



Relationship Between Physical Literacy And Fundamental Locomotor Movement Skills Among Elementary Students By Gender

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ABSTRACT

Physical literacy (PL) is important for developing children's physical competence, confidence, motivation, and engagement in physical activity, while locomotor fundamental movement skills (FMS) provide a foundation for participation in more complex activities. However, evidence on whether the association between PL and locomotor FMS differs across public and private schools and gender groups remains limited in Indonesia. This study examined the association between PL and locomotor FMS among 81 fourth-grade students in Parongpong, Indonesia, comprising 33 public-school boys, 29 public-school girls, 11 private-school boys, and 8 private-school girls. Using the PL-C Quest and TGMD-2, significant positive associations were found among public-school boys ($r = 0.500$, $p = 0.003$), public-school girls ($r = 0.490$, $p = 0.007$), and private-school boys ($r = 0.612$, $p = 0.045$). A positive but non-significant association was found among private-school girls ($r = 0.525$, $p = 0.182$). Overall, higher PL was associated with better locomotor FMS proficiency. Physical education can integrate PL through activities that simultaneously develop movement competence, confidence, motivation, and knowledge.

Keywords: *Physical literacy, Fundamental Movement Skills, Locomotor, Elementary School, Gender.*



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INTRODUCTION

Physical education is central to children's holistic development because it provides opportunities to build movement competence, confidence, and habits that support lifelong participation in physical activity. Internationally, this broader purpose is captured by physical literacy (PL), a multidimensional capacity involving motivation, confidence, physical competence, knowledge, and understanding to value and engage in physical activity across the life course (Bailey et al., 2023; Barnett et al., 2023).

For elementary-school physical education, PL therefore offers a framework that connects what children can do with how willing and prepared they are to remain active. Evidence from school-age populations indicates that PL is relevant to both participation and competence. Reviews of PL assessment research emphasize the need to assess its physical, affective, and cognitive domains together rather than reducing PL to physical performance alone (Shearer et al., 2021; Barnett et al., 2023). Empirical and review evidence further links higher PL with motor competence and physical-activity engagement, supporting the examination of its relationship with fundamental movement skills (FMS) in children (Carl et al., 2022; Liu et al., 2024).

FMS are the observable movement patterns that support participation in more complex physical activities. They are commonly grouped into locomotor, object-control, and stability skills; this study focuses on locomotor skills, such as running, jumping, hopping, galloping, skipping, and sliding, because these skills directly express the child's ability to move through space (Piotrowski et al., 2025). Locomotor proficiency is consequently an important, measurable dimension of physical competence within PL, while the present correlational design does not assume a causal direction between PL and FMS.

Global evidence shows that FMS proficiency is not uniformly achieved during childhood. A recent systematic review found that active-play interventions can improve children's FMS, while also underscoring the need to identify movement proficiency early enough to guide physical-education planning (Zhang et al., 2025). Fourth grade, typically corresponding to approximately 9–10 years of age, is a particularly informative developmental window: it is often described as a “golden age” or mature stage for consolidating basic movement patterns, while children remain within the school-age ranges examined in PL and FMS research (Shearer et al., 2021; Warner et al., 2021). Assessing locomotor skills at this stage can therefore help determine whether children's broader PL is reflected in measurable competence before movement learning becomes more sport-specific.

The relationship is conceptually plausible but should be tested empirically: children's physical competence may support confidence and participation, while regular participation may provide opportunities to practise movement. Existing

evidence therefore supports testing an association between PL and locomotor FMS, but it does not justify treating one construct as the cause of the other (Barnett et al., 2023; Edwards et al., 2018).

The Indonesian school context makes school type analytically important rather than merely descriptive. Public and private schools may provide different opportunities for physical activity through their facilities, staffing, extracurricular provision, and daily support for active behavior; recent Indonesian evidence has also compared activity levels across public and private elementary schools (Rahmadona et al., 2024), while broader evidence links the school environment to students' activity levels (Rao, 2024). At the outset of this study, however, no formal preliminary observation established that students at either target school were less active or that private schools had better facilities; these assumptions therefore could not be treated as facts at the research site. The comparison is consequently empirical: it can test whether the PL–FMS association is consistent across the actual opportunity structures of the selected schools and identify context-specific priorities for physical-education provision.

Gender is equally important because differences in children's motor proficiency are not necessarily uniform across skill domains. A systematic review and meta-analysis reported gender-related variation in fundamental motor skills, indicating that an overall estimate can conceal subgroup-specific patterns (Zheng et al., 2022). Gender-stratified analysis is therefore necessary to determine whether the relationship between PL and locomotor FMS is similar for boys and girls and whether school-type differences persist within each group, rather than attributing any observed pattern to gender alone.

