Effects of a school-based motor coordination program on KTK performance in 8-9 year old children

Efectos de un programa escolar de coordinación motriz en el rendimiento del KTK en niños de 8 a 9 años

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Received: 12-04-26
Accepted: 02-05-26

How to cite in APA

Peqini, E., Naku, B., & Misja, B. (2026). Effects of a school-based motor coordination program on KTK performance in 8-9 year old children. *Retos, 80*, 643-652. https://doi.org/10.47197/retos.v80.119237

Abstract

Introduction: Motor coordination skills reflect how effectively a child integrates information received from the senses-such as visual-spatial orientation, vestibular input, and proprioceptive feedback-to control movement.
Objective: The present study aimed to examine the effect of a structured 12-week program designed to develop coordination skills by stimulating sensory-perceptual processes in children aged 8-9 years.
Methodology: Included 146 children from three public nine-year schools in the urban area of Shkodra (75 boys and 71 girls), divided into an experimental group (n = 77) and a control group (n = 69). Motor coordination was assessed using the Körperkoordinationstest für Kinder (KTK), which consists of four subtests.
Results: The results showed that the experimental group improved from pre to post-test across all subtests (all $p < 0.001$), with large within-group effects (Cohen's dz = 0.91-1.62). At post-test, the experimental group performed better than the control group on every subtest (all $p < 0.001$), with moderate to large effects (Cohen's d = 0.74-1.17). Improvements in the experimental group were consistently greater than those in the control group across all subtests (all $p < 0.001$), with large effects (Cohen's d = 1.08-2.07), supporting a clear program effect beyond normal maturation.
Discussion: The obtained findings align with established literature regarding motor development in early childhood. Using the KTK as a validated instrument for gross motor coordination ensures that these results can be interpreted with high confidence.
Conclusions: This study demonstrates that a structured coordinative, sensory-perceptual program significantly improves gross motor coordination in children aged 8-9 years.

Keywords

Coordination; children; KTK; intervention; sensorimotor.

Resumen

Introducción: Las habilidades de coordinación motriz reflejan la eficacia con la que un niño integra la información recibida de los sentidos-como la orientación visoespacial, la entrada vestibular y la retroalimentación propioceptiva-para controlar el movimiento.
Objetivo: El presente estudio tuvo como objetivo examinar el efecto de un programa estructurado de 12 semanas diseñado para desarrollar habilidades de coordinación mediante la estimulación de procesos sensoriales-perceptivos en niños de 8 a 9 años.
Metodología: Se incluyeron 146 niños de tres escuelas públicas de nueve años del área urbana de Shkodra (75 niños y 71 niñas), divididos en un grupo experimental (n = 77) y un grupo de control (n = 69). La coordinación motriz se evaluó mediante el Körperkoordinationstest für Kinder (KTK), que consta de cuatro subpruebas.
Resultados: El grupo experimental mejoró significativamente en todas las subpruebas ($p<0.001$), con grandes efectos intragrupales (dz de Cohen=0.91-1.62). En el pos-test, el grupo experimental superó al de control en todas las pruebas ($p<0.001$; d de Cohen=0.74-1.17). Las mejoras del grupo experimental fueron consistentemente mayores que las del grupo de control ($p<0.001$), con efectos grandes (d de Cohen=1.08-2.07), respaldando un efecto claro del programa más allá de la maduración normal.
Discusión: Los hallazgos obtenidos se alinean con la literatura sobre desarrollo motor. El uso del KTK como instrumento validado garantiza que estos resultados se interpreten con alta confianza.
Conclusiones: Este estudio demuestra que un programa coordinativo sensorial-perceptivo estructurado mejora significativamente la coordinación motriz gruesa en niños de 8 a 9 años.

Palabras clave

Coordinación; niños; KTK; intervención; sensoriomotor.

