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Comparing the Acquisition of Fundamental Movement Skills in Half-Day Schooling and Extended School Program

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ABSTRACT

The purpose of this study was to compare the acquisition of fundamental movement skills (FMS) in children attending half-day schooling (HDS) and extended school programs (ESP). The sample comprised 73 children, of whom 34 were enrolled in HDS (14 boys, 20 girls) and 39 in ESP (22 boys, 17 girls). Motor performance was assessed across four FMS domains: space covering, surmounting obstacles, resistance overcoming, and object control. Independent samples t-tests were conducted separately for boys and girls. Boys in HDS outperformed their ESP counterparts in object control, resistance overcoming, surmounting obstacles, and space covering (all $p < .05$, with object control reaching $p < .001$). Girls in HDS similarly outperformed ESP peers in object control ($p < .001$ and $p < .05$). No significant advantages were observed for children in ESP across any domain. Overall, children attending HDS demonstrated more developed FMS profiles than their peers in ESP. These findings suggest that school day structure, particularly the availability of free time for unstructured physical activity, may be an important contextual factor in motor development during middle childhood.

1. Introduction

The development of fundamental movement skills (FMS) during early childhood is crucial for lifelong engagement in physical activity, athletic success, and the maintenance of physical and mental health [1,2]. FMS represent basic, universal patterns of movement that serve as a foundation for motor learning and the successful performance of more complex motor tasks in the contexts of sport, recreation, and daily functioning. These skills are typically categorized into three domains: locomotor skills (e.g., running, jumping, hopping), object control or manipulative skills (e.g., throwing, catching, striking), and static and dynamic balance skills (e.g., standing on one leg, walking on a balance beam), all of which are essential for achieving motor literacy and confidence in movement [3]. Insufficient mastery of FMS in early childhood has been associated with reduced levels of physical activity, weaker perceptions of physical competence, and an increased risk of sedentary behaviour, obesity, and diminished functional fitness in later stages of life [4,5]. These adverse developmental outcomes often stem from a lack of exposure to appropriate motor stimuli during sensitive periods of growth and development. Previous research indicates that around the age of eight, children enter a critical developmental window during which motor patterns become consolidated and begin to transition into more complex skill combinations [6,7].

A range of interconnected biological, psychosocial, and environmental factors influences the acquisition of FMS. Genetic predispositions, gender characteristics, and socioeconomic status affect baseline motor potential and access to developmental opportunities, while the quantity and quality of physical activity particularly through active play and structured sports serve as

critical determinants of actual motor development [8,9]. Movement programs that promote varied movement experiences do not only facilitate the learning of skills; they also support the generalization and automation of movements.

Organizational structure of the school day is one important contextual variable for FMS development. Children attending half-day school program have increased time remaining during non-school hours for unstructured play and random physical activity outside of the classroom. But the level of involvement is very sensitive for their habit of engaging in extracurricular motor activities, which may be related to personal interests, family support, and family resources [10]. In contrast, extended school programs (ESP), although offering pedagogical and organizational advantages such as safety, supervision, and access to materials, often involve prolonged periods indoors and less spontaneous physical activity particularly if activities are not explicitly aimed at enhancing motor skills [11]. Some research suggests that such programs may have mixed effects: On one hand, they provide structure, routine and educational resources; on the other, they may limit opportunities for free play, which is crucial for developing motor creativity, sensory integration and movement diversity [12,13]. Although full day school programs have been associated with improved cognitive outcomes [14], the relationship between school day structure and the development of fundamental movement skills remains insufficiently explored. Since extended programs may reduce the amount of time available for spontaneous physical activity, this study hypothesizes that children enrolled in half-day school programs will demonstrate higher levels of fundamental movement skill proficiency compared to their peers in extended school programs.

Accordingly, the aim of this study is to compare the level of fundamental movement skill acquisition among children attending half-day and extended school programs, taking into account specific components of motor performance and analyzing the results separately for boys and girls.

2. Materials And Methods

This cross-sectional, quasi-experimental study compared pupils from two state primary schools in Split, Croatia, chosen because they operate distinctly different daily schedules. The first school follows a conventional half-day schedule (HDS) in which children attend only the morning academic curriculum and depart immediately thereafter. The second employs an extended school-day programme (ESP) that retains chlidren after core instruction for supervised homework, structured leisure activities, and organised physical exercise under qualified staff [15]. School-day format (HDS vs ESP) was treated as the independent variable, whereas scores on the fundamental movement-skill tests served as the dependent outcomes. All assessments were administered within the same two-week period mid-semester to minimise potential seasonal or curricular confounding.

