Comparative study of physical literacy of primary and secondary schools in Semarang City

Estudio comparativo de la alfabetización física en escuelas primarias y secundarias de la ciudad de Semarang

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Abstract

Introduction and Objective. Physical literacy is an important component for students in physical education. However, there is still a lack of scientific evidence in primary and secondary schools in Semarang city. This study aims to determine physical literacy by comparing gender and school level.
Methodology. The research method is descriptive-comparative with observation and test data collection techniques, data analysis is descriptive, and the Mann-Whitney inference is assisted by SPSS.
Results. Comparison of education levels of elementary and junior high school (0.302>0.05), junior and senior high school (0.135>0.05), elementary and senior high school (0.046<0.05). Results, by gender girls (primary vs junior secondary 0.110>0.05), girls (primary vs senior secondary 0.115>0.05), girls (junior secondary vs senior secondary 0.556>0.05), boys (primary vs junior secondary 0.934>0.05), boys (primary vs senior secondary 0.140>0.05), boys (junior secondary vs senior secondary 0.117>0.05).
Conclusion. In conclusion, overall, the difference in school levels with relatively distant ages is significant. In addition, differences in education levels that are not relatively far away and the same age do not have significant differences in physical literacy. Nevertheless, overall physical literacy for schools in Semarang City is not yet optimal, and needs to be improved. In addition, there are limitations to the study, namely, more focus on one city, purposive sampling, which affects the justification of data to generalize; therefore, further improvements are needed.

Keywords

Physical literacy; children with special needs; adaptive physical activity; Semarang city.

Resumen

Introducción y objetivo. La alfabetización física es un objetivo fundamental de la educación física, pues favorece el desarrollo integral de los estudiantes mediante la competencia motriz, la motivación y la comprensión del movimiento. Sin embargo, en las escuelas primarias y secundarias de la ciudad de Semarang aún falta evidencia científica que describa este aspecto.
Metodología. El estudio empleó un método descriptivo-comparativo con observación y pruebas estandarizadas. Los datos fueron analizados de manera descriptiva y con la prueba de Mann-Whitney utilizando SPSS.
Resultados. Los resultados muestran que la comparación entre los niveles de educación primaria y secundaria (0,302 > 0,05), secundaria y bachillerato (0,135 > 0,05), y primaria y bachillerato (0,046 < 0,05) indica diferencias significativas solo en niveles escolares distantes. Según el género, las diferencias entre niñas y niños en los distintos niveles no fueron significativas (p > 0,05).
Conclusión. En general, la alfabetización física de los estudiantes de Semarang aún no alcanza un nivel óptimo y requiere fortalecimiento a través de programas educativos más inclusivos y adaptados a las capacidades individuales. El estudio reconoce como limitación su enfoque en una sola ciudad y el uso de un muestreo intencional, lo que restringe la generalización de los resultados. Se recomienda realizar investigaciones con muestras más amplias y contextos diversos.

Palabras clave

Alfabetización física; niños con necesidades especiales; actividad física adaptada; ciudad de Semarang.

Introduction

Physical literacy is increasingly recognized as a central objective of physical education in the 21st century, as it encompasses the development of motor competence, cognitive understanding, and intrinsic motivation toward active and healthy living (Edwards et al., 2017). Beyond being a foundation for movement skills, it represents a lifelong capacity that enables individuals to engage in meaningful physical experiences and sustain active lifestyles. In several regions, including Latin America, recent narrative reviews emphasize the importance of promoting physical literacy as part of inclusive and holistic education. Countries such as Canada and Australia have systematically integrated this concept into their physical education curricula, serving as references for developing nations that seek to strengthen physical education policies. The promotion of physical literacy, or *alfabetización física* in Spanish, is therefore essential not only for improving students' physical competence but also for fostering personal and social well-being through lifelong participation in physical activity (Afridawati et al., 2025; Akhiruyanto et al., 2022). However, the implementation of physical literacy in Indonesia is still relatively new and tends to focus on mastering basic motor skills only, while the affective and cognitive dimensions have not received adequate attention (Friskawati & Stephani, 2021).