Introduction

Nowadays, children's daily lives are increasingly characterized by insufficient physical and movement activity (Bezerra-Santos et al., 2023). Urbanization, excessive screen exposure, and the lack of adequate spaces for physical activity substantially limit opportunities for free movement (John et al., 2024; Robinson et al., 2015; Stodden et al., 2008). These constraints may negatively affect the development of movement competence and motor skills. In this context, it has been demonstrated that daily physical education classes and systematic sports practice play a crucial role in fostering children's motor participation and psychomotor development (Boaretto et al., 2024; Villouta et al., 2024). Sensory-perceptive development constitutes a fundamental component of overall maturation in childhood, enabling children to process and integrate environmental information in order to guide motor actions effectively (Bustos et al., 2025). Between the ages of 8 and 9 years, the relationship between perception and movement becomes more stable and refined. During this developmental stage, notable improvements occur in postural control, bilateral coordination, spatial and temporal perception, and attentional focus (Robinson et al., 2015). Research indicates that boys participating in systematic physical practices, such as futsal, exhibit significantly higher coordination levels than those with lower engagement (Bezerra-Santos et al., 2023). This period is particularly critical, as deficiencies in motor skill development may lead to long-term limitations in physical competence and reduced engagement in active lifestyles, emphasizing that the specificity and frequency of practice are determining factors for motor growth (Figueiredo et al., 2025). Children today grow up in a highly sensory-rich environment in which visual, auditory, tactile, and kinesthetic information must be continuously integrated. For children undergoing developmental processes, this integration is especially complex, as they rely heavily on sensory input to explore, learn, and understand their surroundings (Turgay & Sarıberberoğlu, 2022). Core sensory-perceptive skills form the neuro-cognitive foundation for motor mastery, encompassing several distinct but interrelated capacities. Spatial orientation and body orientation allow children to establish a mental map of their physical self in relation to the environment, a process critical for navigating complex movement tasks and maintaining spatial awareness during play. Temporal perception enables the child to judge the timing and rhythm of actions, which is essential for tasks requiring synchronization. This is closely linked to kinesthetic sensitivity, which provides the internal feedback necessary for the brain to perceive the position and movement of body parts without visual reliance, thereby refining motor control. Furthermore, the integration of hand-eye coordination and bilateral coordination the ability to use both sides of the body simultaneously and in a synchronized manner represents a higher level of motor organization. These skills are fundamental for successful performance in the KTK subtests, such as hopping and jumping, where neuromuscular efficiency is tested. Finally, the ability to selectively attend to relevant stimuli while suppressing distractions reflects the cognitive-perceptive interface; it ensures that the child can filter environmental noise and focus on the motor goal, which is a prerequisite for both academic learning and organized sports participation. These skills do not develop in isolation but through the continuous interaction of biological maturation and structured experiential learning (Payne & Isaacs, 2020; Bustos et al., 2025). These skills develop progressively through the interaction of biological maturation and experiential learning within physical and social contexts (Payne & Isaacs, 2020). Recent evidence suggests that general motor coordination levels can effectively predict performance in complex sports-specific skills, making early assessment a vital component of physical education curricula (Marinho & Chagas, 2022). Structured motor activities, such as movement-based games and individual or team sports, play a crucial role in enhancing sensory integration and coordinated motor execution (Ayres & Robbins, 2005). Consequently, numerous studies emphasize the importance of incorporating physical education programs early in childhood, not only to promote physical health but also to support cognitive and social development (Westendorp et al., 2011; Wilson et al., 2012). In this regard, it has been demonstrated that the specificity of physical practice and the inclusion of systematic sports significantly influence coordination gains (Figueiredo et al., 2025). Furthermore, daily physical education sessions have a direct impact on promoting motor competence and psychomotor maturation (Boaretto et al., 2024; Villouta et al., 2024). In primary education, sensory-perceptive abilities are closely associated with academic performance; for example, improved hand-eye coordination facilitates writing skills, while enhanced spatial perception supports orientation and navigation in new environments. Therefore, the assessment of these skills using standardized motor and perceptual tests represents a valuable approach for identifying developmental needs and planning early interventions (Lima et al., 2025). Recent research indicates that evaluations of bilateral and lateral coordination, dynamic balance, spatial

