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The Influence of the Blended Learning Model on Fifth-Grade Students' Motivation in Physical Education at SD Aisyiyah Sukabumi

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Sections Info	ABSTRACT
	Objective : This study aims to examine the effect of the blended learning model on learning motivation in physical education for fifth-grade students at SD Aisyiyah, Sukabumi. **Method:** The research employed a quantitative pre-experimental design using a One-Group Pretest-Posttest Design. The population consisted of all fifth-grade students, and a sample of 21 students was selected using cluster random sampling within a probability sampling framework. The data were analyzed using descriptive statistics and a paired-sample t-test. The collected data were analyzed using descriptive statistics and a paired sample t-test. **Results:** The analysis demonstrated an increase in student learning motivation after the implementation of blended learning. The pretest produced a mean score of 27.04 (SD=9.255), while the posttest mean score increased to 38.00 (SD=3.619). The paired-sample t-test yielded a significance value of 0.000 (<0.05), that the blended learning model had a significant effect on students' learning motivation. **Novelty:** This study contributes to the existing literature on blended learning by emphasizing its effectiveness in enhancing motivation in physical education, an area that often receives less attention compared to academic subjects. The findings offer empirical evidence that blended learning can be a valuable approach in elementary school to promote students' engagement and motivation in physical activity learning.

INTRODUCTION

Physical Education faces uniquely complex challenges during the shift to digital and blended learning. Unlike other subjects that can be fully adapted into online formats, physical education fundamentally requires physical activity, direct interaction, and the use of sports facilities that cannot be fully replicated through digital platforms. Limited space for movement at home, insufficient sports equipment, and teachers' difficulty in monitoring and assessing students' motor performance in real time become significant obstacles in implementing online learning. Additionally, the social and collaborative dimensions that are the essence of physical education such as team games, sportsmanship, and interpersonal physical interaction are extremely difficult to facilitate through computer screens. Technical challenges, including unstable internet connectivity, limited digital literacy among teachers and students, and unequal access to technology across regions, further complicate the situation. Moreover, student motivation and engagement in physical activities tend to decline when learning is conducted independently at home, without direct supervision or the competitive atmosphere typically found in the school environment. This condition threatens the core objectives of physical education: developing students' physical fitness, motor skills, and character.

The ultimate aim of education extends beyond the mere transfer of knowledge. Its essential purpose is to cultivate character and values that shape ethical and responsible citizens in the digital age (Harrison et al., 2022). By focusing on both societal well-being

and personal development, education acts as the fundamental mechanism for progress, particularly in addressing the complex challenges of 21st-century learning environments where character development must be integrated with digital competencies (Agboola & Tsai, 2012). However, recent studies reveal significant gaps in implementing holistic education, especially in post-pandemic contexts where blended learning has exposed disparities in pedagogical readiness and technological infrastructure (Rasmitadila et al., 2020). In Indonesia specifically, research suggests that although national policies emphasize character education (*Pendidikan Karakter*), teachers face substantial challenges in integrating these values within technology-mediated instruction, particularly in schools with limited resources and inadequate professional development opportunities (Ekantini, 2022). Every individual is inherently obligated, as a member of society, to educate and be educated. Yet, the transition to blended and digital learning has created new barriers that disproportionately affect students and educators in under-resourced settings.

Within this broad framework, Physical Education, Sports, and Health serves as a crucial medium for comprehensive development. Activities within this subject area foster essential aspects of growth, including physical development and motor skill acquisition, both of which are fundamental to a healthy life. Simultaneously, the subject encourages psychological development and the acquisition of knowledge related to health and wellness. In essence, it is an indispensable component of the educational structure, ensuring that students experience holistic and balanced development.

Most importantly, Physical Education, Sports, and Health is uniquely positioned to nurture values that shape students' character. Through the structured sports and physical activity, participants learn to internalize key ethical and interpersonal principles such as resilience, emotional stability, teamwork, sportsmanship, and spiritual maturity. These values make the subject an essential part of the broader educational mission to cultivate strong and responsible character.

Physical education is a compulsory school subject, even at the elementary level and fully integrated into the educational curriculum. Its primary goal is to develop students' physical, mental, emotional, and social fitness through physical activity. According to Bailey (2006), physical education is fundamentally concerned with learning through the physical, emphasizing the educational process that occurs through carefully selected physical activities and games designed to achieve specific educational objectives. In this context, teachers act as motivators and facilitators who play a vital role in conveying the significance of physical education and sports as a means for development.