This gap becomes even more complex when it comes to children with special needs who attend primary and secondary school. They face multiple barriers in the form of physical or cognitive limitations and the unavailability of an adaptive curriculum that consistently supports the development of physical literacy (Mahendra et al., 2020). UNESCO data (2023) shows that more than 50% of children with disabilities in Southeast Asia still have difficulty accessing inclusive physical learning, both due to limited adaptive physical education teachers and appropriate infrastructure (UNESCO, 2023). UNESCO data (2023) shows that more than 50% of children with disabilities in Southeast Asia still have difficulty accessing inclusive physical learning, both due to limited adaptive physical education teachers and appropriate infrastructure (ParalympicsGB, 2024).

Previous studies have explored aspects of physical literacy, but they still leave a gap. Chaeroni et al. (2025) tested the validity of the Rasch-based PL-C Quest instrument on elementary school students, but the results showed limitations in measuring more complex motor skills (Chaeroni et al., 2025). Jariono et al. (2022), through a literature review, confirmed that Adapted Physical Education (APE) has a positive effect on the physical and cognitive development of children with special needs, even though most of the studies were conducted outside Indonesia (Jariono et al., 2022). Qualitative research by Irmansyah et al. (2025) found that teachers' understanding of physical literacy is still partial, tending to focus only on technical motor skills, while affective and motivational dimensions are often ignored (Irmansyah, Maulidin, et al., 2025). Furthermore, Adi et al. (2025), through a quantitative approach, showed a positive relationship between physical literacy, physical activity, motivation, and learning outcomes of regular elementary school students. However, similar studies have not targeted the population of children with special needs (Adi et al., 2025). In fact, the Positive Youth Development Through Sport (PYD-TS) based intervention implemented by Afridawati (2025) was shown to improve the social skills of children with special needs more significantly than the conventional physical curriculum, but has not been linked to holistic physical literacy outcomes (Afridawati et al., 2025).

From these findings, it is clear that there is a research gap. The majority of studies still focus on the general population, on one level of education only, or are limited to specific dimensions of physical literacy. There is no comprehensive study that systematically compares the physical literacy of students with special needs from primary to secondary school, especially in Indonesia. In fact, the educational transition from primary school to junior and senior high school is a crucial phase that can affect the continuity of motor, cognitive and affective development. Without an in-depth understanding of developmental patterns across levels, it is difficult to design consistent adaptive physical learning strategies.

Based on this gap, this study specifically aims to analyze the physical literacy of students with special needs at the primary to secondary school levels in Semarang City. The main focus is on the comparison of physical literacy achievement across levels of education and gender. This study is relevant because most of the previous literature has not presented a cross-level picture in the context of adaptive physical education in Indonesia (E. Durden-Myers & Bartle, 2023; E. J. Durden-Myers, 2024; Valle-Muñoz, Águila-Lara, et al., 2025; Valle-Muñoz, Mendoza-Muñoz, et al., 2025).

Theoretically, this study is expected to expand the conceptual framework of physical literacy by adding an inclusive perspective based on empirical evidence from developing countries. The international literature has been dominated by studies from developed countries with relatively well-established adaptive physical education systems, so results from Indonesia can make new contributions to the global discourse. Practically, the findings of this study can be used as a reference in developing a consistent, inclusive physical learning strategy from elementary to senior high school, strengthening the capacity of teachers in implementing an adaptive curriculum, and encouraging the formulation of policies that are more responsive to the needs of children with special needs. Thus, this study not only fills a research gap, but also provides tangible benefits for improving the quality of inclusive physical education in Indonesia as well as potentially becoming a reference in international efforts to improve the physical literacy of children with special needs.

Method

Participants

This study used a quantitative approach with a comparative design. There were 214 students with special needs from eight schools in Semarang City, consisting of six inclusive schools and two special schools. The sample included 69 elementary school students, 125 junior high school students, and 20 senior high school students, with a relatively equal proportion of girls and boys. Participants were selected using a purposive sampling technique based on the criteria that students actively participated in adaptive physical education, had identified physical and cognitive barriers, and obtained permission from the school and parents. Recruitment was facilitated by physical education teachers in each school, and the entire research process was carried out with due regard to inclusive education research ethics (E. J. Durden-Myers, 2024).