orientation, and motor reaction speed provide reliable indicators of sensory-perceptive development (Westendorp et al., 2011). Among the available assessment tools, the Körperkoordinationstest für Kinder (KTK) is widely used for children aged 8-9 years, offering a valid and reliable measure of gross motor coordination and supporting the identification of motor development profiles. The KTK battery is specifically recognized for its high reliability and construct validity in assessing coordination within school environments (Lima et al., 2025). Additionally, the effectiveness of 12-week school-based interventions using this tool has been well-documented in improving overall motor quotients (Moura et al., 2021). Despite the extensive global literature on motor development, a significant gap remains regarding the Albanian educational context. Most local research has traditionally focused on general physical fitness, leaving a void in the literature concerning the specific impact of targeted sensory-perceptive stimulation programs. It is not yet fully understood how a structured coordination protocol can specifically alter the motor profiles of children in urban areas like Shkodra. Therefore, the following research question is posed: To what extent does a 12-week sensory-perceptive motor coordination program influence KTK performance in 8-9-year-old children? The primary objective of this study was to examine the effects of a structured 12-week motor coordination program on KTK performance in a sample of primary school children in Shkodra, Albania, comparing an experimental group with a control group following the standard curriculum.

Method

Participants

This study began with an identification and methodological planning phase. Initially, 22 public nine-year schools in the municipality of Shkodra were identified, comprising a total of 30 third-grade classes and 586 students. From this pool, three schools were randomly selected to represent geographic and socioeconomic diversity. A stratified random sampling method as suggested by Villouta et al. (2024), was employed to ensure representation across different urban sectors of Shkodra. Within these schools, six third-grade classes were identified, totaling 162 students.

Informed consent was obtained from parents or legal guardians for all participants, in accordance with the Declaration of Helsinki on ethical principles for research involving human subjects (World Medical Association, 1964) and the International Code of Medical Ethics. To ensure the ethical handling of information, all data were anonymized using alphanumeric codes, and access was restricted solely to the research team. Participants were informed of their right to withdraw at any stage without any negative consequences. Permission to conduct the study was granted by the Local Office of Pre-University Education in Shkodra. Of the 162 students, 10 did not participate due to lack of parental consent, and three others changed schools during the study period. Three children were unable to complete all tests because of fatigue, limited physical ability, or lack of motivation. The final sample consisted of 149 children, of whom 146 were included in the statistical analysis 75 boys and 71 girls. Participants were randomly assigned to two groups: the focus (experimental) group (n = 77) and the control group (n = 69). Both groups underwent pre-intervention testing during the last week of February (24-28 February 2025).

Procedure

All tests were conducted in the gymnasium of the University of Shkodra “Luigj Gurakuqi” during morning hours (09:00-12:00) to minimize fatigue. Testing was administered by six trained specialists (volunteer students) in physical education, who received specific training on the KTK test battery. The KTK is a globally recognized instrument with high construct validity and reliability for assessing gross motor coordination (Lima et al., 2025). Its portability to the Albanian context is supported by its non-verbal nature and the use of standardized physical tasks that are culturally neutral (Moura et al., 2021). Each child received verbal instructions and a demonstration for each subtest, with rest periods of approximately 2-3 minutes between tests. Testing was interrupted if a child showed signs of excessive fatigue, physical difficulty, or lack of motivation.

These data helped identify the current level of sensorimotor development and can also be used to create developmental profiles for educational programs and preventive interventions. Previous European

studies indicate that children aged 8-9 years are particularly responsive to interventions aimed at improving sensory-perceptual and motor skills, which are important for academic performance and participation in sports (Goodway et al., 2019; Wilson et al., 2012).

