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Implementation of Net Games at the Discover Fundamental Stage on Physical Literacy of Elementary School Students

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ABSTRACT

The level of physical activity among Indonesian children remains low according to the World Health Organization (WHO), particularly at the discover fundamental stage (children aged 6–9 years), largely due to insufficient physical literacy. One approach to improving physical literacy through sport is the implementation of net games. This study aimed to determine the effect of net game implementation on the physical literacy of students at the discover fundamental stage. A pre-experimental method with a one-group pretest–posttest design was employed. The research instrument was the Canadian Assessment of Physical Literacy, Second Edition (CAPL-2). The sample consisted of 33 third-grade students of SDN Gudang II, Tanjungsari District, Sumedang Regency, selected through purposive sampling. Shapiro–Wilk normality tests and paired sample t-tests were subsequently conducted. Normality test results for both pretest and posttest yielded significance values above 0.05, confirming normal data distribution across all domains. The paired sample t-test produced a significance value of 0.001 ($p < 0.05$) for all domains, indicating statistically significant differences between pretest and posttest scores. These findings demonstrate that the implementation of net games significantly enhances the physical literacy of students at the discover fundamental stage.

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INTRODUCTION

Physical inactivity has been recognized as the fourth leading risk factor for global mortality. This trend is increasing across many countries and has contributed significantly to the rising burden of Non-Communicable Diseases (NCDs) and the overall deterioration of public health (WHO, 2010). In Indonesia specifically, physical activity levels among children remain low and fail to meet WHO recommendations, particularly at the discover fundamental stage (children aged 6-9 years). Data indicate that more than half of Indonesian children (57.3%) are classified as physically inactive, with the majority (55.2%) spending two or more hours per day engaging with screen-based media such as television, computers, or gaming consoles. The proportion of inactive boys (62.8%) is also higher than that of girls (52.3%) (Harahap, as cited in Rosiana, 2023).

Low levels of physical activity are a contributing factor to the insufficient physical literacy observed among children at the discover fundamental stage. Physical literacy refers to an individual's capacity to recognize, understand, and participate in physical activity in ways that contribute to an enhanced quality of life (Kusumawati, as cited in Rosiana et al., 2023). This concept extends beyond motor skill proficiency to encompass a comprehensive understanding of the benefits of physical activity and the ability to integrate such knowledge into daily routines (Bachtiar, as cited in Keliat, 2019).

The low level of physical literacy among Indonesian children is a pressing concern, given its substantial influence on health outcomes, motor development, and overall quality of life (Putri et al., 2025). Schools play an essential role in fostering physical literacy through physical education lessons and extracurricular sporting activities. Physical activities delivered in an enjoyable manner can help children develop motor skills and contribute to character formation in later life.

One approach to enhancing physical literacy through sport is the implementation of net games. Net games place particular emphasis on the development of fundamental movement skills, including locomotor movements, object-control skills, balance, and agility. Moreover, net games can cultivate sequential foundational sport skills, enabling students to execute desired movements in accordance with the rules of the activity. This approach effectively addresses the movement skill deficiencies commonly observed among students, including striking, catching, and jumping (Arisandi, 2025).

Net games are a category of sport that utilizes a net as a court divider, separating the playing area into two zones. These sports can be played individually or in teams. Points are scored when a player successfully sends the ball or playing object into the opponent's court so that it contacts the ground, with the objective that the opponent is unable to return it over the net. Sports classified in this category include volleyball, table tennis, lawn tennis, badminton, and sepak takraw (Wibowo, 2014).

The discover fundamental stage is a critical developmental phase that plays a pivotal role in nurturing a lifelong appreciation for sport. It is characterized by the development of fundamental movement skills and the cultivation of enjoyment in physical activity. This stage is typically applicable to boys aged 6-9 years and girls aged 6-8 years (Carlsson, 2021). The fundamental stage must be structured and enjoyable, with an emphasis on developing foundational movement literacy and basic movement skills. In order to develop fundamental movement literacy, participation in activities involving speed and endurance elements must be introduced in an engaging and enjoyable manner through purposeful games (Carlsson, 2021).

A growing body of research has investigated physical literacy across different populations. Bachtiar et al. (2024) conducted a program to enhance physical literacy in adolescents,

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encompassing physical literacy assessments via questionnaires, anthropometric measurements, educational presentations, exercise and games, poster distribution, and follow-up health promotion through digital platforms. Husnan et al. (2023) assessed physical literacy and physical fitness levels of elementary school and Islamic elementary school students. Ikhsanto et al. (2023) examined the contributions of physical literacy, sport enjoyment, and physical activity to physical fitness among elementary school students in East Java. Arisandi (2025) investigated physical literacy in early childhood, employing a developmental approach targeting both fine and gross motor skills alongside an understanding of the importance of physical activity for long-term health. Putri et al. (2025) also examined physical literacy among elementary school students, although the specific age group of participants was not explicitly reported.