Procedure

The research process was carried out for three months by involving physical education teachers as accompanying partners in data collection. All assessments were conducted in their respective school environments to maintain student comfort. Assessment instructions were delivered in a simplified manner according to individual needs, and technical adjustments such as the use of visual media, simple language, and nonverbal communication support were provided so that all students could participate optimally (Jariono et al., 2025; Raehang et al., 2025; Sulistiyono et al., 2024).

Instrument

Physical literacy is measured using an adaptive assessment instrument that covers three main domains: motor, cognitive and affective. The motor domain is assessed through observation of basic movement skills appropriate to the child's developmental age. The cognitive domain was measured through a simple questionnaire regarding understanding of physical activity concepts, while the affective domain was assessed through a scale of motivation and attitude towards participation in physical learning. Content validity of the instrument was obtained through expert review of adaptive physical education, while reliability was reviewed through a small group readability trial. Similar instruments, such as the Physical Literacy in Children Questionnaire (PL-C Quest), have been shown to be valid and reliable for school-aged children, including when adapted for special needs (Akhiruyanto & Yudhistira, 2024; Wijaya et al., 2025).

Data analysis

Data analysis was conducted in several stages. First, descriptive analysis was used to calculate the mean value, standard deviation, as well as the frequency distribution and percentage of physical literacy achievement based on the Not Too Good, Good and Very Good categories. Next, the Kolmogorov-Smirnov test was used to check the normality of the data in each education level and gender group. If there were data that were not normally distributed, the Mann-Whitney test was used to test the differences in physical literacy achievement between levels (elementary school-junior high school, elementary school-high school, junior high school-high school) and between boys and girls. All analyses were conducted using SPSS version 25 software with a significance level of 0.05, in accordance with the

current practice of non-parametric analysis in physical literacy research (Bingham et al., 2025; Suntoda et al., 2021a).

Results

The results of this study are presented based on descriptive analysis, distribution of respondents, and normality and correlation tests between levels of education:

Table 1. Descriptive Physical Literacy of Elementary, Middle, and High School Boys

Categories	N (Primary)	Mean	STD.D	N (Junior High)	Mean	STD.D	N (Senior High)	Mean	STD.D	P-Value
Not Too Good	45	162,29	57,54	78	156,54	49,16	10	145,20	31,88	0,032
Good	45	383,29	88,10	78	383,96	105,10	10	341,20	119,91	0,041
Very Good	45	124,51	147,89	78	110,26	145,58	10	160,00	231,90	0,018

Figure 1. Percentage of Physical Literacy in Primary, Junior high, and Senior high for Boys

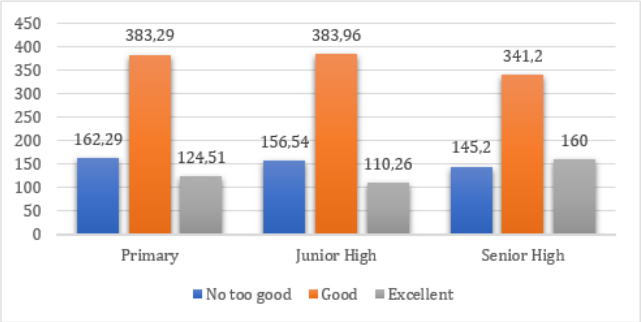

Table 1 and Figure 1 show the results of the descriptive analysis of physical literacy in male students at the primary, junior secondary and senior secondary levels. In the Not Too Good category, the mean score of primary school boys (N = 45) was 162.29 (SD = 57.54), slightly higher than that of junior secondary (N = 78; M = 156.54; SD = 49.16) and decreasing at senior secondary (N = 10; M = 145.20; SD = 31.88). In the Good category, the average score of primary school boys reached 383.29 (SD = 88.10), relatively similar to junior secondary (M = 383.96; SD = 105.10), but decreased in senior secondary (M = 341.20; SD = 119.91). Meanwhile, in the Very B category, Primary School students recorded an average of 124.51 (SD = 147.89), Junior Secondary 110.26 (SD = 145.58), and Senior Secondary 160.00 (SD = 231.90). This data indicates that boys' physical literacy was relatively stable from primary to junior secondary school, but varied at senior secondary, especially in the Very Good category, which actually increased. The results of the descriptive analysis show that the average physical literacy scores of male students tend to decrease as the level of education increases. Elementary school students have the highest average scores compared to junior high and high school students. Based on the significance test indicated by the p-value (< 0.05), there is a significant difference between the educational level groups. This indicates that the level of education affects the variation in physical literacy achievement, where students at the elementary level tend to have better physical literacy skills than those at higher levels.

