

Performance-based assessment for elementary school students' fundamental motor skills in balance, locomotor, and manipulative movements

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Received: 26/04/2025; Accepted: 30/10/2025; Published: 30/10/2025

How to cite: Wibowo, C., Putra, K. P., Nopiyanto, Y. E., Dese, D. C., & Pradibya, A. V. (2025). Performance-based assessment for elementary school students' fundamental motor skills in balance, locomotor, and manipulative movements. *Bima Loka: Journal of Physical Education*, 5(2), 73–84. <https://doi.org/10.26740/bimaloka.v5i2.39985>

Abstrak

Penelitian ini menyoroti pentingnya keterampilan motorik fundamental yang mencakup kemampuan keseimbangan, lokomotor, dan manipulatif yang merupakan aspek krusial dalam perkembangan fisik anak-anak usia sekolah dasar. Penelitian ini bertujuan untuk mengidentifikasi dan memberikan pemahaman yang lebih komprehensif terhadap keterampilan motorik fundamental secara holistik, guna mendukung proses identifikasi anak-anak yang memerlukan intervensi berkelanjutan. Penelitian ini menggunakan pendekatan deskriptif kuantitatif dengan desain *cross-sectional*, melibatkan 310 responden siswa sekolah dasar berusia antara 7 hingga 9 tahun. Instrumen yang digunakan berupa rubrik penilaian kinerja yang mencakup observasi terhadap sebelas jenis keterampilan motorik fundamental. Data dianalisis menggunakan rumus rata-rata ideal dan simpangan baku ideal untuk mengevaluasi tingkat kemahiran dalam masing-masing kategori keterampilan motorik. Selain itu, uji *Independent Sample t-test* digunakan untuk mengidentifikasi perbedaan kemampuan motorik berdasarkan jenis kelamin. Hasil penelitian menunjukkan bahwa keterampilan motorik fundamental siswa sekolah dasar memiliki nilai rata-rata penilaian kinerja sebesar 32,14 (36,12%), dengan mayoritas siswa berada pada kategori “baik”. Rata-rata skor kinerja siswa laki-laki lebih tinggi dibandingkan siswa perempuan, dengan nilai rata-rata sebesar 30,32 dan simpangan baku 3,590, sedangkan siswa perempuan memiliki nilai rata-rata sebesar 28,48 dengan simpangan baku 3,208. Temuan ini mengindikasikan adanya variasi kemampuan motorik di antara siswa sekolah dasar usia 7 hingga 9 tahun. Sebagian besar siswa menunjukkan tingkat keterampilan yang baik, meskipun terdapat beberapa yang masih berada pada kategori kurang memadai. Secara keseluruhan, siswa laki-laki menunjukkan tingkat keterampilan motorik yang lebih tinggi dibandingkan siswa perempuan.

Kata-kata kunci: Penilaian kinerja; keterampilan motorik; keseimbangan; gerak lokomotor; gerak manipulatif

Abstract

Highlighting the importance of fundamental motor skills encompassing balance, locomotor, and manipulative abilities in the physical development of elementary school children. This study aims to ascertain and provide a better understanding of holistic fundamental motor skills, aiding in identifying children needing continuous intervention. This quantitative descriptive study employs a *cross-sectional* approach involving 310 respondents of elementary school students aged 7 to 9 years old. The research instrument comprises an assessment rubric with performance observations encompassing eleven types of fundamental motor skills. Ideal mean formula and ideal standard deviation are utilized to analyze data regarding the proficiency levels of each motor skill category. Additionally, an *Independent Sample t-test* is employed to ascertain the data differences among elementary school students based on gender. The research findings indicate that the elementary school students' fundamental motor skills have an average performance assessment mean of 32.14 (36.12%), with the majority falling into the "good"

category. The average performance score of male students is higher than that of female students, with a mean of 30.32 and a standard deviation of 3.590, while the average performance score of female students is 28.48, with a standard deviation of 3.208. They explain the variation in motor skills among elementary school students aged 7 to 9. Most students exhibit proficient skills, although some fall into the unsatisfactory motor skill category. On average, male students demonstrate higher motor skills compared to female students.

