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Traditional Games Based Deep Learning to Improve Physical Literacy in Elementary School Students

Damdam Taufik Ramdani[1], Lutfi Nurr[2], Rafdlal Saeful Bakhri[3]

[1,2] Universitas Pendidikan Indonesia
[3] STKIP Bina Mutiara Sukabumi
email: lutfinur@upi.edu

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Abstract

This study aimed to analyze the effect of traditional games based on deep learning on elementary school students' physical literacy. Physical literacy is an important component in physical education because it integrates physical competence, motivation, confidence, knowledge, and social interaction in lifelong physical activity. However, physical education learning in elementary schools is often still focused on technical mastery and has not optimally provided meaningful and engaging learning experiences for students. Therefore, traditional games integrated with deep learning approaches were implemented to create active, reflective, and enjoyable learning experiences. This study used an experimental method with a pretest-posttest non-equivalent control group design involving 72 fourth-grade elementary school students. The participants were divided into two groups, namely the galah traditional game group and the sondah traditional game group. Data were collected using the Physical Literacy in Children Questionnaire based on the Australian Physical Literacy Framework. The data were analyzed using descriptive statistics, paired sample t-test, and independent sample t-test. The results showed that both traditional games significantly improved students' physical literacy ($p < 0.05$). However, the galah traditional game group demonstrated a higher increase compared to the sondah group. The findings indicate that traditional games involving dynamic movement, teamwork, social interaction, and strategic decision-making provide more meaningful movement experiences and contribute more optimally to the development of students' physical literacy. Therefore, traditional games based on deep learning can be used as an innovative and effective approach in elementary school physical education learning.

Keywords: *Traditional Games; Deep Learning; Physical Literacy; Physical Education; Elementary School*

Alamat Koresponden : Universitas Pendidikan Indonesia
Email : lutfinur@upi.edu

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INTRODUCTION

Physical education in elementary schools plays a crucial role in supporting the holistic development of students, encompassing physical, cognitive, social, and emotional aspects. Through structured physical activity, students not only acquire movement skills but also provide learning experiences that can shape active and healthy lifestyles throughout life. In the context of modern education, learning is directed at creating meaningful, active, and enjoyable learning experiences that can increase student engagement in physical activity. One concept developing in modern physical education is physical literacy.

Physical literacy is understood as a multidimensional concept encompassing motivation, self-confidence, physical competence, knowledge, and understanding of individuals to engage in lifelong physical activity (Barnett et al., 2020; Cairney et al., 2019). This concept positions physical activity not solely as a motor skill but also as part of an individual's holistic development, encompassing the physical, psychological, social, and cognitive domains (Cornish et al., 2020; Lubay et al., 2025). Thus, developing physical literacy in elementary school students is crucial because elementary school age is a fundamental phase in the development of children's motor skills, self-confidence, motivation, and physical activity habits (Barnett et al., 2020; Scott et al., 2021).

Various studies have shown that physical activity is significantly related to the development of physical self-concept, motivation, and psychological health in children and adolescents. Furthermore, (Babic et al., 2014) explains that physical activity is positively related to physical self-concept, perceived competence, and children's confidence in engaging in movement activities. This suggests that positive physical activity experiences from an early age can support the development of affective and motivational aspects, which are essential components of physical literacy (Scott et al., 2021).

However, physical education in elementary schools still faces various challenges. Learning activities are often oriented toward mastering sports techniques and achieving specific skills, resulting in less meaningful learning experiences and less opportunity for the development of creativity, social engagement, and intrinsic motivation (Hambali et al., 2025). Furthermore, the development of digital technology has led children to spend more time playing with gadgets than actively engaging in direct play with peers. This has

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resulted in decreased physical activity among students and the diminishing presence of traditional games in schools and communities (Ananda et al., 2026; Anatasya et al., 2023).

One approach to improving students' physical literacy is through traditional games. Traditional games are cultural activities that incorporate elements of movement, social interaction, cooperation, creativity, and enjoyable learning experiences (Al Hadiq et al., 2025). Traditional games provide opportunities for students to engage in various basic motor activities such as running, jumping, dodging, maintaining balance, and interacting with peers in an active and enjoyable environment. In addition to improving motor skills, traditional games can also strengthen students' social interaction, responsibility, sportsmanship, and mutual cooperation (Al Hadiq et al., 2025; Astuti & Apriliani, 2025). Research (Hambali et al., 2025) also shows that traditional games have a positive influence on students' learning motivation in physical education lessons.