2.1. Participants

A total of 73 primary school children (mean age: 8 ± 0.44 years) participated in this study. The participants were divided into two groups based on their school program structure: HDS (n = 34; 14 boys and 20 girls) and ESP (n = 39; 22 boys and 17 girls). All participants attended regular classes in primary schools located in the city of Split, Republic of Croatia.

Table 1. Distribution of participants according to type of extracurricular physical activity

Activity Type	Description	N (%)
Object manipulation	Sports involving object control (e.g., soccer)	14 (19%)
Spatial movement	Activities focused on body control in space (e.g., dance, gymnastics, swimming, ballet)	35 (48%)
Resistance-based (combat sports)	Activities involving resistance (e.g., karate, taekwondo, judo)	13 (18%)
No organized physical activity	No participation in structured activities	11 (15%)

Inclusion criteria were the age of 8 years, regular school attendance, and absence of diagnosed motor, cognitive, or developmental disorders. The sample was formed using a convenience sampling method in collaboration with schools that agreed to participate in the study.

Table 1 presents the proportion of children participating in various types of organized physical activities, categorized by the dominant motor demands of each activity. The table also includes a group of children who did not participate in any form of organized physical activity. This

classification provides a more detailed insight into the patterns of children's engagement in structured physical activities outside the regular school curriculum.

Before participation, parents or legal guardians of all participants were informed about the purpose and procedures of the study and provided written informed consent for their child's participation. The study was conducted in 2009 in accordance with the Ethical Code for Research with Children (Council for Children of the Republic of Croatia, 2003), respecting the fundamental ethical principles of beneficence, autonomy, privacy, and justice. All procedures were also aligned with the applicable national and institutional guidelines in force at the time for research involving minor participants.

2.2. Procedures

A battery of 21 standardized tests was employed to evaluate FMS proficiency across four domains: space covering, surmounting obstacles, resistance overcoming, and object control. This test battery was adopted from the validation study of Žuvela, Božanić, and Miletić [16], which reported excellent reliability for obstacle-navigation tasks (ICC = 0.92–0.97), resistance-overcoming tasks (ICC = 0.83–0.94), and spatial-movement tasks (ICC = 0.89–0.95).

All fundamental movement skill (FMS) tasks used in this study were assessed using time-based performance, with shorter execution times indicating higher proficiency. Each task required participants to complete a movement pattern or motor challenge as quickly and efficiently as possible. The tasks were grouped into four domains based on their dominant motor demands.

Space-Covering Domain. This domain comprised six timed locomotor tasks: back crawling (BC) and chest crawling (CC), where the time required to cover a distance of 3.3 meters is measured; straight running (SR), which records the time needed to cover a distance of 20 meters; rolling sideways (LS), where the time required to roll over a distance of 2.3 meters is measured; and changing course running (CCR), which involves covering a 12-meter distance with two changes of direction, with the total execution time recorded.

Additionally, beam walking (BW) was assessed by measuring the time required to walk to the end of a 4-meter-long beam and return, with a repeated attempt if a fall occurred. Surmounting-Obstacles Domain. This domain comprised five timed tasks that required children to negotiate various barriers: running across obstacles (ROBS), which measures the time required to cover a 15-meter distance while overcoming three obstacles; skipping across obstacles (SAO), involving a 20-meter distance with four obstacles; crawling through obstacles (RTO), where the time needed to traverse a 12-meter course is measured; single-leg hops (SLH), assessing the time required to cover a 10-meter distance using one leg only; and jumping through obstacles (JTO), which measures the time necessary to complete a sequence of three hurdle jumps and three crawl-throughs.

Resistance-Overcoming Domain. Five tasks assessed the ability to move or carry external loads: rolling a tube backwards (RTB), which measures the time required to push an object backwards over a distance of 6 meters; carrying the medicine ball (AMB), where the participant holds a 3 kg medicine ball over a distance of 3 meters in two attempts, with time recorded; carrying a Pilates ball around cones (CBAC), which involves carrying a ball over a 7.5-meter course with time measurement; rolling a ball around cones (RBAC), where time is recorded for manoeuvring a ball over a 6-meter distance; and pulling the bag (PB), which measures the time required to pull a 5 kg bag across a 6-meter distance.

