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The impact of movement-based games on the development of physical qualities in 5–6-year-old children in Vietnam: A case study at 19/5 kindergarten, Thai Nguyen city

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Abstract

Movement-based games (MBGs) are considered an effective means of physical education, especially in developing physical fitness among preschool children. The purpose of this study is to evaluate their effectiveness in enhancing the physical qualities of children aged 5–6 years. A total of 60 healthy children aged 5–6 were randomly selected and divided into two groups: an experimental group (EG) with 30 children, who participated in movement-based games designed by the research team, and a control group (CG) with 30 children, who followed the school's standard physical activity program. This study employed six criteria to assess the development of physical fitness qualities in 5–6-year-old children, including: 18-meter sprint; dominant-hand distance throw; standing long jump; ball bouncing and catching; one-leg balance; and a 75-second endurance run. The results after 12 weeks of applying MBGs show that the experimental group achieved higher growth rates across all six physical fitness tests compared to the control group. Among these, the throwing and catching ball test showed the highest improvement at 35.17%, while the standing long jump recorded the lowest increase at 8.66%. Although the control group also exhibited some changes in physical qualities between the pre-test and post-test, these differences were not statistically significant ($p > 0.05$). These results demonstrate that the use of movement-based games (MBGs) is more effective in improving children's physical fitness than the current educational program. We recommend actively integrating MBGs into the teaching process to enhance the quality of physical education in preschools.

Keywords: Children aged 5–6 years, Kindergarten, Movement-based games, Physical fitness qualities.

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Institutional Review Board Statement: This process also received written consent from the children's parents; approval from the Board of Management of the 19/5 Preschool in Thai Nguyen City; and approval from the Academic Council of Thai Nguyen University of Education – Thai Nguyen University under Decision No. 1356/QĐ-ĐHSP dated May 29, 2024.
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1. Introduction

In early childhood education, physical development is considered a fundamental factor contributing to the holistic growth of children [1-3]. Among the various approaches, movement-based games (MBGs) serve as an effective educational tool, enhancing the quality of physical education and fostering essential physical fitness qualities (PFQs) in preschool children [4]. Unlike traditional physical exercises, MBGs integrate movement with play elements, creating an engaging learning environment that stimulates children's interest, while contributing to the development of motor skills as well as their emotional and social competencies [5-7]. Therefore, the use of Movement-based games (MBGs) in education in general, and in preschool physical education in particular, is regarded as an important professional approach that contributes to the realization of holistic child development goals. MBGs are designed in accordance with the psycho-physiological characteristics of preschool age, thereby fostering the development of fundamental physical qualities such as speed, strength, agility, and endurance—core elements for sustainable physical growth [8]. Furthermore, through participation in MBGs, children also cultivate moral, psychological, and volitional qualities, enriching their spiritual life, nurturing bonds of affection, love, and mutual support. At the same time, these games reinforce essential motor skills for daily living. Hence, integrating MBGs into daily preschool activities not only enhances children's physical fitness but also promotes comprehensive development across multiple domains, in line with the child-centered philosophy—a core orientation in modern early childhood education [8, 9].

Numerous studies worldwide have clarified the positive role of MBGs in the physical development of young children, affirming their effectiveness in improving motor skills and physical fitness. Meta-analyses by Zeng, et al. [5] have consistently shown that participation in MBGs enhances fundamental motor abilities, muscle strength, coordination skills, and promotes cognitive and social development in preschool-aged children [5, 10, 11]. Although these studies have provided substantial evidence on the effectiveness of MBGs in promoting physical development in preschool children, most of the research has primarily focused on assessing gross motor skills without thoroughly analyzing specific PFQs such as agility, strength, agility, and endurance - all crucial factors for comprehensive physical development. In Vietnam, MBGs are integrated into five educational domains for children aged 5 to 6, with MBGs regarded as a crucial professional tool for general physical development and specifically for developing PFQs [12, 13]. However, the practical organization of MBGs in many kindergartens remains unsystematic, and their effectiveness has not met the expected outcomes [7, 14]. The content of MBGs is often unsuitable for the specific goals of developing PFQs, or the activities are below the children's motor abilities; MBGs tend to be monotonous and limited in variety; children's PFQs during MBGs remain restricted, characterized by slow movements, lack of agility, and many games fail to stimulate children's interest [15-17].

We hypothesize that Movement-based games (MBGs) can significantly improve the physical fitness components of preschool children aged 5–6 years compared to conventional physical education activities. Therefore, this study was conducted to evaluate the effectiveness of using MBGs as a targeted pedagogical intervention to develop essential physical fitness components for preschoolers, thereby contributing to the achievement of holistic development goals in early childhood education.

