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Efficacy Evaluation of Intervention Strategies For Fundamental Motor Skill Development In Children Aged 8–9 Years: A Controlled Experimental Study At Dang Tran Con Primary School, Ho Chi Minh City

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Abstract:
This study aims to evaluate the efficacy of a comprehensive system of pedagogical intervention strategies specifically designed to enhance Fundamental Motor Skills (FMS) in children aged 8–9 years at Dang Tran Con Primary School, District 4, Ho Chi Minh City. The research cohort comprised 256 primary school students (128 boys, 128 girls) who were randomly assigned to either an experimental group (EG, n = 128) or a control group (CG, n = 128). The experimental group participated in a structured intervention framework consisting of nine specific pedagogical strategies, including station-based learning models, targeted gamification, differentiated instruction, and progressive structural overload. Fundamental motor skills were measured pre- and post-intervention utilizing eight standardized tests evaluating static/dynamic balance, explosive power, linear speed, agility, and hand-eye coordination. Independent and paired-sample t-tests revealed that after a one-semester intervention, the experimental group demonstrated statistically significant and superior improvements ($p<0.05$) across all eight motor tests compared to the control group, regardless of gender or age cohort (8 or 9 years old). In conclusion, the systematic integration of deliberate pedagogical constraints, maximization of Active Learning Time (ALT), and individualization within Physical Education (PE) curricula are critical to optimizing foundational motor development during early childhood education.
Keywords: Fundamental motor skills, physical education, children aged 8–9, pedagogical intervention, primary school.

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1. INTRODUCTION

In modern physical education paradigms, school-based physical activity extends beyond immediate cardiorespiratory fitness to encompass the comprehensive optimization of physiological functions, motor competence, and the cultivation of lifelong physical literacy. According to the World Health Organization (WHO, 2020), children and adolescents require at least 60 minutes of daily moderate-to-vigorous physical activity (MVPA) to ensure optimal musculoskeletal, cardiovascular, and cognitive development. However, rapid global urbanization combined with the pervasive expansion of digital screen devices has accelerated sedentary behaviors, directly undermining physical fitness baselines and restricting critical opportunities for children to develop Fundamental Motor Skills (FMS).

Fundamental motor skills represent the baseline building blocks for complex physical activities, categorized into locomotor skills (e.g., running, jumping, hopping), object control skills (e.g., throwing, catching, kicking), and stability/balance skills (e.g., single-leg stand, axial twisting). Mastery of these skills during early childhood—specifically within the 8–9 age window (corresponding to grades 3 and 4)—is recognized by sports scientists as a critical "window of opportunity." During this biological phase, the central nervous system undergoes intensive myelination and synaptogenesis, facilitating the establishment of permanent neuromuscular pathways. Failure to achieve motor competence during this developmental stage creates a "proficiency barrier," which induces low physical self-efficacy, exacerbates activity avoidance, and increases the long-term risk of pediatric obesity and associated metabolic syndromes.

In Vietnam, the 2018 General Education Curriculum for Physical Education marked a fundamental shift from a content-delivery model to a competency-based framework, designating fundamental motor competence as a primary pillar. Despite this progressive mandate, implementation in urban primary schools, such as Dang Tran Con Primary School (District 4, Ho Chi Minh City), faces substantial operational challenges. These include high student-to-teacher ratios, highly constrained playground spaces, limited curricular time, and substantial baseline variances in students' initial physical capacities. Standardized, one-size-fits-all instructional methodologies fail to address individual developmental trajectories or unlock the latent motor potential of diverse student cohorts.

Consequently, this study was undertaken to fulfill three primary objectives: (1) to conduct an objective baseline assessment of the fundamental motor skill proficiency of students aged 8–9; (2) to design and execute a targeted system of short-term pedagogical interventions; and (3) to empirically validate the efficacy of these interventions through a parallel-group controlled experimental design. The findings aim to provide robust empirical evidence to guide pedagogical reforms in primary school physical education within urban educational environments.

2. LITERATURE REVIEW

2.1. Motor Development Trajectories in Children Aged 8–9 Years

Developmental kinesiology indicates that the 8–9 age cohort constitutes a critical transitional phase from initial motor acquisition to the refinement and automation of foundational skills (Goodway et al., 2019). This stage is characterized by advanced cerebellar maturation, enabling significant improvements in motor reaction time, vestibular stability, and multi-limb coordination. According to motor control theories (Schmidt & Lee, 2011), motor learning is highly dependent on high-volume, deliberate practice coupled with precise, task-specific feedback within an environment that maintains an optimal challenge point.

