

Ball kick to target: The child stood behind a starting line and had to kick a ball towards the target, which was a cone placed 5 metres away. He made 10 attempts and the number of successful kicks was recorded. Three attempts were made with a 1-minute break between attempts. The number of the most successful attempt was recorded Fucuda (2019).

***Jump rope test*:** The child held a rope of appropriate length for his or her height with both hands, legs slightly apart and body upright. The child was asked to jump over the rope continuously for 30 seconds. The rope had to rotate in rhythm and the child had to land with slightly bent knees. The number of successful jumps was recorded. The test was stopped if the child stopped jumping due to fatigue, if he/she became entangled in the rope more than 3 times in a row, and if he/she could not maintain the rhythmic movement. The average number of successful jumps in 30 seconds was recorded Fucuda (2019).

Movement sequence test: The researcher first performed a sequence of 5 simple movements (e.g. jumping-clapping-rotating-coughing-kneeling). The child had to observe and repeat the sequence as accurately as possible. If successful, the sequence becomes more complex (with more movements). The child had a maximum of 2 trials for each sequence. The test was stopped if the child could not remember the order of the movements and made mistakes in the sequence, or if he/she did not have smooth coordination in his/her movements. The highest number of correct movements was recorded Bruininks (1978).

The following tests were used to measure speed, agility and reaction time.

Sprint Test: The child started from a standing position, with one foot in front and the body slightly tilted, from the starting point (line with paper tape). The starting signal was given ("Ready - Go!") and the child ran as fast as possible in a straight line from the starting point to the finishing line, which was 10 m away. The time was measured with a stopwatch. The procedure was repeated 3 times with a 3-minute break between each attempt. The best time was recorded Core (2000).

Shuttle Run Test (agility): The child was standing behind the starting line. He took up a starting position with one foot slightly forward and the body leaning

forward. At the signal "Ready - Go!", the child ran quickly towards a cone which was placed at a distance of 10 meters. He had to touch the cone with his hand and come running back. The test was completed when the child crossed the starting line a second time. The total time taken to complete the test was recorded. Three repetitions were done with a 3 min break between attempts, and the best time was recorded Eriksson et al. (2015).

***Reaction Time Test*:** The child stood with his arm stretched out in front of him. The researcher held a ruler (30 cm) vertically from zero, without the child touching it. The ruler was released without warning. The child tried to catch it with his fingers as quickly as possible. The measurement was recorded at the point where the ruler was grasped (in centimetres). The test was repeated 3 times, with a 1-minute break between attempts and the average was recorded Reigal et al. (2019).

Zig-Zag Running Test: The child stood behind the starting line in a sprinting position. The start signal was given, and the child ran as fast as he/she could in a zigzag pattern between 8 cones placed in a straight line 1.5 metres apart. The child had to maintain control of movement and balance without touching the cones. Time was stopped when the child crossed the finish line. A stopwatch was used to record the time. The test was repeated 3 times with a 1-minute break between attempts and the best time was recorded Fucuda (2019).

Measurement procedure

Before the tests began, parents were informed of the procedure and signed the consent form for their children's participation. The measurement schedule was also designed to ensure that each child was tested under the same conditions.

Data collection took place in two phases: Pre-test: before the start of the contemporary dance programme. Post-test: after the end of the programme.

The tests were carried out over two days for each participant to avoid fatigue. Each movement test trial for balance, coordination, speed, agility and reaction time was performed with a predetermined rest period (1-3 minutes between trials). On the first day the balance and coordination tests were performed and on the second day the speed, agility and reaction time tests were performed.

Statistical analysis

The mean and standard deviation (std) were calculated for all tests of balance (static-dynamic), motor coordination and speed, agility and reaction time before and after the application of the modern dance programme. T-test analyses were performed to compare the means of the tests, pre-test and post-test.

3. RESULTS

Table 1 shows the results of the dynamic and static balance tests. Statistically significant differences were observed between the initial and final measurements. Table 2 shows the results of the motor coordination tests. There are statistically significant differences between the baseline and final measurements. Table 3 shows the results of the speed, agility and reaction time tests. There are statistically significant differences between the initial and final measurements.

Table 1

Table 1 Means and Standard Deviations on Static and Dynamic Balance Tests Before and After the Contemporary Dance Program

Test	Mean Pre	Std Pre	Mean Post	Std Post	t	p
Stork Stand Test	21,08 s	3,818	23,38 s	3,355	**t(12) = -5,196**	**0,0002**
Tandem Walk Test	12,77*	2,204	13,69*	1,653	**t(12) = -3,207**	**0,0075**
Eyes Closed Test	9,31 s	4,090	10,85 s	3,976	**t(12) = -4,382**	**0,0009**

***Number of correct steps, s=seconds**

Table 2

Table 2 Means and Standard Deviations of Motor Coordination Tests Before and After The Dance Program

Test	Mean Pre	Std Pre	Mean Post	Std Post	t	p
Ball Catch Test	8,31***	1,377	8,92	1,115	t(12)= -3,411	0,005
Ball Throw Test	5,38***	0,961	6,62	0,870	t(12) = -6,121	<0,001
Ball Kick to Target Test	5,92***	1,706	6,92	1,320	t(12) = -2,280	0,042
Jump Rope Test	21,69*	7,158	24,77	5,932	t(12)= -3,987	0,002
Movement Sequence Test	5,15**	1,068	5,69	0,947	t(12)= -3,742	0,003

number of correct movements, *successful jumps*number of successful attempts

Table 3

Table 3 Means and Standard Deviations of Speed, Agility and Reaction Time Tests Before and After the Dance Programme