In implementation, traditional games need to be developed through a learning approach that creates active, reflective, and meaningful learning experiences. One relevant approach is deep learning. In the educational context, deep learning refers not only to artificial intelligence technology but also to an approach that emphasizes holistic, reflective, and meaningful conceptual learning (Raja et al., 2026). This approach prioritizes a mindful, meaningful, and enjoyable learning process so that students not only memorize material but also understand, internalize, and connect it to real-life experiences (Al-am et al., 2025; Fitriani & Santiani, 2025; Rahmawati et al., 2025).

The deep learning approach also encourages active student engagement through exploration, reflection, discussion, and collaborative problem-solving. According to (Fauziah et al., 2025), the application of mindful learning, meaningful learning, and fun learning in learning is able to create a better learning experience. In-depth, relevant, and holistic learning for students (Rahmawati et al., 2025), including elementary school students. This concept aligns with the view (Kovač et al., 2025), which explains that deep learning emphasizes a learning process oriented toward meaningful understanding, active student engagement, the ability to connect learning experiences to real-life situations, and the development of critical, collaborative, and reflective thinking. Furthermore, the deep learning approach is seen as capable of creating more enjoyable, motivating learning and supporting holistic student development, across cognitive, social, emotional, and physical aspects.

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In the context of physical education, the implementation of traditional games based on deep learning provides opportunities for students to learn through direct movement experiences, collaborate with peers, develop game strategies, solve movement problems, and reflect on their play experiences. These activities not only improve students' motor skills but also strengthen their self-confidence, communication skills, creativity, and social engagement throughout the learning process. This aligns with the characteristics of deep learning, which emphasize active, contextual, collaborative, and meaningful learning through students' real-life experiences. Therefore, the integration of traditional games based on deep learning into physical education lessons is expected to create more meaningful movement experiences while optimally supporting students' physical literacy development.

Several previous studies have examined the influence of traditional games on students' motor skills, character, learning motivation, and social interactions. However, research specifically integrating traditional games with a deep learning approach to improve elementary school students' physical literacy is still relatively limited. Most previous studies have focused on developing motor skills or character separately, resulting in few studies comprehensively examining the effect of traditional games based on deep learning on elementary school students' physical literacy.

This research offers the novelty of integrating traditional games with a deep learning approach into physical education lessons to improve elementary school students' physical literacy. Unlike previous studies, which generally focused only on motor skills, learning motivation, or character separately, this study examines the influence of traditional games based on deep learning on the development of physical literacy in a multidimensional manner, encompassing the physical, psychological, social, and cognitive domains of elementary school students.

Based on this description, this study aims to analyze the influence of traditional games based on deep learning on elementary school students' physical literacy. This research is expected to contribute to the development of more innovative, meaningful, and contextual physical education learning, while also supporting the development of physical literacy in elementary school students through an active, reflective, and enjoyable learning approach.

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METHOD

This study employed an experimental method with a Pretest-Posttest Non-Equivalent Control Group Design. This study involved two groups: an experimental group and a control group (Creswell & Creswell, 2018).

Table 1. Pretest-Posttest Non-Equivalent Control Group Design

Group	Pretest	Treatment	Posttets
Experimental Class	O_1	X	O_2
Control Class	O_1	Y	O_2

The study was conducted at *Rajapolah* Elementary School, *Rajapolah* District, *Tasikmalaya* Regency, West Java. Participants in this study were 72 fourth-grade elementary school students. The sample was selected using a total sampling technique, so that all students in the class selected as research subjects participated in this study. Students were divided into two treatment groups: the traditional pole game group based on deep learning and the traditional *sondah* game group based on deep learning. All participants participated in physical education learning activities according to the treatment provided throughout the study period.

Protocol

The research began with a pretest to measure students' initial physical literacy levels before receiving treatment. Next, both groups received physical education lessons using traditional games based on deep learning. The first group received treatment through the traditional *galah* game, while the second group used the traditional *sondah* game. The implementation of deep learning-based learning was carried out by integrating the principles of mindful learning, meaningful learning, and joyful learning into each learning activity. In the mindful learning stage, students were guided to consciously and actively understand the goals, rules, and strategies of the game. The meaningful learning stage was carried out by connecting play experiences to students' daily lives, such as cooperation, discipline, and the importance of physical activity for health. Furthermore, the joyful learning stage was implemented through fun, interactive play activities that involved the active participation of all students throughout the learning process.