2.2. Determinants and Catalysts of Motor Intervention Efficacy

Children's motor acquisition is governed by complex, dynamic interactions between intrinsic constraints (e.g., anthropometrics, psychological readiness, prior motor experience) and extrinsic constraints (e.g., environmental affordances, spatial availability, pedagogical strategies). Contemporary physical education literature emphasizes that integrating movement games into the curriculum addresses cardiovascular demands while simultaneously stabilizing vestibular functions and fostering intrinsic motivation (Đào Chánh Thức, 2021). However, systemic frameworks that simultaneously address instructional organization, spatial optimization, and differentiated practice within densely populated urban school environments remain underrepresented. This study addresses this gap by investigating a multidimensional intervention framework designed specifically for high-density, low-space urban primary schools.

3. METHODOLOGY

3.1. Research Design and Participants

This study utilized a parallel-group, controlled pedagogical experimental design. The initial research cohort comprised 256 primary school students aged 8 to 9 years attending Dang Tran Con Primary School, District 4, Ho Chi Minh City, during the 2025–2026 academic calendar. The cohort was divided into two distinct, independent groups:

Experimental Group (EG): n=128 (comprising 32 8-year-old boys, 32 8-year-old girls, 32 9-year-old boys, and 32 9-year-old girls).

Control Group (CG): n=128 (exhibiting an identical demographic and gender distribution).

To maintain ecological validity and prevent contamination effects within the school setting, allocation was conducted at the intact classroom level, ensuring that students within the same class received the same instructional protocol.

3.2. Measurement Instrumentation

Following an extensive screening process and a Delphi consensus protocol involving 35 physical education experts (including PhDs, senior lecturers, and veteran primary PE teachers), eight standardized field tests were selected. These tests demonstrated high reliability and validity coefficients ($r>0.80, p<0.05$) across four core motor dimensions:

Stability and Postural Control: Stork balance stand test (s); 15-meter heel-to-toe walk test (s).

Explosive Power (Musculoskeletal Strength): Vertical jump test (cm); Standing long jump test (cm).

Locomotor Speed and Agility: 30-meter sprint from a standing start (s); 4×10-meter shuttle run test (s).

Object Control and Coordination: Tennis ball throw for distance (m); 30-second two-handed wall toss and catch test (repetitions).

3.3. Intervention Framework

Grounded in a SWOT analysis of the school's structural and spatial parameters, a system of nine pedagogical solutions was implemented for the EG over a single academic semester:

S1: Organizational restructuring to maximize physical activity density by minimizing sedentary teacher lecturing and utilizing station-based circuit training models.

S2 & S5: Structured integration of targeted gamification and peer-led team competitions to enhance intrinsic motivation and engagement.

S3 & S7: Application of differentiated instruction. Students were grouped dynamically based on baseline motor proficiency (proficient, competent, emerging) to adjust task constraints, movement amplitudes, and execution velocities, adhering to the pedagogical principle of optimal individual challenge.

S4 & S8: Spatial optimization strategies leveraging low-cost, high-affordance improvised implements (e.g., rubber markers, plastic hoops, chalk-drawn trajectories) to overcome playground restrictions.

S6 & S9: Systematization of progressive overload principles across all target domains, ensuring a balanced distribution of stability, strength, velocity, and coordination tasks.

The CG followed the conventional, standard national physical education curriculum without exposure to these specialized pedagogical modifications.

3.4. Data Collection and Statistical Analysis

Data collection was executed via double-blinded pedagogical testing protocols conducted at pre-test (baseline) and post-test (post-one semester) intervals. Quantitative profiles were processed using Microsoft Excel and specialized statistical software. Descriptive statistics generated means (x), standard deviations (Sx), and coefficients of variation (Cv). Inter-group and intra-group variances were determined using independent-sample t-tests and paired-sample t-tests, respectively. The rate of growth (W%) was calculated utilizing Brody's growth formula. Statistical significance was established *a priori* at $\alpha=0.05$.

4. RESULTS

4.1. Baseline Equivalency (Pre-Test Analysis)

Pre-test statistical evaluations confirmed that, with the exception of the 15m heel-to-toe walk test among the 8-year-old boy cohort ($t=2.246, p<0.05$), there were no statistically significant differences in baseline motor parameters between the EG and the CG across genders and age groups (p>0.05). This structural homogeneity establishes a highly reliable baseline for evaluating the direct effects of the independent variable (the intervention program).