Table 2. Descriptive Physical Literacy of Girls' Elementary, Junior High, and Senior High Schools

Categories	N (Primary)	Mean	STD.D	N (Junior High)	Mean	STD.D	N (Senior High)	Mean	STD.D	P-Value
Not Too Good	24	166,37	44,03	47	166,43	49,66	10	125,40	109,78	0,041
Good	24	348,96	55,81	47	384,52	94,16	10	329,90	117,26	0,032
Very Good	24	158,33	152,99	47	71,74	132,77	10	140,00	142,98	0,027

Figure 2. Percentage of Physical Literacy in Girls' Primary, Junior high, and Senior high

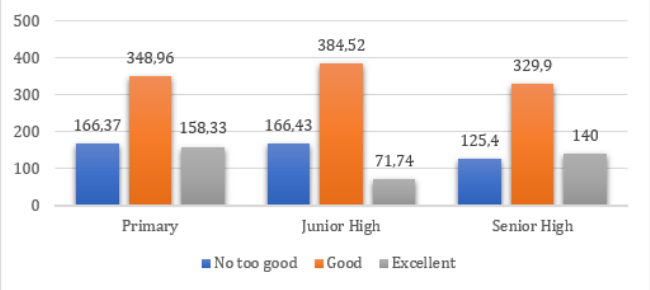

Table 2 and Figure 2 present the results of the descriptive analysis of physical literacy among female students at the primary, junior secondary and senior secondary levels. In the Not Too Good category, primary school students (N = 24) had a mean score of 166.37 (SD = 44.03), almost the same as junior secondary (N = 47; M = 166.43; SD = 49.66), but decreased quite sharply in senior secondary (N = 10; M = 125.40; SD = 109.78). In the Good category, the average score of primary school students was 348.96 (SD = 55.81), increased in Junior High (M = 384.52; SD = 94.16), but decreased again in Senior High (M = 329.90; SD = 117.26). Meanwhile, in the Very Good category, primary school students recorded an average of 158.33 (SD = 152.99), lower in Junior Secondary (M = 71.74; SD = 132.77), and increased again in Senior Secondary (M = 140.00; SD = 142.98). These results show that girls' physical literacy development is not linear, with sharper fluctuations in scores than boys, especially in the Not Too Good and Very Good categories. The results of descriptive analysis show that the level of physical literacy among female students tends to decline at higher levels of education. The highest average score was found in the elementary school group, while junior high and high school students showed lower averages. The significance test showed a p-value < 0.05 in each category, indicating that there were significant differences between the three levels of education.

Figure 3. Percentage of primary, junior high and senior high education levels

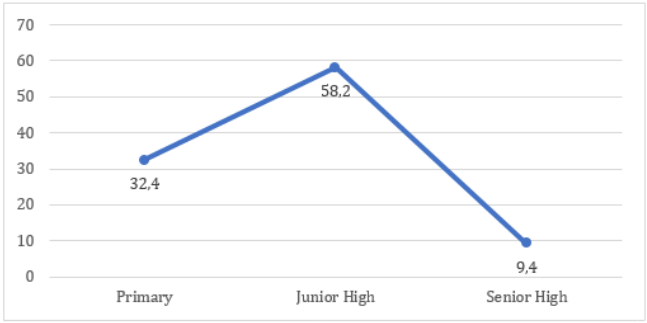

Figure 3 shows the distribution of respondents by education level. The majority of students were at the junior high school level, which amounted to 58.2% of the total sample. Furthermore, elementary school students ranked second with a percentage of 32.4%, while the smallest proportion was at the senior high school level at only 9.4%. This result shows that most of the research participants came from the junior secondary level, while the number of students at the senior secondary level was relatively smaller. This distribution is important to consider because the difference in the number of respondents at each level can affect the pattern of physical literacy analysis produced.