Keywords: Performance assessment; motor skills; balance; locomotor movement; manipulative movement

INTRODUCTION

Fundamental motor skills encompass not only locomotor and manipulative abilities but also balance, which is a crucial element in elementary school-aged children's physical and cognitive development (Rudd et al., 2015). Balance skills enable children to maintain their body posture while standing or walking (Sember et al., 2020). In contrast, locomotor skills allow elementary school students to move from one place to another (Korbecki et al., 2017), and manipulative skills enable them to control movements through object manipulation (Dewi & Verawati, 2022). This phenomenon underscores the importance of understanding how elementary school students develop and refine their basic motor skills. However, previous research has indicated that many elementary school children struggle to master these skills (Oktarifaldi et al., 2024; Zimmer et al., 2016).

The age range of 7 to 9 years was chosen because during this phase, children are in the active stage of basic motor development and are a crucial period for the formation of optimal movement patterns (Junior et al., 2020). Research results explain that children aged 7-9 years are at the peak stage of gross motor coordination development, where balance, locomotor, and manipulative skills develop intensively (Li et al., 2019; Reyes et al., 2019). Furthermore, this phase is crucial for the quality of children's motor development before entering the age of 10 years, when motor skills begin to lead to movement specialization (Li & Ma, 2020; Serrien & O'Regan, 2021). Therefore, focusing on the 7-9 age group provides an opportunity to identify motor skills earlier and more relevantly as a basis for planning physical education learning at the elementary school level.

Some common issues include elementary school students struggling to maintain balance during physical activities (Cosma et al., 2016), difficulty coordinating movements while running or jumping (Yasue et al., 2019), and challenges in controlling hand and foot movements during sports activities in physical education classes at school (Telford et al., 2021). This occurrence can be ascribed to diverse factors, including the dynamic phase of motor development among children of elementary school age, during which some may need additional time and practice to master fundamental motor skills effectively (Strooband et al., 2020). Additionally, environmental factors like limited opportunities for outdoor play or restricted access to sports facilities can also influence the development of children's basic motor skills (Escolano-Pérez et al., 2021).

While the importance of fundamental motor skills is widely recognized, more research should be conducted on the holistic assessment of these skills, particularly at the elementary school level. Existing studies focus on specific aspects of motor skills, such as balance or coordination, but rarely investigate the interrelation between various fundamental motor skills and how comprehensive assessment can aid in understanding overall child development. Moreover, based on observational findings, many physical education teachers need an

understanding of assessments that genuinely evaluate the performance of elementary school students, especially in fundamental motor skills. Physical education teachers often need to conduct continuous monitoring. The majority merely teach sports disciplines and conduct test-based assessments without considering students' characteristics and the essence of fundamental movement. Therefore, research on performance-based assessment for fundamental motor skills in elementary school students is crucial. This research is expected to provide a better understanding of holistic fundamental motor skills, aid in identifying children in need of continuous intervention, and develop more effective learning strategies to enhance fundamental motor skills in elementary school students aged 7-9 years old.

METHOD

Participants

The participants in this study were 310 elementary school students aged 7 to 9 years old. Participants came from several elementary schools in Salatiga City. The sampling technique used was purposive sampling, selecting schools and students who met the age criteria for active basic motor development (7–9 years old) and were willing to participate. Purposive sampling was chosen to ensure that the data collected were relevant to the research objectives and aligned with children's motor development characteristics in that age range.

The use of purposive sampling in this cross-sectional study was carefully considered to avoid selection bias and ensure that participants shared similar characteristics regarding educational context and physical activity within the school environment. Elementary schools were chosen as the research location because they are an appropriate environment for observing and measuring fundamental motor skills in school-aged children.

Table 1. Characteristics Of Elementary School Students

Gender	Age			Total
	7	8	9	
Male students	48	56	53	157
Female students	49	64	40	153

Ethics

The research ethics commission of the Faculty of Medicine and Health Sciences, Satya Wacana Christian University, has thoroughly reviewed the proposed research protocol scrutinized the research report submitted and declared it to be ethically appropriate in accordance with the Declaration of Helsinki.

Procedure

This quantitative descriptive research utilizes a cross-sectional approach among elementary school students. The instrument employed in this research uses a performance-based assessment rubric developed by a team in a previous study tailored to the characteristics of elementary school students aged 7 to 9 years (Wibowo et al., 2024). The assessment rubric comprises various types of movements, including assessments of balance, locomotor, and manipulative skills. The fundamental movements consist of 11 actions: sitting and standing up, rolling, standing on one leg, galloping, sliding, jumping, bouncing a ball, catching, throwing, kicking, and hitting. Through expert validation and field testing, the assessment instrument was deemed valid and reliable, with an item validity ratio of 1, criterion validity of $0.000 < 0.05$, and reliability based on Cronbach's alpha of 0.72.