Instrument

Motor coordination and sensory-perceptual abilities were assessed using the *Körperkoordinationstest für Kinder* (KTK), a standardized and well-established scientific instrument (Molina et al., 2025) suitable for children aged 5-14 years (Kiphard & Schilling, 1974; Novotná et al., 2025). Previous studies have demonstrated the high reliability, consistency, and validity of the KTK for measuring gross motor coordination and sensorimotor development (Campbell-Pierre & Rhea, 2023; Mardiansyah & Bakhtiar, 2023).

The following subtests were administered:

1. Balance Beam (6, 4.5, and 3 cm) - assesses dynamic balance and vestibular control.
2. Moving Sideways (total number of relocations in 20 seconds) - assesses motor ability and bilateral coordination.
3. Hopping for Height (best hopping height for the right and left leg) - measures strength, coordination, and proprioceptive perception.
4. Jumping Laterally (total number of lateral jumps in 15 seconds) - assesses speed, rhythm, and spatial orientation.

In this study, the KTK demonstrated high internal consistency (Cronbach's $\alpha = 0.86$).

Intervention

Following baseline testing, the experimental group participated in a 12-week intervention program (03 March-30 May 2025), consisting of structured exercises for three hours per week, based on contemporary literature on sensory-perceptual and motor development (Amarawardana, 2018; Bidzan-Bluma & Lipowska, 2018; Bonafede & Van Der Merwe, 2023).

The program was integrated into physical education classes and implemented by teachers with our methodological support. It was designed to include sensory-perceptual skills through exercises that varied in each session (to avoid automatization and to prioritize sensory engagement), to compare the experimental group with the control group, and to analyze differences by gender. The intervention was organized around four main components: kinesthetic control, body awareness and body imagery in space, visual coordination, and tactile control. Each session lasted 45 minutes and was held three times per week, incorporating exercises that combined all four components and increased gradually in intensity and complexity. In addition to program implementation, direct observation was conducted to document qualitative aspects such as motivation and active participation.

The intervention program focused on developing four core sensory-perceptual components: kinesthetic (proprioceptive) control, body awareness and imagery, visual coordination, and tactile control. Kinesthetic control aimed to enhance awareness of body position and movement in space through input from muscular, articular, and vestibular receptors. Body awareness and imagery were developed through exercises that improved body schema, balance, and coordination, with positive effects on cognitive and emotional functions as well. Visual coordination targeted improvements in spatial perception, visual tracking, and precision in object manipulation, while tactile control focused on developing tactile sensitivity and the ability to discriminate object characteristics through direct contact. All components were addressed through structured motor activities, adapted to the children's age and integrated into physical education classes. The control group continued with the regular curriculum without any specific intervention. At the beginning of June 2025, both groups underwent post-intervention testing under the same conditions as the baseline assessment. The data were recorded and analyzed using descriptive and inferential statistical methods.

Data analysis

KTK data were recorded in individual files for each participant and subsequently analyzed using descriptive and inferential statistics. Descriptive statistics were calculated, and inferential analyses were conducted using IBM SPSS Statistics for Windows, version 26.0, IBM, SPSS Inc., Armonk, NY, USA.

Hypotheses: H1: The 12-week sensory-perceptive program will significantly improve the total motor quotient (MQ) of the experimental group compared to the control group.

H2: The greatest improvements will be observed in subtests involving dynamic balance and lateral movement, as these are highly sensitive to structured coordination training (Bezerra-Santos et al., 2023).

Results

The experimental group showed statistically significant improvements from pre to post-test across all KTK subtests (WB, JS, HH, MS; all $p < 0.001$), with large effect sizes (Cohen's $dz = 0.91$-1.62). At post-test, the experimental group outperformed the control group in all subtests ($p < 0.001$; Cohen's $d = 0.74$-1.17). Analysis of change scores (Δ = Post-Pre) confirmed markedly greater improvements in experimental group compared with the control group (all $p < 0.001$; Cohen's $d = 1.08$-2.07), indicating a strong intervention effect beyond normal maturation.