4.2. Post-Intervention Motor Skill Variance in Boys

Following the one-semester pedagogical intervention, the male cohorts within the EG exhibited substantial motor improvements compared to their CG counterparts.

Table 1. Inter-group statistical comparison and growth rates (W%) of motor test metrics for Boys (Ages 8 and 9) post-intervention.

Assessment Metric	Age	EG (x±S)	CG (x±S)	W% (EG)	W% (CG)	t-value	p-value
Stork Balance Stand (s)	8	14.68 ± 2.96	12.90 ± 1.65	16.93%	5.55%	3.371	< 0.05
	9	17.60 ± 2.41	15.71 ± 2.68	16.09%	5.39%	4.732	< 0.05
15m Heel-to-Toe Walk (s)*	8	15.15 ± 0.59	16.85 ± 0.59	11.29%	2.65%	12.376	< 0.05
	9	14.73 ± 0.53	16.18 ± 0.67	11.09%	2.55%	12.692	< 0.05
Vertical Jump (cm)	8	25.94 ± 2.37	24.34 ± 2.73	11.20%	3.00%	4.923	< 0.05
	9	29.06 ± 3.26	27.06 ± 2.33	11.24%	3.76%	4.105	< 0.05
Standing Long Jump (cm)	8	120.13 ± 8.48	111.59 ± 10.36	7.98%	3.30%	4.621	< 0.05
	9	131.81 ± 9.71	124.69 ± 7.91	7.53%	3.05%	4.078	< 0.05
30m Standing Sprint (s)*	8	6.99 ± 0.34	7.24 ± 0.28	5.10%	1.75%	4.235	< 0.05
	9	6.60 ± 0.25	6.89 ± 0.22	4.56%	1.79%	4.862	< 0.05
4x10m Shuttle Run (s)*	8	13.40 ± 0.42	13.92 ± 0.38	6.05%	2.15%	7.811	< 0.05
	9	12.79 ± 0.40	13.50 ± 0.47	6.15%	1.98%	8.202	< 0.05
Tennis Ball Throw (m)	8	13.35 ± 1.56	12.04 ± 1.38	10.65%	4.35%	3.586	< 0.05
	9	14.32 ± 1.64	13.60 ± 1.45	10.57%	4.13%	3.687	< 0.05
30s Wall Toss & Catch (reps)	8	22.72 ± 3.82	20.97 ± 3.33	17.34%	5.67%	4.105	< 0.05
	9	25.47 ± 2.99	23.00 ± 2.77	17.33%	5.73%	5.854	< 0.05

*Note: * Temporal metrics measured in seconds; lower values indicate performance enhancement*

For 8-year-old boys, the growth rate (W%) within the EG ranged from 5.10% to 17.34%, outperforming the natural developmental growth observed in the CG (1.75% to 5.67%) by a factor of two to three. Statistically significant inter-group variances favoring the EG were confirmed across all eight evaluations ($t>2.040, p<0.05$). Similarly, 9-year-old boys in the EG exhibited marked performance growth (4.56% to 17.33%) relative to the CG (1.79% to 5.73%). The most pronounced gains occurred in hand-eye coordination (30s Wall Toss & Catch) and static balance equilibrium (Stork Balance Stand).

4.3. Post-Intervention Motor Skill Variance in Girls

Consistent with the trends identified in the male cohorts, female students in the EG responded positively to the restructured pedagogical strategies.

Table 2. Inter-group statistical comparison and growth rates (W%) of motor test metrics for Girls (Ages 8 and 9) post-intervention.