Table 2. Fundamental motor movements

Basic types of movement	Movement skills
Balance	Sit and stand up Rolling Standing on one leg
Locomotor	Gallop Sliding Jump
Manipulative skills	Bouncing a ball Catching Throwing Kicking Hitting

The procedural steps in this study included explaining the research objectives and obtaining consent from students and parents regarding participation. Data collection was conducted using a performance assessment rubric through direct observation supported by video recordings and images of each movement to improve the accuracy and consistency of the assessment. The assessment team consisted of physical education teachers, trained research assistants, and physical education lecturers, who had previously received training in using the assessment rubric and understanding each movement indicator. Students' motor skills were documented, then analyzed using the rubric by the research team based on the results of observations from videos/photos. This strategy was implemented to minimize observation bias and increase data objectivity. After completing the assessment, the data were compiled and analyzed statistically.

Data analysis

To ascertain the outcomes of elementary school students' fundamental motor skills in balance, locomotor, and manipulative movements, the Research Team developed criteria using the ideal mean formula and standard deviation as depicted in Table 3. Meanwhile, to analyze the differences among elementary school students based on gender and the data discrepancies in types of motor movements, an Independent Sample t-test was utilized and analyzed with the assistance of SPSS 25 software.

Table 3. Classification of Categories

Interval	Frequency
$X > M + 1.5 Sd$	Very Good
$M + 0.5 Sd < X \leq M + 1.5 Sd$	Good
$M - 0.5 Sd < X \leq M + 0.5 Sd$	Sufficient
$M - 1.5 Sd < X \leq M - 0.5 Sd$	Insufficient
$X \leq M - 1.5 Sd$	Poor

RESULT

This section will outline the results of a quantitative descriptive study, which aims to provide a comprehensive overview of a phenomenon or observed variable through numerical data and descriptions.

Table 4. Balance Movement Skill Group Statistics

Interval	Category	Frequency	%	Mean
$X > 10$	Very Good	49	15.8	9.69
$8 < X \leq 10$	Good	118	38	
$7 < X \leq 8$	Sufficient	65	20.9	
$5 < X \leq 7$	Insufficient	77	24.8	
$X \leq 5$	Poor	1	0.32	

Based on table 4, The analysis presented is the result of a performance-based assessment of balance skills. The data indicate a frequency distribution within predefined categories based on value intervals. Findings reveal that 49 students (15.8%) achieved an excellent category with scores above 10. Additionally, 118 students (38%) attained a good category with scores ranging from 8 to 10. Furthermore, 65 students (20.9%) demonstrated sufficient skills with scores between 7 and less than 8. On the other hand, 77 students (24.8%) exhibited inadequate skills, with scores between 5 and less than 7. Only one student (0.32%) fell into the low-skilled category with scores less than or equal to 5. The total average score reached 9.69. Thus, the analysis of elementary school students' skill distribution within the existing value range provides a comprehensive overview of their balanced skill achievements within the framework of the established categories.

Table 5. Locomotor Movement

Interval	Category	Frequency	%	Mean
$X > 10$	Very Good	59	19	9.79
$8 < X \leq 10$	Good	128	41.2	
$7 < X \leq 8$	Sufficient	73	23.5	
$5 < X \leq 7$	Insufficient	46	14.8	
$X \leq 5$	Poor	4	1.2	

The data analysis reveals the frequency distribution of students' motor skills across various categories based on interval values. The research findings indicate that 59 students (19%) performed excellently with scores above 10. Furthermore, 128 students (41.2%) obtained an excellent category with scores ranging from 8 to 10. Meanwhile, 73 students (23.5%) demonstrated sufficient skills with scores between 7 and less than 8. On the other hand, 46 students (14.8%) exhibited less satisfactory skill levels, with scores between 5 and less than 7. Only four students (1.2%) fell into the low-skilled category with scores less than or equal to 5. The total average score for motor skills reached 9.79. This analysis provides a holistic understanding of elementary school students' locomotor skill achievements within the context of the established categories.