In the present framework, PL is treated as a multidimensional construct and locomotor FMS as an indicator of its physical-competence dimension. This framing explains why the two constructs should be examined together while maintaining an appropriately non-causal interpretation for the cross-sectional data (Bailey et al., 2023).

Although Indonesian reviews and school-based studies have advanced discussion of PL and FMS, evidence remains insufficient on whether their association is stable across public and private elementary schools and across gender

groups (Harliawan et al., 2024; Ridha et al., 2025). This comparison is needed because school type represents differences in learning opportunities, whereas gender stratification tests whether a pooled relationship masks different movement experiences or levels of physical competence. Addressing both factors in one analysis provides a more useful basis for interpreting local findings and designing equitable physical-education support.

Accordingly, this study aimed to examine the association between PL and locomotor FMS among fourth-grade students in public and private elementary schools in Parongpong, Indonesia, and to determine whether the association differs by school type and gender. We hypothesized that (H1) PL would be positively associated with locomotor FMS, and that (H2) the strength of this association would vary across the four groups defined by school type and gender. Because the study is cross-sectional, these hypotheses concern association rather than causation. The findings are intended to clarify local patterns and inform more equitable physical-education planning for Indonesian elementary schools.

RESEARCH METHODOLOGY

This quantitative cross-sectional correlational study examined the association between physical literacy and locomotor Fundamental Movement Skills (FMS) without intervention or treatment. The design was selected to estimate the direction and strength of the association overall and within school-type and gender strata (Creswell, 2014). Ethical approval details were not documented in the available study records; consequently, the ethics committee, approval number, written parental or guardian informed-consent procedure, and student-assent procedure cannot be reported for the present study. This reporting limitation must be resolved before submission, and no claim of formal ethical approval is made here.

The study was conducted in the northern part of Parongpong Subdistrict, West Bandung Regency, involving nine schools consisting of seven Public Elementary Schools (SDN) and two Private Elementary Schools (SDS). The selection of the location was based on the characteristics of the schools, which represent both public and private schools within the same region; thus, it is expected to provide a more representative picture of students' physical literacy and locomotor FMS abilities.

The population for this study consisted of all fourth-grade students at the nine schools, totaling 415 students. Fourth-grade students were selected because they fall within the 9–10-year-old age range, a critical developmental phase during which basic motor skills have matured sufficiently to be accurately assessed using standardized instruments (Willie, 2022)

The sample size for this study was determined based on the total population using the Slovin formula with a margin of error of 10% (Sukmawati, 2022). The sample size was calculated using the Slovin formula with a margin of error of 10%.

Figure 1. Slovin Formula

$$n = \frac{N}{1 + Ne^2}$$

Keterangan:

n = ukuran sampel
 N = ukuran populasi
 e = *margin of error* (tingkat kesalahan yang ditoleransi)

With a population of 415 students and a margin of error of 10%, the following calculation was obtained:

Figure 2. Sample Size Calculation

$$\begin{aligned} n &= \frac{415}{1 + 415(0,10)^2} \\ n &= \frac{415}{1 + 415(0,01)} \\ n &= \frac{415}{1 + 4,15} \\ n &= \frac{415}{5,15} \\ n &= 80,58 \end{aligned}$$

Based on these calculations, the minimum required sample size is 81 students (rounded up from 80.58).

The 81 students were selected using proportionate stratified random sampling, with allocation proportional to the population of each participating school. This procedure ensured representation of the public and private schools while giving eligible students within each stratum an equal opportunity for selection. The sampled students were then classified as boys or girls for the prespecified subgroup analyses.

Physical literacy was assessed using the Physical Literacy in Children Questionnaire (PL-C Quest), designed for children aged 4–12 years and covering the physical, affective, cognitive, and behavioral dimensions of physical literacy. The instrument was selected because prior psychometric work in Indonesian elementary-school students reported adequate validity and reliability (Lubay et al., 2025), while broader reviews support multidomain physical-literacy assessment in school-age children (Barnett et al., 2023). No new construct-validity or internal-consistency analysis was performed for the present sample; therefore, sample-specific validity and reliability coefficients cannot be reported, and the results rely on previously established instrument evidence.

Locomotor FMS were assessed with the Test of Gross Motor Development–Second Edition (TGMD-2), using the running, galloping, hopping, leaping, standing long jump, and sliding tasks. Each child performed two trials for each skill, and each performance criterion was scored 1 when correctly performed and 0 otherwise; criterion scores were summed to obtain the locomotor score (Eddy et al., 2020). PL-C Quest administration took place in the classroom, whereas TGMD-2 testing was conducted on an open outdoor field during scheduled school activities.