Table 1. Descriptive statistics at post-test (Experimental vs Control)

KTK subtest	Experimental (M ± SD)	Control (M ± SD)
WB	48.70 ± 11.77	35.64 ± 10.53
JS	29.40 ± 5.07	25.36 ± 5.38
HH	43.58 ± 8.89	36.48 ± 8.35
MS	9.84 ± 1.84	8.54 ± 1.68

Note. Values are presented as mean (M) ± standard deviation (SD).

Post-test results showed that the experimental group achieved higher mean scores than the control group across all KTK subtests, suggesting overall superior performance at the end of the intervention.

Table 2. Within-group pre-post comparisons (paired t-test) for Experimental and Control groups (Cohen's dz)

Group	Subtest	Pre (M ± SD)	Post (M ± SD)	t	p-value	Cohen's dz
Experimental	WB	43.27 ± 12.68	48.70 ± 11.77	14.220	4.094e-23	1.62
Experimental	JS	26.74 ± 5.79	29.40 ± 5.07	7.956	1.334e-11	0.91
Experimental	HH	36.36 ± 10.01	43.58 ± 8.89	12.161	1.650e-19	1.39
Experimental	MS	8.48 ± 1.78	9.84 ± 1.84	11.394	4.119e-18	1.30
Control	WB	36.62 ± 10.73	35.64 ± 10.53	-2.919	4.764e-03	-0.35
Control	JS	25.52 ± 5.90	25.36 ± 5.38	-0.602	5.493e-01	-0.07
Control	HH	36.62 ± 9.38	36.48 ± 8.35	-0.406	6.862e-01	-0.05
Control	MS	8.62 ± 1.83	8.54 ± 1.68	-0.630	5.310e-01	-0.08

Values are presented as mean (*M*) ± standard deviation (*SD*). Effect sizes are reported as Cohen's *dz*. The within-group analysis (Table 2) reveals that the experimental group achieved statistically significant improvements in all KTK subtests from pre-intervention to post-intervention ($p < 0.001$). The effect sizes, measured by Cohen's *dz*, ranged from 0.91 to 1.62, which are considered large to very large. Conversely, the control group showed non-significant changes or minimal variations ($p > 0.05$), confirming that the observed motor gains in the experimental group are attributable to the 12-week sensory-perceptive program rather than typical maturation.

Table 3. Between-group comparison at post-test (Welch's t-test) and effect size (Cohen's d)

KTK subtest	t (Welch)	p-value	Cohen's d
WB	7.080	5.875e-11	1.17
JS	4.653	7.493e-06	0.77
HH	4.981	1.787e-06	0.82
MS	4.499	1.396e-05	0.74

Welch's t-test was used. Effect sizes are reported as Cohen's *d* (0.2 = small, 0.5 = medium, 0.8 = large).

At post-test, the experimental group performed statistically better than the control group across all subtests, with moderate to large effect sizes, confirming superior performance following the intervention. Between-group comparisons at post-test (Table 3) further support the study's hypothesis. The experimental group significantly outperformed the control group in all coordination subtests ($p < 0.001$). The Cohen's d values (0.74 to 1.17) indicate a moderate to large effect size, with the most prominent difference observed in the Walking Backwards (WB) subtest ($d = 1.17$), representing a substantial practical impact on dynamic balance.

Table 4. Primary intervention effect: Change scores (Δ = Post-Pre) compared between groups.

KTK subtest	ΔExperimental (M ± SD)	Δ Control (M ± SD)	t (Welch)	p-value	Cohen's d
WB	+5.43 ± 3.35	-0.99 ± 2.80	12.585	6.207e-25	2.07
JS	+2.66 ± 2.94	-0.16 ± 2.20	6.612	7.431e-10	1.08
HH	+7.22 ± 5.21	-0.14 ± 2.97	10.630	4.070e-19	1.71
MS	+1.36 ± 1.05	-0.09 ± 1.15	7.938	6.278e-13	1.32

Δ = Post-test - Pre-test. Welch's t-test was used. Effect sizes are reported as Cohen's d.