Table 6. Manipulative Movement

Interval	Category	Frequency	%	Mean
$X > 13$	Very Good	46	14.8	12.66

$11 < X \leq 13$	Good	91	29.3
$9 < X \leq 11$	Sufficient	158	50.9
$7 < X \leq 9$	Insufficient	14	4.5
$X \leq 7$	Poor	1	0.3

Based on table 6, Data analysis shows the distribution frequency of students' manipulative movement skills within the specified interval values. Findings indicate that 46 students (14.8%) achieved highly proficient manipulative skills with scores above 13. Additionally, 91 students (29.3%) were categorized as proficient, scoring between 11 and 13. Furthermore, 158 students (50.9%) demonstrated satisfactory proficiency, falling from 9 to 11. Conversely, only 14 students (4.5%) exhibited less satisfactory skills, scoring between 7 and 9. One student (0.3%) was classified under the low proficiency category, scoring less than or equal to 7, with a total average skill score of 12.66. Consequently, this analysis comprehensively overviews students' manipulative movement skills within the established categories.

Table 7. Overall Fundamental Motor Skills

Interval	Category	Frequency	%	Mean
$X > 36$	Very Good	51	16.45	32.14
$30 < X \leq 36$	Good	112	36.12	
$25 < X \leq 30$	Sufficient	99	31.93	
$19 < X \leq 25$	Insufficient	46	14.83	
$X \leq 19$	Poor	2	0.64	

Based on table 7, The findings reveal that 51 students (16.45%) exhibit highly proficient fundamental motor skills, with scores exceeding 36. Furthermore, 112 students (36.12%) demonstrated good skills, scoring between 30 and 36. Additionally, 99 students (31.93%) show satisfactory skills, scoring between 25 and 30. On the other hand, 46 students (14.83%) exhibit less satisfactory skills, with scores ranging from 19 to 25. Only two students (0.64%) fall into the category of low skills, with scores less than or equal to 19. The overall total averages 32.14. Thus, this analysis provides a comprehensive understanding of students' proficiency in overall fundamental motor skills based on balance, locomotor, and manipulative movements.

Table 8. Statistical data on male and female students

Gender	N	Mean	Std. deviation
Male students	157	30.32	3.590
Female students	153	28.48	3.208

Based on table 8, In a sample of respondents consisting of 157 male elementary school students and 153 female elementary school students, the mean performance score for male students is 30.32 with a standard deviation of 3.590, while the mean performance score for female students is 28.48 with a standard deviation of 3.208. These findings suggest that, on average, male students demonstrate higher performance scores than their female counterparts, with a slightly greater degree of variability among male students than female students.

Table 9. Independent Sample t-test Of Male and Female students

Levene's test	Sig. (2-tailed)	t	df	Description
0.367	0.000	4.758	308	significant

Based on the results outlined in Table 9, it is evident that the outcome of Levene's test is 0,367, which exceeds 0,05, indicating homogeneity of variance within the data. Conversely, the Sig. (2-tailed) value yields 0,000, less than 0,05, thereby inferring a significant difference in the mean assessments of fundamental motor skills between female and male students. Notably, the calculated t-value from the table stands at 4.758, elucidating that female students' mean assessment scores are lower than male students. In light of these findings, further planning is warranted to comprehend the underlying factors contributing to the significant disparity in evaluating fundamental motor skills between female and male students. Additionally, it is advisable to implement appropriate intervention strategies to enhance the motor skills of female students who exhibit a gap in motor performance scores relative to their male counterparts.

DISCUSSION

The discussion regarding this research's findings indicates the presence of variation in the attainment of motor skills among elementary school students. The frequency distribution of motor skills across different categories, assessed based on value intervals, offers a comprehensive overview of students' balance, locomotion, and manipulation performance. Research results reveal that most students demonstrate good or excellent skills across various aspects of motion, albeit significant variability exists in achievement among different categories.

Firstly, in the context of balance motion, most students demonstrate good skills, with the highest percentage of the total sample reaching the excellent category. These findings indicate that students possess relatively strong abilities in maintaining their physical balance. However, several students have shown that they need more satisfactory or even low skills in balance motion, which should be a concern when devising strategies for further intervention. This issue could be attributed to factors such as core muscle weakness, body mass index, lack of balance training, or even coordination problems ([Lengkana et al., 2020](#); [Rodríguez-Negro et al., 2019](#)). Coordination issues can lead to an inability to maintain balance effectively. Students struggle to regulate their body movements accurately, affecting their balance ([Verbecque et al., 2021](#)).