Data analysis began with descriptive statistics, including the mean, standard deviation, minimum, and maximum values for each variable. Next, a normality test was conducted using the Shapiro–Wilk test. The relationship between physical literacy and fundamental locomotor movement skills was analyzed using Pearson’s product-moment correlation if the data were normally distributed. If the data did not meet the assumption of normality, the analysis was performed using Spearman’s rank correlation. The analysis was conducted on the entire sample and separately by gender. The significance level used in this study was $p < 0.05$ (Field, 2009).

RESULTS AND DISCUSSION

RESULTS

The sample comprised 81 fourth-grade students: public-school boys ($n = 33$), public-school girls ($n = 29$), private-school boys ($n = 11$), and private-school girls ($n = 8$). Descriptive statistics for Physical Literacy and Locomotor FMS are presented in Table 1.

Table 1. Descriptive Statistics for Physical Literacy and Fundamental Locomotor Movement Skills

No	Group	n	Mean PL	Mean Fms
1	Boys, Public School	33	101.73	35.33
2	Girls, Public School	29	94.38	33.07
3	Boys, Private School	11	96.91	33.73
4	Girls, Private School	8	83.88	32.00

Based on Table 1, male students in public schools had the highest average Physical Literacy (101.73) and Fundamental Movement Skills: Locomotor (35.33) scores compared to the other groups. Conversely, the lowest average Physical Literacy score was found among female students in private schools (83.88), while the lowest average Fundamental Movement Skills: Locomotor score was found in the group of female students in private schools (32.00). Shapiro–Wilk normality results for the prespecified subgroups are presented in Table 2.

Table 2. Results of the Shapiro-Wilk Normality Test

No	Group	Variable	Sig	Description
1	Boys, Public School	Physical Literacy	0,025	Non Normal
		Fundamental Movement Skills	0,561	Normal
2	Girls, Public School	Physical Literacy	0,236	Normal
		Fundamental Movement Skills	0,260	Normal
3	Boys, Private School	Physical Literacy	0,366	Normal
		Fundamental Movement Skills	0,481	Normal
4	Girls, Private School	Physical Literacy	0,931	Normal
		Fundamental Movement Skills	0,775	Normal

The Shapiro–Wilk results showed that Physical Literacy was non-normal only among public-school boys ($p = 0.025$), whereas their Locomotor FMS scores were normal ($p = 0.561$). Both outcomes met the normality criterion among public-school girls ($p = 0.236$ and 0.260), private-school boys ($p = 0.366$ and 0.481), and private-school girls ($p = 0.931$ and 0.775).

The public school girls, private school boys, and private school girls subgroups met the normality criterion for both variables. Pearson's product-

moment correlation was therefore used for these three subgroups, whereas Spearman's rank correlation was used for public-school boys.

The prespecified school type by gender correlation results are presented in Table 3. The full-sample Pearson estimate is reported separately as a supplementary association because normality was not assessed separately for the entire sample.

Table 3. Correlation Test Results

No	Group	Method	r	p	Interpretation
1	Boys, Public School	Spearman	0,500	0,003	Positive, Moderate, Significant
2	Girls, Public School	Pearson	0,490	0,007	Positive, Moderate, Significant
3	Boys, Private School	Pearson	0,612	0,045	Positive, Strong, Significant
4	Girls, Private School	Pearson	0,525	0,182	Positive, Moderate, Not Significant

Overall, the results of the study indicate that the relationship between Physical Literacy and Fundamental Locomotor Movement Skills is positive across all respondent groups. This means that the higher a student's level of Physical Literacy, the better their Fundamental Locomotor Movement Skills.

At subgroup level, public-school boys showed a moderate positive Spearman correlation ($r = 0.500$, $p = 0.003$); public-school girls showed a moderate positive Pearson correlation ($r = 0.490$, $p = 0.007$); and private-school boys showed a positive Pearson correlation ($r = 0.612$, $p = 0.045$). Private-school girls showed a moderate positive Pearson correlation ($r = 0.525$, $p = 0.182$). The subgroup results indicate positive associations of varying precision, and no causal inference is warranted.