Test	Mean Pre	Std Pre	Mean Post	Std Post	t	p
Sprint Test	2,800s*	0,2739	2,669s	0,2750	t(12)=6.2	<0,001
Shuttle Run Test	5,808s	0,4132	5,662s	0,3664	t(12)=2.84	0,015
Reaction Time Test	17,54s	5,695	16,31s	4,385	t(12)=2.48	0,029
Zig-Zag Running Test	9,00s	1,225	7,85s	0,899	t(12)=5.20	<0,001

S*=seconds

4. DISCUSSION

The aim of the present study was to investigate the effect of contemporary dance on the development of motor development in children aged 7-10 years, focusing on balance, coordination, speed, agility and reaction time. The following research hypotheses were tested:

Participation in the contemporary dance programme will improve children's balance, coordination, speed, agility and reaction time. The results of the statistical analysis showed that participation in the programme had a positive effect, with statistically significant differences between baseline and final measures on all tests.

In particular, there was a statistically significant improvement in all three balance tests (Stork Stand Test, p = 0.02; Tandem Walk Test, p = 0.0075; Eyes Closed Test, p = 0.0009), confirming that performing contemporary dance movements improves motor control and the ability to maintain balance in both posture and movement. These findings are consistent with previous studies Golomer et al.

(1999); Hugel et al. (1999), which have shown that dance improves static and dynamic balance by continuously adapting the body to changes in posture and movement. Thus, dance is particularly effective in improving static and dynamic balance, as well as closed eye balance.

Coordination showed a significant improvement (ball catch test, p=0.005; ball throw test, p=0.000; ball kick to target test, p=0.042; jump rope test, p=0.002; movement sequence test, p=0.003). This result suggests that dance training helps to improve visual-motor coordination and control of the upper and lower limbs. These findings are consistent with research by Piek et al. (2008), who found that participation in activities that require repetitive movement patterns (such as dance) improved neuromuscular coordination. It is concluded that dance is particularly effective in improving movement coordination because it requires precise and combined limb movements in a rhythmic structure.

The children's speed improved significantly after the contemporary dance programme, as shown by the sprint test, p = 0.000, shuttle run test, p = 0.015, reaction time test, p = 0.029, zigzag run test, p = 0.000. The decrease in reaction time and increase in agility are likely to be related to the constant change of movement required in dance. Similar findings were reported by Vernetta et al (2020) who found that children who participated in dance programme showed improvements in speed and reaction time due to the increased motor adaptation required to perform complex dance combinations. Dance can significantly improve children's speed and reaction time because it involves exercises that require rapid adaptation and execution of movements. The children's speed improved significantly after the contemporary dance programme.

In the present study, valid and reliable motor tests were used, ensuring the accuracy of the measurements. In addition, the pre- and post-test design allowed the comparison of pre- and post-test performance. However, the small sample size (13 children) could be considered a limitation of the study as it limits the generalizability of the results. Future research could examine the long-term effects of contemporary dance on a larger number of participants and explore the effects of different types of dances by including a control group to draw stronger conclusions. Overall, the research reinforces the importance of modern dance as an integrated form of physical activity that improves motor development in early school-age children.

5. CONCLUSIONS AND SUGGESTIONS

Regarding the research hypothesis that participation in the contemporary dance programme will improve children's balance, it is concluded that contemporary dance has a positive effect on children's static and dynamic balance. Regarding the research hypothesis that participation in the contemporary dance programme will improve children's coordination, it is concluded that contemporary dance has a positive effect on children's movement coordination. Similar conclusions are reached by Piek et al. (2008) and Davids et al. (2000), who highlight the role of dance in improving motor coordination through repetition and rhythmic accuracy. Regarding the hypothesis that participation in the modern dance programme will improve children's speed, agility and reaction time, it is concluded that modern dance improves these parameters. The same conclusions were reached by Vernetta et al (2020) who found that dance improves neuromuscular speed through complex movements and increased motor response.

As dance has a positive effect on both the functional and physical abilities of children, its practical application in different areas of education and physical activity is enhanced. Dance can be integrated into physical education by designing and implementing specific programmes that target specific motor skills according to the needs of the students. In addition, holistic pedagogical development is possible through specialised dance programmes that enhance both the cognitive and socio-emotional domains of children. Dance can also be used as an alternative form of exercise for athletes to improve their speed and agility, and as a means of injury prevention. Finally, dance can be used as a tool to develop motor skills, especially for children with low motor confidence.

Future research can compare the effects of different dance genres (e.g. ballet, hip hop, modern, Latin) on motor skills to determine the impact and effectiveness of each genre. Further research could also be conducted on children with motor difficulties or developmental disorders to investigate whether dance can act as a tool for motor rehabilitation. Finally, future studies could compare children who take part in dance classes of any kind with children who do not, to further strengthen the contribution of contemporary dance to motor development.

CONFLICT OF INTERESTS

None.

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