Based on the foregoing, it is evident that research specifically focused on the discover fundamental stage and on how this stage can be leveraged to enhance students' physical literacy remains limited. Furthermore, no study has to date specifically examined the effectiveness of net games at the discover fundamental stage in improving physical literacy. It is therefore necessary to investigate whether the implementation of net games produces measurable improvements in the physical literacy of students at the discover fundamental stage.

METHODS

This study employed a pre-experimental method, which is a form of quantitative research designed to examine cause-and-effect relationships between variables. This method is appropriate when variable control is difficult to achieve or when a full experimental design is not feasible in the given research context (Rukminingsih et al., 2020).

A one-group pretest posttest design was adopted. This design involves a single group of participants measured twice, once before the intervention (pretest) and once after its completion (posttest), with the aim of comparing outcomes between the two measurement points to determine whether a significant change occurred following the intervention (Rukminingsih et al., 2020).

Participants

The study population comprised all 238 students enrolled at SDN Gudang II, Tanjungsari District, Sumedang Regency. Population refers to the entire set of data, individuals, objects, or phenomena that are the object of interest in a research study (Darmawan, as cited in Purwanza et al., 2022; Suharyadi & Purwanto, as cited in Purwanza et al., 2022).

Sampling Procedures

The sample consisted of 33 third-grade students aged 6-9 years (discover fundamental stage) from SDN Gudang II, Tanjungsari District, Sumedang Regency. A purposive sampling technique was employed, whereby the researcher selected participants based on several deliberate considerations, including the research problem, study objectives, research hypotheses, methodology, and instrument requirements. Purposive sampling is a method of obtaining a sample by selecting participants from the population according to the researcher's judgment. The researcher determined that the information required could be obtained from a specific target group capable of providing the necessary information, as that group possessed relevant characteristics and met the criteria established by the researcher (Asrulla et al., 2023).

Materials and Apparatus

Physical literacy was assessed using the Canadian Assessment of Physical Literacy, Second Edition (CAPL-2). This instrument encompasses four domains of physical literacy: (1)

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Motivation and Confidence, (2) Knowledge and Understanding, (3) Physical Competence, and (4) Daily Behavior. In the present study, however, assessment was limited to three of the four domains; the Daily Behavior domain was excluded due to equipment constraints. The CAPL-2 represents an updated and more refined assessment protocol, having been validated on a sample of over 10,000 children in Canada. This extensive validation renders the protocol more accurate and reliable in reflecting a child's level of physical literacy. The second edition was developed by the Healthy Active Living and Obesity Research Group (HALO), with contributions from more than 100 researchers and practitioners across related disciplines

Data Analysis

Data obtained from the pretest and posttest were analyzed quantitatively to determine the effect of net game implementation at the discover fundamental stage on the physical literacy of elementary school students, using IBM SPSS Statistics Version 29. The first step involved compiling pretest and posttest scores and computing descriptive statistics to characterize the data, including minimum and maximum values, mean, and standard deviation. The Shapiro-Wilk normality test was selected given the relatively small sample size of 33 students. If the data were found to be normally distributed, hypothesis testing would proceed using a paired sample t-test to determine whether a statistically significant difference existed between pretest and posttest scores. The decision rule stipulated that if $p \leq 0.05$, H_o would be rejected and H_1 accepted. If the data were not normally distributed, the Wilcoxon signed-rank test would be applied instead.

RESULTS

To provide an overview of students' physical literacy before and after the intervention, descriptive statistics were calculated for each assessed domain. The results include the minimum score, maximum score, mean, and standard deviation for both the pretest and posttest measurements. These descriptive data offer an initial indication of changes in students' physical literacy following the implementation of the net game intervention.

Table 1. Descriptive Statistics of Pretest Scores by Domain

Domain	N	Min	Max	Mean	Std. Dev.
Motivation and Confidence	33	9.90	22.80	15.245	3.1858
Knowledge and Understanding	33	1.00	5.00	3.06	1.273
Physical Competence	33	7.64	20.71	15.0258	3.20454

Table 1 presents the descriptive statistics of students' physical literacy prior to the intervention. The highest mean score was observed in the Motivation and Confidence domain (M = 15.25, SD = 3.19), followed by Physical Competence (M = 15.03, SD = 3.20). The Knowledge and Understanding domain recorded the lowest mean score (M = 3.06, SD = 1.27), indicating relatively limited knowledge and understanding of physical activity concepts before the intervention.