Figure 4. Percentage of Gender of Boys and Girls in Primary, Junior, and Senior High Schools

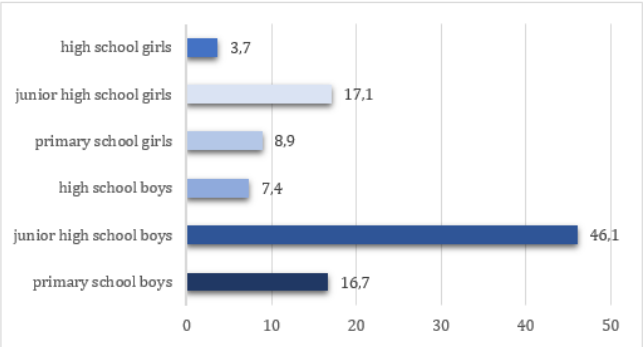

Figure 4 illustrates the distribution of respondents by gender and education level. In the male group, the majority of students came from Junior High with a percentage of 46.1%, followed by Elementary School with 16.7%, and Senior High with the smallest percentage of 7.4%. Meanwhile, in the female group, the largest distribution was also in junior high school at 17.1%, followed by elementary school at 8.9%, and the smallest was senior high school with only 3.7%. This result shows that the respondents were dominated by junior high school boys, while the number of senior high school girls was relatively very small. This condition is important to note because differences in sample proportions can affect the results of comparative and inferential analyses conducted.

Table 3. Tests of Normality

Categories		Sig.	Description
Education Level	Primary School	,161	Normal
	Junior High	,200	Normal
	Senior High	,011	Not Normal
Gender	Girls (Primary School)	,200	Normal
	Girls (Junior High)	,200	Normal
	Girls (Senior High)	,031	Not Normal
	Boys (Primary School)	,200	Normal
	Boys (Junior High)	,110	Normal
	Boys (Senior High)	,023	Not Normal

Based on the normality test results shown in Table 3, it can be seen that the data with the education level category at the elementary school level (Sig. = 0.161 > 0.05) and junior high school level (Sig. = 0.200 > 0.05) are normally distributed. However, at the Senior High level (Sig. = 0.011 < 0.05) the data is not normally distributed. Furthermore, in terms of gender category, the normality test results showed that the Elementary School Girls (Sig. = 0.200 > 0.05), Junior High School Girls (Sig. = 0.200 > 0.05), and Elementary School Boys (Sig. = 0.200 > 0.05) and Junior High School Boys (Sig. = 0.110 > 0.05) had normal distribution. However, the High School Girls (Sig. = 0.031 < 0.05) and High School Boys (Sig. = 0.023 < 0.05) groups were not normally distributed. Thus, because there are several groups of data that do not meet the assumption of normality, the comparative test used is the Mann-Whitney test, which is a non-parametric test and is suitable for data that is not normally distributed.

Table 4. Uji Mann–Whitney

Categories	Sig.(p)	Description
Education Level		
Primary vs Junior High	,302	Not significant
Primary vs Senior High	,046	Significant
Junior high vs Senior high	,135	Not significant
Gender		
Girls (primary vs junior high)	,110	Not significant
Girls (primary vs senior high)	,115	Not significant
Girls (junior high vs senior high)	,556	Not significant
Boys (primary vs junior high)	,934	Not significant
Boys (primary vs senior high)	,140	Not significant
Boys (junior high vs senior high)	,117	Not significant

The results of the Mann-Whitney test displayed in Table 4 show that, in general, there is no significant difference in physical literacy between education levels or between genders. The only significant difference was found in the comparison of primary school students with senior secondary school students ($p = 0.046$), indicating a decline in the quality of physical literacy as students enter senior secondary school. In contrast, the comparisons of primary school to junior secondary and junior secondary to senior secondary showed no significant differences, which could be interpreted as the development of physical literacy being relatively stable from primary to junior secondary school. In terms of gender, neither boys nor girls showed significant differences at each level, although the descriptive data showed fluctuations in scores in the girls' group. Thus, it can be concluded that the physical literacy of students with special needs is still relatively good at the primary and junior high school levels, but begins to decline at senior high school, while gender differences are not the main determining factor in variations in physical literacy achievement.