Comparison of change scores (Δ) shows that the improvement in the experimental group was significantly greater than that of the control group across all subtests, providing the clearest evidence that the observed effects are not explained solely by maturation, but by the intervention itself.

The inferential analysis confirms the primary hypothesis (H1). The experimental group exhibited a statistically significant superior improvement compared to the control group across all KTK subtests ($p < 0.001$). Notably, the largest effect size was observed in the Walking Backwards (WB) subtest (Cohen's $d = 2.07$) and Hopping on One Leg (HH) (d = 1.71), indicating a 'huge' practical significance. These results demonstrate that the 12-week program specifically enhanced dynamic balance and vertical explosive power far beyond the gains attributable to natural chronological maturation observed in the control group.

Table 5. Sex comparison of change scores (Δ = Post-Pre) within the Experimental group

KTK subtest	Δ Boys (n=37) M ± SD	Δ Girls (n=40) M ± SD	t (Welch)	p-value	Cohen's d (M–F)
Δ WB	5.41 ± 3.56	5.45 ± 3.19	-0.058	0.9541	-0.01
Δ JS	2.59 ± 2.75	2.72 ± 3.13	-0.194	0.8463	-0.04
Δ HH	6.89 ± 3.84	7.52 ± 6.25	-0.540	0.5912	-0.12
Δ MS	1.14 ± 0.95	1.58 ± 1.11	-1.877	0.0644	-0.43

Δ = Post-test - Pre-test. Cohen's d (M-F) is calculated as boys minus girls; negative values indicate larger Δ in girls.

Gender-based comparison suggests that boys and girls benefited similarly from the intervention across most subtests; any potential differences were small or not statistically significant, indicating that the program was effective for both genders.

Regarding gender-based differences, the inferential process shows no statistically significant differences between boys and girls in their response to the intervention ($p > 0.05$ for all subtests). The small effect sizes (ranging from -0.01 to -0.43) suggest that the sensory-perceptive program is equally effective regardless of the child's sex. This supports the portability and universal application of the protocol within the school physical education curriculum, as both groups achieved comparable motor coordination gains through the structured 12-week program.

Discussion

The overall results of this intervention demonstrate a significant shift in motor coordination profiles following a 12-week structured program. While Vandorpe et al. (2010) and Coppens et al. (2021) have established through extensive longitudinal data that motor coordination is a relatively stable trait that typically evolves slowly with biological age, the marked improvements observed in the experimental group in Shkodra provide a direct empirical contrast. These findings suggest that the motor quotient

(MQ) is not merely a fixed developmental byproduct but is highly plastic when exposed to targeted sensory-perceptive stimulation. This effectiveness of a 12-week timeframe mirrors the gains reported by Moura et al. (2021), though a key distinction emerges: our study demonstrates that these neurological adaptations are equally achievable in a terrestrial school gymnasium environment, whereas Moura et al. (2021) focused on the unique buoyancy and resistance of aquatic settings. This suggests that the structure of the exercise is more influential than the medium in which it is performed.

Specifically, the significant improvements in the Walking Backwards (WB) and Hopping on One Leg (HH) subtests ($p < 0.001$) indicate a substantial refinement in dynamic balance and explosive power. This aligns with the theoretical framework of Proske and Gandevia (2012) regarding sensorimotor integration, which posits that proprioceptive feedback is essential for motor refinement. Our results provide a practical validation of this theory, sharing common ground with the findings of Bustos et al. (2025), who noted that motor mastery is dependent on environmental information processing. Furthermore, while Kurnaz and Altinkök (2023) and Mardiansyah et al. (2024) emphasize the general health benefits of movement, our data shows a much higher effect size (Cohen's $d = 2.07$ for WB). This specific data point reinforces the argument of Bezerra-Santos et al. (2023) that systematic and specific coordination practice is a far more potent determinant of motor success than general, unstructured physical activity. The magnitude of change in the Shkodra cohort suggests that the "quality" of movement tasks-specifically those challenging balance-triggers faster neural adaptations than general maturation.