2. Material and Methods

2.1. Participants

The research team selected a total of 60 healthy preschool children aged 5 to 6 from 19/5 Kindergarten, Thai Nguyen City, Vietnam. All children met similar conditions in terms of cognitive level, development of PFQs, and had access to comparable facilities and activity organization resources. They were also informed in advance about the testing procedures before participating in the experiment. . This process also received written consent from the children's parents; approval

from the Board of Management of the 19/5 Preschool in Thai Nguyen City; and approval from the Academic Council of Thai Nguyen University of Education – Thai Nguyen University under Decision No. 1356/QĐ-ĐHSP dated May 29, 2024.

The study subjects were divided into two groups: 1) Experimental group (EG): Consisting of 30 children aged 5–6, who participated in the trial using MBGs developed by the research team. The experimental period lasted 12 weeks. 2) Control group (CG): Consisting of 30 children aged 5–6, who followed the current program implemented by the kindergarten.

2.2. Procedure

To organize the experiment, we first conducted an initial assessment of PFQs development levels in both the control group (CG) and the experimental group (EG). This study used six criteria to evaluate the physical fitness development of preschool children, including: an 18-meter sprint (assessing speed), dominant-hand long throw and standing long jump (assessing strength), ball striking and catching, one-leg balance (assessing agility), and a 75-second endurance run (assessing stamina). These criteria align with the regulations set by the Ministry of Education and Training on evaluating PFQ development in 5–6-year-old preschool children in Vietnam [18, 19] and correspond with the physical fitness evaluation criteria used at 19/5 Kindergarten, Thai Nguyen City [20]. Subsequently, the children in both groups underwent a 12-week experimental process, with three sessions per week, each lasting 35 minutes. Each session included 2 minutes for engaging activities to stimulate interest; 5 minutes for warm-up; 23 minutes for organizing games; and 5 minutes for cool-down and recovery [19, 21]. The experimental procedure was conducted as detailed in Table 1:

After the 12-week experiment, both the control group and the experimental group underwent a second physical fitness assessment (following the same procedures as the initial assessment), and the results were compared and evaluated against the baseline data.

Table 1.
12-Week Experimental Program of Movement-Based Games (MBGs).

Time	Week	Game category			
		Agility	**Strength**	**Dexterity**	**Endurance**
From February 3 to February 9	1	x	x		x
From February 10 to February 16	2	x		x	x
From February 17 to February 23	3		x	x	x
From February 24 to March 2	4	x	x	x	
From March 3 to March 9	5	x	x		x
From March 10 to March 16	6	x	x	x	
From March 17 to March 23	7		x	x	x
From March 24 to March 30	8	x		x	x
From March 31 to April 6	9		x	x	x
From April 7 to April 13	10	x	x	x	
From April 14 to April 20	11	x	x		x
From April 21 to April 27	12	x		x	x

2.3. Statistical Analysis

The collected data were analyzed using SPSS statistical software version 20 with the following parameters: mean ($\overline{X}$), standard deviation (± SD), mean comparison (t-test), and percentage. Descriptive analysis was used to identify the characteristics of the subjects. A paired sample t-test was applied to determine the differences between pre- and post-intervention. The statistical significance level was set at a probability threshold of $p < 0.05$.

3. Results

3.1. Assessing the Impact of Traditional Children's Games on the Physical Development of 5- to 6-Year-Olds at 19/5 Kindergarten, Thai Nguyen City

To evaluate the effectiveness of traditional children's games on the development of children's physical fitness, we conducted a pre-experimental assessment of the physical fitness of both the control group and the experimental group. The results are presented in Table 2.

Table 2.
The results of the independent samples t-test for the physical fitness of experimental and control groups before the experiment.

Test	N	Group	M	SD	t-value	p-value
18-meter sprint	30	CG	7.1523	0.91412	0.599	0.554
	30	EG	7.0733	1.04307		
Standing long jump	30	CG	88.9153	9.81770	-1.789	0.084
	30	EG	90.0483	9.64329		
Dominant-hand distance throw	30	CG	6.8140	0.70767	-1.043	0.305
	30	EG	6.9503	.99512		
Ball bouncing and catching	30	CG	16.6667	4.07121	-1.087	0.286
	30	EG	16.9667	3.66233		
Single-leg balance	30	CG	23.1267	6.73596	-0.326	0.747
	30	EG	23.1597	6.48747		
75-second self-paced run	30	CG	148.2500	19.41612	.543	0.591
	30	EG	148.2307	19.46009		

The comparison of the development levels of physical fitness components (PFCs) in children aged 5–6 years between the control group (CG) and the experimental group (EG) prior to the intervention (Table 2) shows that, across all test indicators (agility, strength, dexterity, endurance), the differences in mean values between the two groups were very small and not statistically significant (P ranging from 0.203 to 0.933; $p > 0.05$). This indicates that the initial physical fitness of the two groups was equivalent. These results confirm that the grouping was completely objective, ensuring the validity of the experimental design. On this basis, we proceeded with the 12-week intervention using Movement-based games (MBGs), with the outcomes presented in Table 3.