DISCUSSION

Based on the findings of this study, there was a significant positive relationship between physical literacy and locomotor Fundamental Movement Skills (FMS) among boys attending both public and private elementary schools. In both school types, boys with higher levels of physical literacy, reflected in motivation, confidence, knowledge, and understanding of physical activity, tended to demonstrate better locomotor movement skills (Warner et al., 2021). Although the strength of the relationship varied from moderate to strong, with boys in private

schools showing the strongest association, the overall findings indicate that improvements in physical literacy are associated with enhanced fundamental locomotor competence among boys (Harliawan et al., 2024). These findings suggest that higher mean scores within a particular group do not necessarily correspond to a stronger relationship between variables. This pattern may be related to differences in school environments and opportunities for physical activity that influence the development of physical literacy and children's movement competence. The availability of sports facilities and infrastructure in private schools may also represent an important contextual factor (Rao, 2024). Boys generally tend to have greater opportunities to engage in active outdoor play and structured sports activities, providing them with more movement experiences than girls ((Zheng et al., 2022), which may contribute to higher levels of fundamental motor skill proficiency (Bakhtiar, 2014). Furthermore, boys generally demonstrate higher physical competence, although motivational and self-regulatory aspects can also be improved through appropriate learning interventions (Wilhite et al., 2025).

The findings also showed that the strength of the relationship between physical literacy and Fundamental Movement Skills varied across groups. Among girls in both public and private elementary schools, a positive relationship was found between physical literacy and locomotor FMS. Among girls attending public schools, this relationship was statistically significant and moderate in strength. Meanwhile, among girls attending private schools, a positive relationship of moderate strength was observed, although it was not statistically significant.

Differences in movement competence based on gender are generally influenced by a combination of biological factors, physical development, and movement experiences acquired during childhood (Bolger et al., 2018). In addition, physical literacy profiles across genders are influenced not only by physical competence but also by daily physical activity behaviors (Moncanis et al., 2025). Overall, the positive relationships identified across all participant groups support the concept of physical literacy as an important foundation for lifelong engagement in physical activity, with Fundamental Movement Skills representing a key component of physical competence (Khudolii et al., 2025). Children with higher physical literacy tend to demonstrate greater motivation, confidence, knowledge,

and understanding to participate in various physical activities, thereby providing more opportunities to practice and develop fundamental movement skills continuously (Shearer et al., 2021). Physical activity levels are associated with individual characteristics and gender (Rahmadona et al., 2024), while physical, affective, and cognitive dimensions interact to support the acquisition of movement skills (Bailey et al., 2023). The development of FMS through diverse movement experiences may, in turn, contribute to improvements in physical literacy (Gnophanxay et al., 2026).

The success of this developmental process is also supported by teachers' competence and confidence in implementing the curriculum (Firdaus et al., 2023). Teachers who understand the concept of physical literacy are better positioned to integrate fundamental movement skill development into structured and meaningful learning activities (Butler et al., 2020). These findings have practical implications for physical education teachers, highlighting the need to move toward learning approaches that integrate physical, affective, and cognitive dimensions (Suherman et al., 2021). Developing physical literacy is an important step toward fostering sustainable active lifestyles (Anggia, 2024), by emphasizing motivation, competence, and confidence as essential learning outcomes (Usher et al., 2016).

This study has several limitations. The cross-sectional design means that the data only describe relationships between variables at a single point in time and cannot explain longitudinal changes (Setia, 2016). Therefore, the findings cannot be used to establish a causal relationship between physical literacy and Fundamental Movement Skills but only demonstrate an association between the two variables (Wang & Cheng, 2020). In addition, the non-significant relationship found among girls attending private schools should be interpreted cautiously. Nevertheless, these findings may serve as a scientific reference for supporting the development of physical education curricula in Indonesia that integrate the concept of physical literacy (Ridha et al., 2025). Future research should involve larger samples, investigate additional factors such as the use of technology-based learning through fitness applications (Rusmitaningsih et al., 2026), and explore the support provided by family, school, and community environments in developing physical literacy comprehensively to promote lifelong active lifestyles (Durdan-Myers, 2024).

CONCLUSION

This study demonstrates an association between physical literacy and locomotor Fundamental Movement Skills (FMS) among elementary school students, with the strength of the association varying according to school type and gender. The findings indicate a positive association among male and female students in public schools, as well as among male and female students in private schools.

The main contribution of this study lies in identifying patterns of association between physical literacy and locomotor FMS by simultaneously considering school type and gender. The strongest association was found among male students in private schools, indicating that the relationship between the two variables was not uniform across all student groups. This finding provides a more specific perspective on physical literacy and FMS among elementary school students in Indonesia by highlighting the relevance of school context and gender when examining the association between these two variables.

Practically, the findings support the integration of physical literacy components into physical education learning, particularly through learning experiences that develop movement competence alongside motivation, self-confidence, knowledge, and understanding of physical activity. Such learning experiences can be adapted to the characteristics and needs of students across different school and gender groups.

As this study employed a cross-sectional design, the findings indicate an association and cannot be used to establish a causal relationship. Future research is recommended to involve larger samples and employ longitudinal or intervention-based designs to examine the development and potential causal relationships between physical literacy and locomotor FMS over time.

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