Assessment Metric	Age	EG (x±S)	CG (x±S)	W% (EG)	W% (CG)	t-value	p-value
Stork Balance Stand (s)	8	15.74±2.42	14.70±2.76	16.47%	5.42%	4.280	< 0.05
	9	19.36±3.15	17.52±2.52	16.17%	5.54%	3.998	< 0.05
15m Heel-to-Toe Walk (s)*	8	15.85±0.57	17.27±0.66	11.52%	2.77%	12.519	< 0.05
	9	15.06±0.52	16.48±0.63	11.28%	2.62%	13.071	< 0.05
Vertical Jump (cm)	8	23.31±3.17	21.38±2.17	10.59%	3.12%	3.284	< 0.05
	9	25.66±3.02	24.13±2.76	9.84%	2.62%	3.332	< 0.05
Standing Long Jump (cm)	8	107.41±8.16	101.84±6.71	7.58%	3.37%	4.135	< 0.05
	9	117.19±8.10	112.91±7.78	8.07%	3.03%	4.727	< 0.05
30m Standing Sprint (s)*	8	7.21±0.32	7.50±0.32	4.39%	1.46%	4.063	< 0.05
	9	6.95±0.31	7.16±0.33	4.87%	1.56%	4.590	< 0.05
4x10m Shuttle Run (s)*	8	13.87±0.42	14.28±0.44	6.17%	2.01%	8.685	< 0.05
	9	13.31±0.40	13.78±0.40	6.38%	1.96%	9.023	< 0.05
Tennis Ball Throw (m)	8	9.85±1.31	9.45±1.02	9.50%	3.94%	2.921	< 0.05
	9	11.07±1.45	10.12±1.41	11.05%	3.36%	3.346	< 0.05
30s Wall Toss & Catch (reps)	8	22.88±3.97	19.66±2.84	18.02%	5.56%	4.246	< 0.05
	9	24.44±2.84	21.69±3.30	17.37%	5.78%	6.021	< 0.05

Both the 8-year-old and 9-year-old female cohorts in the EG demonstrated uniform improvements across all targeted skill domains (ranging from 4.39% to 18.02%), significantly outperforming the CG, which followed conventional instruction (1.46% to 5.78%). Notably, the typical performance anxiety observed in primary school girls regarding object control tasks (throwing and catching) was mitigated. This was evidenced by marked increases in the Tennis Ball Throw (W% > 9.5%) and the Wall Toss & Catch test (W% > 17%). Inferential statistical testing confirmed that the EG post-test values significantly exceeded those of the CG ($p<0.05$).

5. DISCUSSION

The experimental results demonstrate that the integrated execution of the nine pedagogical interventions generated a robust, synergistic effect on the motor capacities of children aged 8–9. While natural biological growth coupled with the conventional PE curriculum (CG) yielded modest performance gains (ranging from 1.5% to 5.7%), this improvement remained relatively slow and structurally uneven. Conversely, the experimental group achieved extensive, statistically significant development (ranging from 4.3% to over 18%) across the entire spectrum of fundamental motor skill components.

Mechanistic Effects of Restructured Active Learning Time (ALT): A long-standing limitation in school-based physical education is high procedural "waiting time," during which students stand in lines waiting for individual technical trials. The implementation of station-based learning and smaller group configurations successfully addressed this spatial-temporal barrier. This restructuring maximized the Active Learning Time during which students engaged directly in task execution. This adjustment aligns with established motor learning principles (Schmidt & Lee, 2011), which identify high-volume, deliberate repetitions as a primary driver for central nervous system adaptations and the consolidation of automated motor programs. Neuromuscular pathways linking cortical commands to peripheral effectors are optimized through repeated execution within continuous station transitions.

Impact of Gamification and the Constraints-Led Approach: A notable finding of this research was the accelerated improvement observed in hand-eye coordination and postural equilibrium tests. This confirms the efficacy of Strategies 2, 5, and 6, which focused on structured team competitions and gamified movement tasks. Children aged 8–9 (grades 3–4) show high engagement with gamified challenges and peer interactions, but can disengage during rigid, highly technical instructional drills. By integrating fundamental motor skills into dynamic obstacle courses or cooperative relay tasks, instructors established an optimized environment that activated students' intrinsic motivation. When engaging in a playful context without the stress of immediate technical assessment, children explored and self-organized their movement strategies to maintain balance and manipulate objects with greater precision. This outcome aligns with international literature (Thuc, 2021, 2024), which identifies purposeful movement games as an effective method for enhancing vestibular stability and motor control in primary school populations.

Individualization and Differentiated Pedagogical Stratification: The application of Strategy 3 (dynamic skill-based stratification) effectively addressed the challenge of high intra-class variance in physical capacity. Highly skilled students were presented with progressive motor challenges, while students with lower baseline skills received targeted instruction, minimizing performance anxiety and avoidance behaviors. This approach aligns with the competency-based curriculum mandates established in the 2018 General Education Reforms in Vietnam.

Study Limitations: The identified pedagogical benefits were measured within a short-term longitudinal horizon (one academic semester) within a single urban primary school characterized by specific spatial restrictions. To track the long-term stabilization of these fundamental motor skills and their subsequent transition into specialized sports capabilities, broader multi-center studies extending over several academic years are warranted.