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Table 2. Descriptive Statistics of Posttest Scores by Domain

Domain	N	Min	Max	Mean	Std. Dev.
Motivation and Confidence	33	13.40	26.40	20.555	3.4681
Knowledge and Understanding	33	4.00	9.00	5.97	1.357
Physical Competence	33	8.00	21.07	15.925	3.36944

As shown in Table 2, all domains demonstrated higher mean scores following the intervention. The Motivation and Confidence domain increased from 15.25 to 20.56, while the Knowledge and Understanding domain increased from 3.06 to 5.97. Similarly, the Physical Competence domain showed an increase from 15.03 to 15.93. These findings provide preliminary evidence that the net game intervention contributed positively to students' physical literacy development across affective, cognitive, and physical domains.

Prior to hypothesis testing, the normality of the data distribution was examined using the Shapiro-Wilk test. This procedure was selected because the sample size was fewer than 50 participants. The results of the normality test are presented in Table 3.

Table 3. Shapiro–Wilk Normality Test Results by Domain

Domain	Test	Statistic	df	Sig.	Distribution
Motivation and Confidence	Pretest	0.950	33	0.134	Normal
	Posttest	0.977	33	0.690	Normal
Knowledge and Understanding	Pretest	0.901	33	0.125	Normal
	Posttest	0.929	33	0.291	Normal
Physical Competence	Pretest	0.967	33	0.411	Normal
	Posttest	0.953	33	0.167	Normal

The results presented in Table 3 indicate that all pretest and posttest scores were normally distributed, as evidenced by significance values greater than 0.05. Specifically, the p-values ranged from 0.125 to 0.690 across all domains. Therefore, the assumption of normality was satisfied, justifying the use of parametric statistical analysis. Consequently, a paired-samples t-test was conducted to determine whether significant differences existed between pretest and posttest scores.

Following confirmation that the data met the normality assumption, a paired-samples t-test was performed to evaluate the effectiveness of the intervention by comparing pretest and posttest scores in each physical literacy domain.

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Table 4. Paired Sample t-Test Results by Domain

Domain	Comparison	Two-Sided p	Decision
Motivation and Confidence	Pretest- Posttest	0.001	H_o Rejected
Knowledge and Understanding	Pretest - Posttest	0.001	H_o Rejected
Physical Competence	Pretest - Posttest	0.001	H_o Rejected

As presented in Table 4, statistically significant differences were found between pretest and posttest scores across all physical literacy domains. The obtained p-values (p = .001) were lower than the established significance level of .05, resulting in the rejection of the null hypothesis. These findings indicate that the implementation of net games significantly improved students' Motivation and Confidence, Knowledge and Understanding, and Physical Competence. Therefore, the intervention was effective in enhancing the physical literacy of elementary school students during the Discover Fundamental stage.

DISCUSSION

The results of this study provide compelling empirical evidence that the implementation of net games significantly enhances the physical literacy of elementary school students at the discover fundamental stage. These findings are consistent with the theoretical argument that game-based physical activity interventions, when developmentally aligned, are effective vehicles for fostering physical literacy in children (Whitehead, 2010; Mandigo et al., 2012). The statistically significant improvements observed across all three CAPL-2 domains, Motivation and Confidence, Knowledge and Understanding, and Physical Competence, collectively confirm that net games address the multi-dimensional nature of physical literacy, extending beyond motor skill development to encompass affective and cognitive dimensions.

The substantial improvement observed in the Motivation and Confidence domain (mean gain = 5.31 points; Δ = +34.8%) is particularly noteworthy. This domain encompasses children's self-efficacy beliefs and intrinsic motivation toward physical activity, which Cairney et al. (2019) identified as the most predictive affective factors for long-term physical activity participation. The enjoyable and cooperative nature of net game activities likely contributed to positive emotional experiences during physical education, thereby strengthening students' sense of competence and willingness to engage in future physical activity (Siedentop et al., 2011). This finding aligns with Self-Determination Theory, which posits that physical activities that satisfy basic psychological needs, including autonomy, competence, and relatedness,foster intrinsic motivation and sustained engagement (Wright & Burrows, 2006). The structured but playful nature of modified net games may have provided an optimal environment for need satisfaction at this developmental stage.

The most pronounced relative improvement was observed in the Knowledge and Understanding domain, where mean scores nearly doubled from pretest to posttest (Δ = +95.1%). This domain assesses students' comprehension of physical activity concepts, health benefits of movement, and sport-specific rules and strategies. The marked improvement in this domain suggests that the net game intervention was effective not only as a physical activity medium but also as a pedagogical tool for delivering conceptual knowledge about physical activity and sport. Mitchell et al. (2013), in their seminal work on tactical games approaches, demonstrated that game-based learning facilitates the simultaneous development of tactical awareness and conceptual understanding of sport, as students must

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actively think about game problems during play. The pretest scores in this domain were the lowest across all three domains (mean = 3.06 out of a maximum of 9 at posttest), suggesting considerable room for improvement, which may partly account for the magnitude of the observed gain. Future studies should examine whether this knowledge gain is durable over time, as knowledge retention and transfer are critical components of physical literacy development (Tremblay & Lloyd, 2010).