Discussion

The purpose of this study was to explore the physical literacy of students with special needs at the primary, junior secondary and senior secondary school levels, highlighting inter-level differences as well as variations by gender. The focus of the analysis is on comparing primary school with junior secondary, primary school with senior secondary, and junior secondary with senior secondary, while identifying the physical literacy achievements of female and male students. Using a quantitative comparative design, this study seeks to provide an empirical understanding of the dynamics of physical literacy development in Semarang City that has not been studied previously.

The results of the analysis show that the transition from elementary school to junior high school is relatively stable, indicating the continuity of physical literacy skills in these two phases of education. These findings are consistent with the study by Irmansyah, Mujriah, et al. (2025); Suntoda et al. (2021 bwhich explains that during middle childhood to early adolescence, students with disabilities generally maintain their motivation for physical activity because the intensity of adaptive physical education is still maintained. In contrast, a comparison between elementary and high schools shows a statistically significant decline (Irmansyah, Mujriah, et al., 2025; Suntoda et al., 2021b). In contrast, the comparison between primary and senior secondary schools shows a significant decline. This is in line with the report of Permana et al. (2024), who confirmed that the higher the level of education, the academic load often reduces attention to adaptive physical learning (Permana et al., 2024). The comparison between junior high and senior high is not significant, but there is a downward trend, indicating that the critical point of physical literacy occurs when students enter senior secondary education. From a gender perspective, there were no significant differences between male and female students at all levels. However, descriptive trends showed interesting variations: male students' achievements were relatively consistent at all levels, while female students showed sharper fluctuations, increasing at the lower secondary level and decreasing at the upper secondary level. This phenomenon is in line with the findings of Liu et al. (2025); Ma et al. (2024), who noted that girls with special needs tend to face greater barriers to participation due to factors such as motivation, family support, and access to sports facilities (X. Liu et al., 2025; Ma et al., 2024). Meanwhile, boys are often more involved in competitive play-based activities that enrich the motor experience (Salehian, 2025).

The results confirm two important points. Firstly, in terms of level, the physical literacy is relatively good between primary and junior secondary schools, while the weakest is between primary and senior secondary schools. Secondly, in terms of gender, although the difference is not significant, male students tend to be more stable, while female students need more attention as their achievements fluctuate and tend to decline in senior secondary. This indicates a double challenge: the sustainability of adaptive physical education programs across levels and the need for a more gender-sensitive approach.

In relation to the literature, the results of this study demonstrate novelty. Previous studies in Indonesia have mostly focused on regular students or on only one level of education (Cho & Ahn, 2024). This study fills this gap by presenting a comprehensive picture across levels and comparing gender variations. Thus, the main contribution of this study is to expand the horizon of physical literacy analysis into the

context of inclusive education longitudinally. Furthermore, the decline in physical literacy at the senior secondary level can be explained through adolescent development theory. According to Carl et al. (2022), upper adolescence is characterized by increased academic pressure and psychosocial changes that impact physical activity participation (Carl et al., 2022). The adaptive physical education curriculum at the upper secondary level, which is not yet fully responsive to the needs of students with disabilities, also has the potential to reinforce this trend. In addition, the studies of Rahmawati and Essiet et al. (2021) emphasize the importance of continuing physical activity experiences since the primary level so that physical literacy competencies are not lost in the transition phase to Senior High School. (Essiet et al., 2021).

The practical implications of these findings lie in the importance of consistent adaptive physical education design at every level and a gender-sensitive approach. This result is in line with the views of Dewi and Oktadinata et al. (2023) who emphasized the need for social support-based pedagogical strategies to increase girls' self-efficacy in physical education (Oktadinata et al., 2023). Thus, developing a curriculum that provides equal learning opportunities for all students, without emphasizing normative assessments of "good" or "poor," is an important step toward strengthening the sustainability of physical literacy in inclusive environments.

Conclusions

Based on these results and discussion. Shows that the difference or range of education and age is far there is a significant difference in physical literacy because one of them higher levels of education has more activities outside of school, and in growth can be said to enter early adolescence. However, the descriptive analysis of physical literacy from elementary, middle and high school education levels and gender cannot be said to be optimal, so realization and implementation of physical literacy are needed. However, this study contributes theoretically by comparing differences in education levels and gender. Nevertheless, there are limitations of the research to be improved in future research, namely using probability sample selection to obtain optimal data generalization, and expanding sampling not only in one city.

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