Object-Control Domain. Five tasks evaluated precision and coordination with handheld implements: rolling a ball by hand to a wall (RBHW), where the time required to complete six consecutive attempts is measured; dribbling a football around cones (DBAC), which involves controlling the ball over a 6-meter distance with time recording; rolling a handball around cones (RHAC), measuring the time to navigate a 6-meter course; tossing and catching a volleyball against a wall (TCVW), where the time is recorded for performing six consecutive tossings and catches; and tossing and catching a tennis ball against a wall (TCTW), which measures the time required to complete five successive tossing and catches using a tennis ball.

Testing was conducted within the school facilities (gymnasium and outdoor areas) in coordination with teachers to minimize disruptions to classes and daily student routines. All motor skill assessments were administered by trained experts in the field of kinesiology, following standardized testing protocols to ensure the reliability and consistency of the collected data.

2.3. Statistical analysis

The distribution of data was assessed for normality using the Shapiro–Wilk test. As the assumption of normality was met, results were expressed as means and standard deviations (SD).

To compare differences between HDS and ESP groups, an independent samples t-test was used for each FMS task. To quantify the magnitude of differences, Cohen's d was calculated for each comparison. Effect sizes were interpreted according to conventional benchmarks: approximately 0.20 for a small effect, 0.50 for a medium effect, and 0.80 or above for a large effect [17]. The level of statistical significance was set at $p < 0.05$. Statistical analyses were performed using SPSS 28.0 statistical software (SPSS, Chicago, IL, USA)

3. Results

The results of the t-test for anthropometric measurements indicated no statistically significant differences between children attending half-day and full-day school programs in terms of body height and body mass. Among boys, no significant differences were found in body height ($t = -0.06$; $p = 0.95$) or body mass ($t = -0.06$; $p = 0.95$). Similarly, in girls, the differences in body height ($t = 0.02$; $p = 0.98$) and body mass ($t = 1.89$; $p = 0.08$) were not statistically significant, although the difference in body mass approached the threshold of significance.

Table 2 shows that several statistically significant differences in fundamental movement skills were observed between the ESP and HDS groups of boys. The HDS group performed significantly better in object control skills such as RBHW ($p < .001$, large effect), DBAC ($p < .01$, medium effect), and RHAC ($p < .05$), medium-to-large effect). Additional significant differences were found in TCVW ($p < .05$, large effect), also reflecting superior object manipulation. Within the domain of resistance overcoming skills, a significant advantage was observed for the HDS group in CBAC ($p < .05$, medium-to-large effect). Regarding surmounting obstacles, HDS participants outperformed in SLH ($p < .05$, large effect), while in the category of space covering skills, significant differences were found in RS ($p < .05$, medium-to-large effect) and CCR ($p < .05$, large effect). These findings indicate that the HDS group outperformed the ESP group in a range of object-control, resistance, coordination, and locomotor tasks, with effect sizes ranging from medium to large, underscoring both statistical and practical relevance.

Table 2. Differences in FMS proficiency tasks between the ESP and HDS groups of boys

Variable		ESP (n = 22)		HDS (n = 14)		t	ES
		M	SD	M	SD		
Object Control	RBHW	5.41	±0.97	4.35	±0.97	**3.19*** **	1.09
	DBAC	4.33	±0.77	3.78	±1.05	1.81	0.62
	RHAC	4.14	±0.76	3.62	±0.60	**2.19***	0.74
	TCTW	3.76	±1.02	3.45	±1.17	0.85	0.29
	TCVW	6.45	±1.88	5.08	±1.29	**2.39***	0.82
Resistance Overcoming	RTB	6.04	±1.63	5.10	±1.26	1.83	0.62
	AMB	4.53	±0.80	4.31	±0.78	0.81	0.29
	CBAC	5.36	±0.73	4.86	±0.50	**2.27***	0.78
	RBAC	7.62	±1.02	7.62	±1.01	-0.00	0.00
	PB	5.24	±0.85	4.97	±0.75	0.98	0.34
Surmounting Obstacles	ROBS	6.13	±1.09	5.54	±0.86	1.73	0.60
	SAO	6.49	±1.12	5.51	±0.68	**2.94***	1.00
	RTO	5.04	±0.68	4.67	±0.52	1.74	0.58
	SLH	4.74	±0.53	4.34	±0.41	**2.43***	0.81
	JTO	7.08	±1.04	6.52	±1.06	1.55	0.51
	CC	5.48	±0.94	5.03	±0.79	1.47	0.51
Space Overing	BC	6.51	±1.21	6.12	±1.29	0.93	0.31
	SR	4.08	±1.21	3.69	±1.51	0.87	0.29
	RS	4.56	±0.37	4.31	±0.24	**2.28***	0.72
	CCR	3.31	±0.79	2.72	±0.37	**2.57***	0.89
	BW	6.04	±1.49	5.90	±1.10	0.30	0.10