Secondly, regarding locomotor motion, the research findings indicate that most elementary school students also demonstrate performance assessment achievements in the good category. However, a small number of students need more satisfactory skills. This suggests that although most students have good locomotor motion abilities, there is still room for improvement, especially for students exhibiting lower skill levels. Issues in coordination between various body parts and motor control can lead to difficulties in performing locomotor movements effectively. Students who struggle to regulate their steps, maintain balance, or coordinate body movements face challenges in achieving good motor skills ([Kim & Lim, 2018](#)). Developing training, education, and learning models that provide opportunities for elementary school students to practice and learn locomotor movements regularly and systematically can help enhance their skills ([Haris et al., 2023](#)). These programs should be designed to introduce

movements gradually, strengthen the involved muscles, and to improve coordination and motor control by engaging in physical activities (Duncan et al., 2019)

Thirdly, the findings indicate that most students demonstrate satisfactory achievements concerning manipulative motion. Nevertheless, a few students showed that they needed more acceptable or even higher skill levels in manipulative motion. The attainment of assessments in the satisfactory category still needs to be deemed sufficient to support students' daily physical activities. Manipulative motor skills involve coordination and precision between the hands, eyes, and brain. This is crucial in executing movements in sports requiring high precision (Krupnik et al., 2015; Xing et al., 2020). In many physical activities at school, proper technique is vital for achieving good performance. Manipulative motor skills aid individuals in developing the necessary methods to execute specific movements in sports (Chen et al., 2016). This underscores the importance of developing manipulative skills among elementary school students, especially those exhibiting difficulties in manipulative motion.

The research findings also indicate differences in motor skill attainment between male and female students. Although these differences cannot be overlooked, with male students achieving higher average scores than female students, they also underscore the need for further research to understand the underlying factors driving these disparities. These research findings are supported by previous studies explaining the influence of gender on fundamental motor skill abilities along with supporting components (Shams, 2018; Zheng et al., 2022). These findings emphasize the necessity of appropriate intervention strategies to enhance the motor skills of female students, which shows disparities in motor performance scores compared to male students.

Furthermore, the statistical analysis results indicate a significant difference in the average assessment of fundamental motor skills between male and female students. The Levene's test results demonstrate variance homogeneity in the data, while the t-test indicates a significant difference in the average assessment between the two groups. This suggests a consistent difference in basic motor skills between male and female students, necessitating further attention to developing inclusive and sustainable educational programs. Thus, the conclusion drawn from this discussion is that the research findings underscore the importance of a holistic understanding of elementary school students' fundamental motor skills and the need for appropriate intervention strategies to enhance the quality of movement learning in the school environment through physical education. These findings also emphasize the need for awareness of individual differences in motor skill attainment and the necessity for a differential approach in addressing the needs of students based on their characteristics.

This study has limitations primarily concerning its scope and methodology. The research only focused on elementary school students aged 7-9 years old. Furthermore, the research design utilized a cross-sectional approach, capturing only a snapshot of motor skill attainment at one point. As a result, the study did not account for longitudinal changes or developmental trajectories in motor skill acquisition over time. Additionally, the assessment of motor skills relied on performance evaluations within predefined categories, which may not fully capture the complexity and multidimensionality of motor skill development. The study did not explore contextual or environmental factors influencing motor skill attainment, such as socioeconomic status, access to physical activity resources, or cultural influences. Addressing

these limitations in future research endeavors would provide a more comprehensive understanding of motor skill development among elementary school students.

CONCLUSION

The research conclusion explains the variation in movement skills among primary school students aged 7 to 9. Most students exhibit proficient skills, although some need more satisfactory abilities. Balance issues may stem from core muscle weakness or inadequate practice. Locomotor skills necessitate structured training programs. Meanwhile, manipulative skills emphasize movement coordination. Gender disparities highlight the need for a differentiated approach, as evidenced by significant statistical differences between male and female students. This underscores the necessity for an inclusive approach to physical education at the elementary school level.

Nevertheless, it is essential to acknowledge the limitations of this study. The research solely focused on elementary school students within a specific age range, potentially limiting the generalizability of the findings to broader age groups or educational levels. Additionally, the cross-sectional research design only captures a brief snapshot of motor skill attainment at a single point, overlooking longitudinal changes in skill development. Moreover, the reliance on predefined categories for skill assessment may only partially capture the complexity of motor skill development. Future research efforts should address these limitations to provide a more comprehensive understanding of motor skill development among elementary school students and to devise tailored intervention strategies.

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