6. CONCLUSION

Objective assessments using eight standardized field tests confirmed that the baseline fundamental motor skill proficiency of students aged 8–9 at Dang Tran Con Primary School, Ho Chi Minh City, presented substantial room for development. Following the implementation of the specialized pedagogical framework, the system of nine interventions—encompassing organizational adjustments, extensive gamification, differentiated task constraints, and progressive spatial-temporal optimization—yielded significant improvements. The experimental group demonstrated superior, comprehensive development in postural stability, explosive power, linear speed, agility, and object manipulation compared to students tracking the standard curriculum ($p<0.05$). These empirical findings suggest that urban primary institutions can benefit from adopting individual task constraints and optimized instructional designs to systematically enhance pediatric physical literacy and motor competence.

REFERENCES

1. Bien, L. Q., & Diu, H. M. (2023). Building competency-based assessment standards for primary school physical education in the 2018 general education curriculum. *Vietnam Journal of Educational Sciences*, 19(03), 97-103.
2. Ministry of Education and Training. (2018). *Circular 32/2018/TT-BGDĐT promulgating the general education curriculum*. Hanoi.
3. Ministry of Education and Training. (2020). *Circular 48/2020/TT-BGDĐT regulating sports activities in schools*. Hanoi.
4. Government of Vietnam. (2015). *Decree 11/2015/NĐ-CP regulating physical education and sports activities in schools*. Hanoi.
5. Dung, L. T., That, L. P., & Thach, T. H. N. (2025). Research on establishing criteria for motor skill assessment of 4th-grade students at Vietnam American Primary School, District 11, Ho Chi Minh City. *Journal of School Physical Education and Sports Science*, 2, 73-79.
6. Goodway, J. D., Ozmun, J. C., & Gallahue, D. L. (2019). *Understanding motor development: Infants, children, adolescents, adults* (8th ed.). Jones & Bartlett Learning.
7. Hang, P. T. L., Bich, B. N., & Tuan, L. H. T. M. (2023). *Physical education 4 - Creative horizons*. Vietnam Education Publishing House.
8. Ho, L. V., & Lang, L. N. (2001). *Developmental and pedagogical psychology*. Vietnam National University Hanoi Press.

9. Ly, T. D., & Thang, P. V. (1996). *100 movement games for primary school students*. Education Publishing House.

10. Magill, R. A., & Anderson, D. I. (2017). *Motor learning and control: Concepts and applications* (11th ed.). McGraw-Hill Education.

11. McLennan, N., & Thompson, J. (2015). *Quality physical education (QPE): Guidelines for policy makers*. UNESCO Publishing.

12. Schmidt, R. A., & Lee, T. D. (2011). *Motor control and learning: A behavioral emphasis* (5th ed.). Human Kinetics.

13. Son, M. T., & Xuan, N. Q. (2017). Current status of physical education work in primary schools in Binh Tan District, Ho Chi Minh City. *Dong Thap University Journal of Science*, 24, 29-34.

14. Thanh, L. Q. (2011). *Sports measurement*. Hanoi Sports Publishing House.

15. Thuc, D. C. (2021). Using movement games in physical education class to improve physical fitness and stabilize vestibule for children aged 6-7 years. *International Journal of Human Movement and Sports Sciences*, 9(6), 1396-1402. https://doi.org/10.13189/saj.2021.090635

16. Thuc, D. C., & Phong, D. T. (2024). Movement games as a means of enhancing physical fitness and vestibular stability in 8-9-year-old pupils in the Mekong Delta, Vietnam: A case study. *International Journal of Human Movement and Sports Sciences*, 12(4), 738-746. https://doi.org/10.13189/saj.2024.120420

17. Tu, T. T. (2019). Selection and application of movement games in extracurricular activities for second-grade primary school students in Thai Nguyen Province. *TNU Journal of Science and Technology*, 201(08), 205-209.

18. Uan, N. Q. (2010). *Textbook of general psychology*. Hanoi National University of Education Publishing House.

19. Uyen, P. T. L., & Hiep, L. Q. (2017). *Sports physiology: Textbook for sports universities and colleges*. Hanoi Sports Publishing House.

20. World Health Organization (WHO). (2020). *WHO guidelines on physical activity and sedentary behaviour*. World Health Organization. https://www.who.int/publications/i/item/9789240015128

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