Table 3.
The results of the independent samples t-test for the physical fitness of experimental and control groups after the experiment.

Test	N	Group	M	SD	t-value	p-value
18-meter sprint	30	CG	6.9573	0.90457	7.752	0.000
	30	EG	6.2140	0.72683		
Standing long jump	30	CG	88.5197	12.97726	-3.813	0.001
	30	EG	97.8423	9.37664		
Dominant-hand distance throw	30	CG	7.2035	1.07874	-3.969	0.000
	30	EG	8.0500	0.38245		
Ball bouncing and catching	30	CG	17.3333	3.77225	-8.185	0.000
	30	EG	22.9333	4.03377		
Single-leg balance	30	CG	24.4873	6.33557	-5.780	0.000
	30	EG	29.7083	2.44555		
75-second self-paced run	30	CG	151.1167	15.96636	-6.446	0.000
	30	EG	165.9880	9.74744		

The results in Table 3 show that, after the intervention, all physical fitness indicators of the experimental group were higher than those of the control group. The differences between the two groups in all test items were statistically significant ($p < 0.05$). This confirms the effectiveness of the selected physical activity games in developing the physical fitness components of 3–4-year-old children at 19/5 Preschool, Thai Nguyen City.

Table 4.
The results of the paired samples t-test of experimental and control groups before and after the experiment.

Test	Pre – test (M ± SD)	Post – test (M ± SD)	t	P	Percentage of change (%)
Groups Control					
18-meter sprint	7.15± 0.91	6.96± 0.90	1.381	0.178	2.73
Standing long jump	88.92± 9.82	88.52±10.97	0.283	0.779	0.44
Dominant-hand distance throw	6.81± 0.71	7.20± 1.08	-2.292	0.029	5.72
Ball bouncing and catching	16.67± 4.07	17.33± 3.78	-2.710	0.011	4.00
Single-leg balance	23.13± 6.74	24.49± 6.34	-2.319	0.028	5.88
75-second self-paced run	148.25±19.42	151.12±15.97	-1.280	0.211	1.93
Groups Experimental					
18-meter sprint	7.07±1.04	6.21±0.73	8.799	0.000	12.15
Standing long jump	90.05±9.64	97.84±9.38	-5.276	0.000	8.66
Dominant-hand distance throw	6.95±0.99	8.05±0.38	-5.156	0.000	15.82
Ball bouncing and catching	16.97±3.67	22.93±4.03	-9.187	0.000	35.17
Single-leg balance	23.16±6.48	29.71±2.45	-6.053	0.000	28.28
75-second self-paced run	148.23±10.46	165.98±9.74	-5.467	0.000	11.98

The results in Table 4 indicate that after 12 weeks of intervention, the physical fitness of the experimental group showed growth across all six tests, with higher rates compared to the control group. Among these, the throwing and catching ball test demonstrated the highest increase (35.17%), while the standing long jump test recorded the lowest improvement (8.66%). The balance-on-one-leg test improved by 28.28%, the speed test (18 m sprint) by 12.15%, and the endurance test (75-second run) by 11.98%.

In the control group, there were also changes in the physical fitness components between the pre-test and post-test; however, these differences were not statistically significant ($p > 0.05$). After the intervention, the control group showed some improvement in physical fitness, but the degree of increase was modest. The greatest improvement was observed in the throwing and catching ball test (5.88%), while the smallest increase was in the standing long jump test (0.44%). These findings once again confirm that physical activity games have a positive effect on developing the physical fitness components of 5–6-year-old children in preschool.

4. Discussion

This study aimed to evaluate the effectiveness of Movement-based games (MBGs) on the development of physical fitness components in 5–6-year-old children at preschool through a 12-week experimental program. The results confirmed that PAGs had a significant positive impact on the development of children's physical fitness components. This was evidenced by statistically significant improvements across all six tests in the experimental group (Tables 3 and 4).

The findings of this study are consistent with previous research, emphasizing that physical activity games create a dynamic learning environment in which children actively participate and support one another, thereby improving physical competence and developing essential qualities such as speed, strength, agility, and endurance [8, 9].