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The research instrument used was the Physical Literacy in Children Questionnaire (PL-C Quest), developed based on the Australian Physical Literacy Framework, which covers physical, psychological, social, and cognitive domains (Barnett et al., 2020). In this study, the PL-C Quest questionnaire used was derived from (Lubay et al., 2025) and has been retested on elementary school students. The results of the study obtained validity values ranging from 0.226 to 0.677 and reliability test results obtained a Cronbach's α value of 0.847 (Lubay et al., 2025).

Table 2. Domain Distribution for Each Physical Literacy Item in Children Questionnaire (Lubay et al., 2025)

Domain	Item range	Number of items	Score range	Aspects measured
Physical	P1-P12	12	12-48	Movement skills, fitness, coordination.
Psychological	P13-P19	7	7-28	Motivation, self-confidence, enjoyment.
Social	P20-P23	4	4-16	Social interaction, cooperation, ethics.
Cognitive	P24-P30	7	7-28	Knowledge, understanding of rules, strategies.
Total Score	P1-P30	30	30-120	Overall physical literacy

This instrument was used to measure students' perceptions of physical literacy before and after treatment was given.

RESULT

This study aimed to determine the effect of deep learning-based traditional games on the physical literacy of elementary school students.

Table 3. Description of physical literacy data (overall)

Statistics	*Galah*			*Sondah*		
	Pretest	Posttest	Gain	Pretest	Posttest	Gain
Total	3509	4120	611	3434	3845	411
Average	97,47	114,44	16,97	95,39	106,81	11,42
Maximum score	112	120	35	115	120	36
Minimum score	75	87	1	71	79	0

The data analyzed included pretest, posttest, gain scores, prerequisite analysis, and hypothesis testing using paired sample t-tests and independent sample t-tests. The

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overall descriptive physical literacy data are shown in Table 3. Based on the analysis, the traditional *galah* game group showed greater improvement than the traditional *sondah* game group. In the *galah* group, the average pretest score of 97.47 increased to 114.44 in the posttest, with an average gain score of 16.97. Meanwhile, the *sondah* group experienced an increase from a pretest average of 95.39 to 106.81 in the posttest, with an average gain score of 11.42. These results indicate that the traditional *galah* game provided greater improvements in physical literacy than the traditional *sondah* game.

Furthermore, based on the average gain scores in each physical literacy domain, the physical domain showed the highest improvement in both treatment groups (Figure 1). The pole group achieved an average increase of 8 in the physical domain, while the *sondah* group achieved 4.75. In the psychological domain, the pole group achieved an increase of 3.83 and the *sondah* group 3.42. Furthermore, the social domain showed an increase of 1.69 in the pole group and 1.53 in the *sondah* group. In the cognitive domain, the pole group achieved an increase of 3.44, while the *sondah* group achieved 1.72.

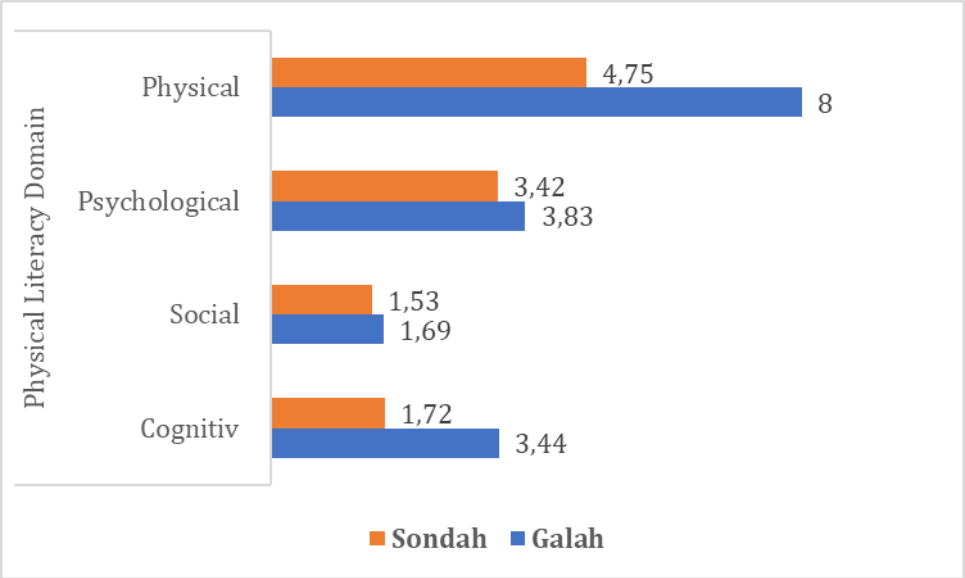


Figure 1. Average gain score based on the physical literacy domain

These results indicate that traditional *galah* games contribute significantly to improvements in almost all physical literacy domains. Before testing the hypotheses, the data were first tested using normality and homogeneity tests.