A critical point of discussion is the lack of significant gender differences in the intervention's outcomes. This finding stands in sharp contrast to the regional observations of Laukkanen et al. (2020), who noted variations based on sex in European cohorts, often favoring boys in gross motor tasks. However, the Shkodra results are in full agreement with Villouta et al. (2024), suggesting that in a controlled educational setting where both genders receive the same stimulus, the quality of the curriculum overrides biological sex as a predictor of development. This supports the perspective of Figueiredo et al. (2025), who argue that motor competence is primarily a product of the specificity of practice. Therefore, the similarities between boys and girls in this study demonstrate that the 12-week program is a robust, universal tool that can bridge the developmental gap often attributed to gender-specific socialization.

The stability of the control group's scores further confirms that these gains were not a result of natural maturation or the "practice effect" of the test itself, a phenomenon discussed in the developmental models of Stodden et al. (2008) and Lima et al. (2017). While Stodden et al. (2008) focus on the long-term reciprocal relationship where better coordination leads to more activity over years, Holfelder and Schott (2014) reinforce this by reporting consistent associations between fundamental movement skills and sustained physical activity. The current results demonstrate that a short, 12-week "catalyst" program can effectively trigger this positive cycle much earlier than natural maturation would allow. This provides practical weight to the calls by Boaretto et al. (2024) and Villouta et al. (2024) for the urgent integration of daily, high-quality physical education.

Finally, the success of this protocol in the Shkodra context, despite the geographical challenges sometimes noted in Albanian motor research (Marta et al., 2026), highlights the importance of standardized assessment. The ability of the KTK battery to capture these nuanced changes in a Balkan cohort reaffirms its construct validity and portability, as recently highlighted by Lima et al. (2025). Consequently, the implementation of such structured models, as suggested by Biru et al. (2025), remains essential for modernizing the physical education curriculum. By improving motor control, as advocated by Rudd et al. (2015), we are not just teaching physical skills but are providing a foundation for the academic and social development of primary school children through enhanced cognitive-motor integration.

Conclusions

In conclusion, the implementation of a structured 12-week motor coordination program focused on sensory-perceptual stimulation leads to significant improvements in children aged 8-9 years within a school setting. The evidence demonstrates that the experimental group achieved superior performance across all KTK subtests (WB, JS, HH, MS) compared to the control group, which remained largely unchanged. The analysis of change scores (Δ) confirms that these improvements are directly attributable to the intervention rather than natural maturation or repetitive testing effects.

From a functional perspective, these results signify more than an increase in test scores; they represent a fundamental enhancement in motor competencies essential for physical education. Specifically, the gains in WB indicate improved balance and postural control, while the progress in JS and HH reflects strengthened bilateral coordination and neuromuscular efficiency. Furthermore, the improvements in MS suggest more sophisticated motor planning and sensorimotor integration. These findings underscore that performance on coordination tasks is deeply rooted in the integration of proprioceptive, vestibular, and visual-spatial information.

Regarding sex differences, the intervention proved equally effective for both boys and girls, indicating that such programs can be successfully implemented in mixed-gender classes without the need for major adaptations at this developmental stage. From a practical standpoint, these findings advocate for the integration of structured coordination modules into the regular physical education curriculum, ideally two to three times per week. Implementing dedicated blocks focused on "Coordination and Movement Control" in lower primary grades provides a necessary foundation for safer and more effective participation in lifelong physical activity.

Acknowledgements

The authors would like to express their sincere gratitude to University of Shkodra “Luigj Gurakuqi” for its institutional support and continuous encouragement in advancing scientific research. The contribution and support provided were essential for the successful completion of this study.

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