The Physical Competence domain, which encompasses fundamental movement skills, object control, and locomotor abilities, showed a statistically significant improvement, though the absolute magnitude of change was comparatively modest (mean gain = 0.899 points; Δ = +6.0%). This result is consistent with the existing literature indicating that fundamental movement skill development in children is a gradual process that typically requires sustained, progressive intervention over an extended period (Lubans et al., 2010; Okely et al., 2004). The relatively short duration of the present intervention may therefore have limited the magnitude of observable physical competence gains. Nevertheless, the statistically significant improvement within the intervention timeframe is promising and suggests that net games provide an appropriate stimulus for physical skill development at the discover fundamental stage. The physical demands inherent in net games, including rapid directional changes, eye-hand coordination, postural control, and dynamic balance, are directly aligned with the foundational motor competencies targeted by the CAPL-2 Physical Competence domain (Longmuir et al., 2017).

The selection of the CAPL-2 as the measurement instrument strengthens the validity and comparability of the present findings within the international physical literacy literature. The CAPL-2 was developed and validated through an extensive, multi-stakeholder process involving over 10,000 Canadian children and more than 100 researchers and practitioners (Francis et al., 2016). Its multi-domain structure enables a comprehensive assessment of physical literacy that goes beyond single-domain instruments, thereby capturing the holistic nature of the construct as conceptualized by Whitehead (2013). However, it is acknowledged that the exclusion of the Daily Behavior domain in the present study represents a limitation, as habitual physical activity patterns are a critical component of physical literacy and may be differentially influenced by net game participation. Future studies should endeavor to administer all four CAPL-2 domains to enable a complete assessment of the intervention's impact.

From a pedagogical perspective, the effectiveness of net games in improving physical literacy can be attributed to several interrelated mechanisms. First, net games inherently require repetitive execution of fundamental movement patterns, particularly striking, tracking, and repositioning movements, which provide multiple learning trials per session and facilitate the development of automaticity in motor skill execution (Lubans et al., 2010). Second, the social and interactive dimensions of net games promote peer learning and cooperative engagement, which are recognized as important contextual factors in physical literacy development (Sport for Life Society, 2019). Third, the rule-governed structure of net games provides a meaningful context for knowledge application, enabling students to connect physical activity concepts to real game situations, thereby supporting the integration of cognitive and physical dimensions of literacy (Griffin & Butler, 2005).

These findings also carry significant implications within the Long-Term Athlete Development (LTAD) framework. The discover fundamental stage, as described by Carlsson (2021) and the Sport for Life Society (2019), is explicitly identified as the developmental window during which the foundations of fundamental movement skills and positive physical activity attitudes must be established. Failure to develop these foundations during this

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sensitive period is associated with reduced physical activity participation and lower physical literacy in adolescence and adulthood (Kirk, 2005). The present findings therefore suggest that net game interventions implemented during the discover fundamental stage can contribute to the broader LTAD objective of producing physically literate individuals capable of sustaining active lifestyles.

Several limitations of the present study should be acknowledged. The pre-experimental design with a single group and the absence of a control group limit the internal validity of the findings, as changes in physical literacy scores cannot be unequivocally attributed to the net game intervention in the absence of a comparison condition. Selection bias is also possible given the use of purposive sampling. The exclusion of the Daily Behavior domain from the CAPL-2 assessment represents a further constraint. Additionally, the duration of the intervention was not explicitly reported, which limits the ability to assess dose, response relationships. Future research should employ randomized controlled or quasi-experimental designs with matched control groups, incorporate all four CAPL-2 domains, and investigate the long-term retention of physical literacy gains following net game interventions. Studies comparing the relative efficacy of different game categories, such as invasion games, striking and fielding games, and net games, in promoting physical literacy at the discover fundamental stage would also advance the evidence base.

CONCLUSION

This study concludes that net games are effective in enhancing the physical literacy of elementary school students at the discover fundamental stage. The intervention improved students' motivation and confidence, knowledge and understanding, and physical competence, indicating that net games can serve as a meaningful and developmentally appropriate strategy for promoting physical literacy in physical education.

AUTHORS' NOTE (Jangan di hapus)

The authors declare that there is no conflict of interest regarding the publication of this article. The authors confirmed that the paper was free of plagiarism.

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