Table 4. Normality Test Results

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Variable	Traditional Games	Shapiro-Wilk	
		Statistic	Sig.
Physical literacy	*Galah*	1,459	0,316
	Sondah	1,375	0,103

Table 5. Homogeneity Test Results

Variable	Levene Statistic	df1	df2	Sig.
Physical literacy	0.339	1	70	0,562

The results of the Shapiro-Wilk normality test showed that the physical literacy data for the *galah* group achieved a significance value of 0.316 and for the *sondah* group, 0.103. Both values are greater than 0.05, indicating that the data are normally distributed. Furthermore, the results of the homogeneity test using Levene's Test showed a significance value of 0.562 > 0.05, thus the research data was declared homogeneous and met the assumptions for parametric testing.

Table 6. Paired Sample t-test results

Traditional Games	t	Df	Sig. (2-tailed)
Galah	11,520	35	0,000
Sondah	6,698	35	0,000

The results of the paired sample t-test showed a significant increase in physical literacy in both treatment groups. The traditional *galah* games group obtained a t-score of 11.520 with a significance of 0.000 ($p < 0.05$), while the traditional *sondah* games group obtained a t-score of 6.698 with a significance of 0.000 ($p < 0.05$). These results indicate that both deep learning-based traditional games significantly improved elementary school students' physical literacy.

Table 7. Independent Sample t-test results

Variable	t	df	Sig. (2-tailed)
Physical literacy	2,466	70	0,016

Furthermore, the independent sample t-test results showed a t-value of 2.466 with a significance level of 0.016 ($p < 0.05$). These results indicate a significant difference in the

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influence of the traditional *galah* game and the traditional *sondah* game on elementary school students' physical literacy.

Table 8. Description of average gain score data

Traditional Games	N	Mean	Std. Deviation	Std. Error Mean
Galah	36	16,97	8,84	1,473
Sondah	36	11,42	10,227	1,705

Based on the average gain score, the traditional *galah* game based on deep learning proved more effective in improving students' physical literacy than the traditional *sondah* game based on deep learning.

DISCUSSION

The results of the study indicate that traditional games based on deep learning significantly improved elementary school students' physical literacy. Based on paired sample t-test analysis, both treatment groups, the traditional *galah* game and the traditional *sondah* game, experienced significant improvements in physical literacy after receiving the learning treatment. However, independent sample t-test results indicated that the traditional *galah* game based on deep learning had a greater impact than the traditional *sondah* game based on deep learning.

These findings suggest that game characteristics influence the quality of movement experiences and student engagement during physical education learning. Traditional *galah* games are group games that involve dynamic physical activities such as running, moving quickly, dodging, defending the playing area, and working together as a team to achieve game goals. These activities provide opportunities for students to develop various domains of physical literacy, particularly the physical, psychological, social, and cognitive domains simultaneously. This is evident in the results, which show that the *galah* group achieved a higher average gain score than the *sondah* group in almost all physical literacy domains. Theoretically, the results of this study align with the concept of physical literacy, which emphasizes the integration of physical competence, motivation, self-confidence, knowledge, and social engagement in lifelong physical activity (Barnett et al., 2020; Cairney et al., 2019; Shearer et al., 2018; Whitehead, 2001).

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Traditional pole-walking activities enable students to gain more complex and contextual movement experiences through locomotor activity, changes of direction, decision-making, team communication, and game strategies, all dynamically implemented in realistic play situations. This game requires students to actively move, maintain body coordination, read game situations, and collaborate with team members to achieve a common goal. This environment provides a movement learning experience that is not only physical but also integrates students' cognitive, social, and emotional aspects. Furthermore, pole-walking also provides students with the opportunity to develop movement competence through various basic movement skills such as running, dodging, maintaining balance, agility, and body coordination. Active and enjoyable play activities can increase students' intrinsic motivation and confidence in physical activity. This aligns with research (Hilmi et al., 2025), which states that traditional games effectively improve students' motor skills, motivation, self-confidence, and understanding of the importance of physical activity in daily life.