In the study conducted by Dao Thanh Chuc, it was demonstrated that MBGs help improve physical fitness and stabilize the vestibular system in primary school students [22]. This finding is consistent with the results of our study, which also confirmed that MBGs have a significant impact on the development of physical fitness qualities in children. Similarly, in the research of Duong Van Tan, the effectiveness of MBGs in enhancing the overall physical fitness of university students was clearly shown. The integration of MBGs into instruction made lessons more engaging, improved students' learning attitudes, and significantly boosted their physical development [23]. Both of these studies yielded findings consistent with ours, further validating the positive effects of MBGs in developing physical fitness qualities—particularly when implemented systematically and tailored to the age group. However, the key difference lies in the target participants.

Cuong, Tran Ngoc Hai, and Huynh Duy conducted a study on the impact of MBGs on male students' physical fitness during physical education classes. The results showed that the application of MBs in PE lessons at Saigon University had a positive effect on improving male students' overall physical fitness, specifically in terms of the explosive power of the legs, agility, speed, and maximal aerobic speed [24]. The difference between their study and ours lies in the target population: their research focused on male university students, whereas our study was conducted on preschool children. Moreover, our study primarily focused on four key physical fitness qualities including Agility, strength, dexterity, and endurance.

A study conducted by Larysa Kuznetsova and colleagues on primary school students with moderate intellectual disabilities revealed that lessons incorporating MBGs had a positive impact on both the physical and mental well-being of these students. The study also confirmed that, following the implementation of the proposed MBGs, students experienced improvements in mental state, memory, cognition, and attention. Additionally, the frequency of nervous breakdowns, depressive states, and stress-related symptoms decreased during the course of participating in the selected physical activity games [25].

The study by Verónica Alcaraz-Muñoz and colleagues analyzed the impact of traditional MBGs on the emotional intensity of primary school students. The results showed that female students exhibited higher levels of positive emotional intensity during non-competitive games, while male students experienced stronger positive emotions in cooperative-competitive and competitive games. These findings highlight the positive role of traditional MBGs in the holistic development of children [26]. While our study focused on the use of MBGs to enhance physical fitness qualities in preschool-aged children, their research delved into the socio-emotional aspect, revealing gender-based differences in the experience of positive emotions when engaging in different types of games. This comparison suggests that MBGs not only influence children's physical development but also contribute significantly to their emotional well-being.

Several studies have indicated that the use of MBGs contributes to increased engagement in physical education classes [5-7]. For instance, the study by Webster, et al. [6] demonstrated that incorporating MBGs into PE lessons enhances positive emotions and learning motivation in children and adolescents. The study also found that implementing MBGs over a 12-week period, with a frequency of 3–4 sessions per week and a duration of 35 minutes per session, yielded the most effective results in promoting the development of fundamental motor skills in children [23]. This research holds significant value for our study, as it provided a basis for determining the optimal weekly frequency for implementing MBGs to ensure effective physical fitness development in preschool children.

Thus, the present study not only reinforces previous findings but also extends them by demonstrating that physical activity games can significantly improve speed, strength, endurance, and agility in 5–6-year-old preschool children. Future research could further analyze the effects of MBGs on each specific physical fitness component, or examine the relationship between physical development and the ability to perform fundamental motor skills in children.

5. Limitations of the Study

Although this research provides new insights into the effects of MBGs on the development of physical fitness components in 5–6-year-old preschool children, several limitations remain.

First, the study sample was limited to 5–6-year-old children at the 19/5 Preschool in Thai Nguyen City, Vietnam. Therefore, the findings may have limited generalizability to other age groups, educational levels, or preschool settings."

Second, the study focused exclusively on evaluating the effects of MBGs on the physical fitness components of 5–6-year-old children, without providing an in-depth assessment of other aspects such as motor skills or emotional development.

To overcome these limitations, future research should include more diverse participants across different ages and health conditions, extend the duration of the intervention, and broaden the scope to examine the influence of MBGs not only on the overall quality of physical education classes but also on children's motor skill development in particular.

6. Conclusion

The use of movement-based games (MBGs) to develop physical fitness qualities (PFQs) in preschool children at 19/5 Kindergarten, Thai Nguyen City, Vietnam, remains limited. Our study demonstrated that a 12-week training program with physical activity games was effective in improving speed, strength, endurance, and agility in children. Significant improvements were clearly reflected in the growth across all six tests (18-meter sprint, standing long jump, dominant-hand ball throw, throwing and catching ball, balance on one leg, and 75-second run) in the experimental group compared to the control group.

Based on the experimental results, we conclude that in order to enhance the effectiveness of using MBGs to develop PFQs in 5- to 6-year-old children, preschool teachers need to continuously improve their competence in collecting and designing MBGs that are appropriate for promoting physical development. They should also create engaging and age-appropriate play environments that attract and motivate children, and develop skills to generate excitement and stimulate children's active participation during PAG sessions.

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