Legend: RBHW – Rolling a ball with the hand against a wall; DBAC – Dribbling the football ball around cones; RHAC – Rolling the handball around cones; TCTW– Tossing and catching the tennis ball against a wall; TCVW – Tossing and catching a volleyball against the wall; RTB – Rolling a tube backwards; AMB – Arrying the medicine balls ; CBAC – carrying the Pilates ball around cones; RBAC – Rolling the ball around cones PB – Pulling the bag; ROBS – Running over obstacles; SAO – Skipping across obstacles; RTO - Rawling through obstacles; SLH – Single-leg hops; JTO – Jumping and through obstacles; CC – Chest crawling; BC – Back crawling; SR – Straight running; RS – Rolling sideways; CCR– Changing course running; BW – beam walking ; *p < 0.05, **p < 0.01, ***p < 0.001

Table 3 shows that several statistically significant differences in fundamental movement skills were observed between the ESP and HDS groups of girls. Within the domain of object control skills, the HDS group performed significantly better in RBHW ($p < .05$, large effect), DBAC ($p < 0.001$, large effect), and RHAC ($p < .05$, medium-to-large effect), indicating better ball-handling performance. Although not statistically significant, moderate effect sizes were also found for RTO (medium effect), suggesting a potentially meaningful difference in surmounting obstacles. Similarly, small-to-moderate effects were observed for AMB and RBAC (resistance overcoming skills), and JTO (surmounting obstacles), which may reflect favorable trends for the HDS group. In the space covering domain, SR and CCR showed small effects in favor of HDS, but these differences were negligible or not practically relevant.

Table 3. Differences in FMS proficiency tasks between the ESP and HDS groups of girls

Variable		ESP (n = 17)		HDS (n=20)		t	ES
		M	SD	M	SD		
Object Control	RBHW	5.25	±0.57	4.70	±0.72	**2.56***	0.84
	DBAC	6.06	±1.45	4.81	±0.93	**3.16*****	1.05
	RHAC	4.67	±0.65	4.28	±0.35	**2.29***	0.77
	TCTW	4.28	±1.13	4.50	±1.48	-0.51	0.17
	TCVW	5.50	±0.75	5.30	±0.98	0.70	0.23
Resistance Overcoming	RTB	5.72	±1.17	5.64	±1.13	0.21	0.07
	AMB	4.78	±0.81	5.09	±0.77	-1.19	0.39
	CBAC	5.46	±0.59	5.43	±0.49	0.16	0.06
	RBAC	7.73	±0.98	8.07	±0.73	-1.20	0.41
	PB	5.41	±1.00	5.45	±0.50	-0.17	0.05
Surmounting Obstacles	ROBS	6.48	±0.80	6.39	±0.82	0.36	0.11
	SAO	6.09	±0.71	5.85	±0.89	0.91	0.29
	RTO	5.20	±0.83	4.84	±0.40	1.70	0.57
	SLH	4.99	±0.65	4.81	±0.46	0.99	0.31
	JTO	7.83	±1.03	7.20	±0.91	1.97	0.67
	CC	5.55	±0.83	5.37	±0.60	0.77	0.26
Space Covering	BC	6.63	±0.94	6.21	±0.72	1.55	0.49
	SR	4.51	±1.60	4.87	±1.55	-0.70	–0.23
	RS	4.65	±0.30	4.60	±0.29	0.44	0.17
	CCR	3.48	±0.65	3.63	±0.76	-0.64	–0.21
	BW	6.40	±1.34	6.39	±1.39	0.02	0.01

Legend: RBHW – Rolling a ball with the hand against a wall; DBAC – Dribbling the football ball around cones; RHAC – Rolling the handball around cones; TCTW – Tossing and catching the tennis ball against a wall; TCVW – Tossing and catching a volleyball against the wall; RTB – Rolling a tube backwards; AMB – Arrying the medicine balls ; CBAC – carrying the Pilates ball around cones; RBAC – Rolling the ball around cones ; PB – pulling the bag; ROBS – Running over obstacles; SAO – Skipping across obstacles; RTO – rawling through obstacles; SLH– Single-leg hops; JTO – Jumping and through obstacles; CC– Chest crawling; BC–Back crawling; SR– Straight running; RS - Rolling sideways; CCR – Changing course running; BW – beam walking; $p < 0.05$, $^{**}p < 0.01$, $^{***}p < 0.001$