The characteristics of the traditional pole game, which emphasize teamwork, strategy, sportsmanship, and social interaction, also provide a more meaningful learning experience for elementary school students. Research (Nurhikmah et al., 2025) explains that the pole game contains elements of movement, strategy, cooperation, and sportsmanship that can strengthen students' motor skills and social behavior in Physical Education (PJOK) learning. Meanwhile, (Anitra et al., 2026) emphasize that traditional games serve not only as a means of entertainment but also as a medium for character building, strengthening social interaction, and developing students' critical thinking and collaboration skills. These research findings also support Whitehead's view that physical literacy develops through meaningful movement experiences and involves active interaction between individuals and the physical activity environment (Scott et al., 2021; Shearer et al., 2018; Whitehead, 2001). In this context, the traditional *galah* game provides an authentic, enjoyable, and interactive physical activity experience that fosters the holistic development of students' physical, psychological, social, and cognitive domains.

Furthermore, the application of a deep learning approach to learning contributes to improving students' physical literacy. The implementation of the principles of mindful, meaningful, and joyful learning enables students not only to engage in physical play activities but also to understand learning objectives, reflect on their playing experiences,

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and connect them to their daily lives (Rahmawati et al., 2025). This active, reflective, and enjoyable learning process enables students to be more emotionally and socially engaged during the learning process. This finding aligns with that of (Fauziah et al., 2025), who stated that the deep learning approach can create a more engaging learning experience. In-depth, relevant, and meaningful learning for elementary school students.

The traditional game of *Sondah* also demonstrated a significant impact on improving students' physical literacy, although the improvement was lower than that of the pole vault. *Sondah* emphasizes balance, body coordination, concentration, agility, and individual movement control through the activity of jumping on one leg, maintaining body stability, and avoiding mistakes when moving between squares. This activity provides strong stimulation for students' physical and psychological development, particularly in aspects of movement coordination, focus, balance, and self-control.

Research (Riasianita et al., 2024) explains that *Sondah* can improve children's kinesthetic intelligence through jumping movements, maintaining balance, eye-foot coordination, and the ability to support the body while moving. Furthermore, *Sondah* also contributes to students' social and emotional development. Similarly, (Rahmat & Nur, 2024) explain that the traditional game of *Sondah* can improve students' social skills, such as cooperation, empathy, communication, assertiveness, and self-control through play activities and group discussions during the game. However, the individual performance-oriented nature of *sondah* games results in a relatively lower intensity of social interaction and collective movement activity compared to pole vault games.

In pole vault games, students are required to actively move in dynamic team situations, engage in continuous team communication, develop joint strategies, and make quick decisions in a competitive context. Conversely, in *sondah* games, movement activities focus more on individual balance and precision, thus limiting stimulation of the social domain, active engagement, and contextual movement experiences.

The results of this study also reinforce previous research findings that traditional games positively contribute to the development of physical activity, movement skills, learning motivation, and social interaction in elementary school students (Astuti & Apriliani, 2025; Hambali et al., 2025). Traditional games provide contextual, active, and enjoyable learning experiences, thereby increasing student engagement in physical education lessons. Furthermore, integrating traditional games with a deep learning approach can

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create more reflective and meaningful learning, enabling students not only to actively move but also to understand the value, purpose, and benefits of physical activity in their lives. Based on the research results, the physical domain experienced the highest improvement in both treatment groups. This indicates that deep learning-based traditional game activities are highly effective in improving elementary school students' motor skills. However, improvements also occurred in the psychological, social, and cognitive domains, confirming that physical literacy is a multidimensional concept that develops through holistic and meaningful physical activity experiences.

Although this study showed positive results, it still has several limitations. The study was conducted in only one elementary school with a relatively limited sample size, so generalization of the results requires caution. Furthermore, this study only examined the effect of traditional games like *galah* and *sondah* on elementary school students' physical literacy over a specific period. Therefore, further research is recommended to involve a larger sample size, a wider variety of traditional games, and examine the long-term impact of deep learning-based learning on students' physical literacy development.

CONCLUSION

Based on the research results, traditional games based on deep learning have a significant impact on improving the physical literacy of elementary school students. Both traditional games, the *galah* and *sondah*, have been shown to improve students' physical literacy after being given learning interventions. However, the traditional *galah* game based on deep learning demonstrated a greater impact than the traditional *sondah* game based on deep learning. These findings indicate that the game's characteristics, which involve dynamic physical activity, social interaction, teamwork, and decision-making, contribute optimally to the development of the physical, psychological, social, and cognitive domains of physical literacy.

Furthermore, the implementation of a deep learning approach through the principles of mindful learning, meaningful learning, and joyful learning, can create a more active, reflective, and meaningful learning experience for elementary school students. Therefore, traditional games based on deep learning can be an innovative and effective alternative to physical education instruction to support the development of elementary school students' physical literacy.

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