4. Discussion

This study aimed to compare fundamental movement skill (FMS) proficiency between children enrolled in a half-day school program (HDS) and those participating in an extended school program (ESP), with separate analyses conducted for boys and girls. The results of this study reveal statistically significant differences in fundamental movement skills between children enrolled in a half-day school program and those participating in extended daycare, favouring the half-day program group. Children in the half-day program, particularly boys, achieved better outcomes on most tasks, including object control, obstacle navigation, and spatial movement skills, indicating more efficient and faster execution of motor tasks. Similarly, among girls, students in the half-day program demonstrated notable advantages in task object control. The results of this study indicate that increased free time and greater opportunities for spontaneous physical activity, as provided by the half-day school model, may have a more favourable impact on the development of fundamental movement skills compared to structured extended-day programs.

One of the key reasons for these differences may lie in activities within extended daycare

programs, which often involve sedentary behaviour, homework-related tasks, and organized activities that are not primarily focused on developing a broad spectrum of motor abilities [11]. In comparison, children attending half-day school programs have greater flexibility in how they use their free time, which may include spontaneous play, sports activities, and more varied movement factors that are essential for the development of fundamental movement skills [10,12]. These results are also reinforced by research, which highlights the significance of leisure time and its quality use in the general child's development. In particular, unstructured free time that is appropriately organized or that promotes unstructured physical exercise serves as a protective and developmental factor within the child's microsystem [18].

In this context, the study by Žuvela, Matijašević, and Penjak [19] is particularly relevant, as it demonstrates that there is no statistically significant correlation between the amount of time spent in organized physical activities and the level of fundamental movement skills among eight-year-old children. The authors emphasize that it is the quality and content of physical activities rather than their frequency or duration, that play a crucial role in the development of motor competence. These findings further underscore the importance of ensuring spontaneous, diverse, and developmentally appropriate movement in children's daily routines, which is most often facilitated by more flexible school models such as half-day programs [20].

Children who have more opportunities for spontaneous and self-directed physical activity, which are more commonly found among students in half-day programs, are more likely to develop motor creativity, functional fitness, and a positive perception of their abilities. It is also important to consider that, in addition to environmental influences and school programs, morphological and functional factors significantly affect performance in fundamental motor skill tasks. The study by Žuvela, Kezić, and Krstulović [21] confirms that explosive strength, endurance, and specific physical characteristics are statistically significant predictors of success in tasks measuring functional coordination and motor integration. These findings further support the importance of diverse and purposefully structured physical engagement for the development of fundamental motor skills in younger school-aged children.

In the context of child development, the role of free time and its organization represents a highly important factor that should not be overlooked. Blažević and Matijašević [22] warn that organizational patterns which fully structure children's free time without incorporating developmentally meaningful content may have limited or even adverse effects on children's psychophysical development. These findings underscore the importance of a thoughtful design of school programs, especially in optional subjects, in order to warrant the promotion of not only the cognitive but also the motor development of children. Although full-day schooling has been shown to significantly support the development of cognitive skills [14], it raises the question of to what extent such educational models also promote the development of fundamental movement skills, which are essential for a child's overall functioning. In this regard, Schröder et al. [13] highlight that the effectiveness of full-day school programs in fostering physical activity largely depends on the quality, diversity, and developmental relevance of the movement, play, and sport opportunities integrated into the structure of the school day. The further development and refinement of physically active components within full-day school programs require a holistic and collaborative approach to educational governance [23].

5. Conclusion

The present findings suggest that children from half-day school programmes are more proficient in fundamental movement skills than their counterparts in extended school programmes. The results indicate that increased freedom of use of free time and scope for spontaneous movement may have an important beneficial effect on children's motor development. At the same time, methodological limitations have been emphasized, which is why further studies are needed to take the school environment, the organization of leisure time into account in a more comprehensible manner of influence on the development of motor abilities of the younger school age.

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Conflict of Interest

No conflict of interest is declared by teheauthors. In addition, no financial support wasreceived.

Ethics Committee

The study was conducted in 2009 in accordance with the Ethical Code for Research with Children (Council for Children of the Republic of Croatia, 2003), respecting the fundamental ethical principles of beneficence, autonomy, privacy, and justice.

Author Contributions

Study Design, FŽ, BM; Data Collection, FŽ, BM; Statistical Analysis, FŽ, PM; Data Interpretation, PM, BM; Manuscript Preparation, FŽ, PM, BM; Literature Search, FŽ, PM, BM. All authors have read and agreed to the published version of the manuscript.

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