The COVID-19 pandemic necessitated a shift from traditional face-to-face instruction to online learning, requiring students to study from home using digital platforms. This transition has proven particularly challenging for physical education and sports classes. Many students reported falling behind in the material and failing to complete assigned tasks. This is largely due to a lack of student motivation and awareness, stemming from boredom and disengagement with distance learning.

Blended learning combines face-to-face and online activities, combining traditional classroom instruction with digital learning experiences (Garrison, 2008; Graham et al., 2013). This modern model, driven by rapid technological advances, offers an important solution: it allows Physical Education classes to continue even when students cannot attend in person. Because blended learning enables students to learn both offline and online. This e-learning approach is highly recommended during the COVID-19

pandemic. As a result, educators must innovate by adopting learning models to increase student motivation.

Learning motivation refers to an internal state within an individual state that drives students to engage in learning activities to achieve a specific goal. In educational contexts, motivation is naturally oriented toward creating the psychological conditions that drive a person's enthusiasm for learning (Ryan & Deci, 2000a). Essentially, It is the inner force that triggers behaviors aimed at accomplishing a desired objective.

In Physical Education, Sports, and Health, motivation plays critical role for re-engaging students. Its primary role is to renew students' desire to learn, which can be observed through their active participation in learning activities, especially when utilizing a blended learning method. By applying various motivational strategies, educators can bridge the gap between passive attendance and genuine involvement, ensuring that students appreciate both the physical and theoretical components of the subject.

Effective motivational techniques ultimately determine the longevity of a student's learning journey. Motivation is not a static but a dynamic process that requires continuous reinforcement. In blended learning environments, motivation acts as the psychological fuel that encourages students to take ownership of their education, manage their time across platforms, and persist through challenging tasks. A well-motivated student in a blended Physical Education, Sports, and Health environment will actively participate in physical practice, engage in online discussions, and demonstrate sustained interest, ultimately translating their enthusiasm into improved motor skills, better health literacy, and a lifelong commitment to physical activity.

Based on the interview conducted by the researcher with physical education teachers at SD Aisyiyah Sukabumi on January 20, 2021, distance learning was found to be extremely boring for students, particularly for physical education lessons. The practical nature of the subject made completing assignments difficult, leading to low student motivation. Students tended to prefer choose playing over doing schoolwork at home. The interview also highlighted several obstacles to online learning:
1. Many parents are not technologically proficient (tech-illiterate).
2. Some parents lack the time or tools to assist their children with assignments.
3. Learning relied exclusively on a limited number of applications, neglecting other available platforms.

The author is interested in conducting research on the implementation of a blended learning model for Physical Education, Sports, And Health at SD Aisyiyah Sukabumi. The primary challenge being addressed is the significant decline in student learning motivation during the pandemic. In response to this, the author advocates for a modern learning approach that leverages technology and the internet to support the teaching and learning process. Educators must be creative and innovative in selecting models that can effectively restore students' enthusiasm.

The blended learning model is proposed as the most suitable solution for Physical Education, Sports, and Health instruction at this time. Its strength lies in its ability to combine both online and face-to-face learning components. This hybrid approach offers a much-needed balance, ensuring that students are not solely confined to remote, online instruction. By reintroducing in-person sessions, the model aims to revitalize students directly, revitalize their interest, and ultimately boost their motivation to actively

participate in learning process. The research focuses on evaluating the effectiveness of this blended model in restoring student motivation and optimizing learning outcomes.

RESEARCH METHOD

This study employed a quantitative approach using a pre-experimental design with a One-Group Pretest-Posttest Design. This design was selected to examine the effect of the blended learning model on students' learning motivation in physical education. The research was conducted over one semester (approximately 16 weeks) during the 2021 academic year at SD Aisyiyah Sukabumi, Indonesia.

The population of this study consisted of all fifth-grade students at SD Aisyiyah Sukabumi. A sample of 21 students from one intact class was selected using purposive sampling. This technique was deemed appropriate because the class was intentionally chosen based on its representativeness, accessibility, and participation in blended learning activities during the pandemic. According to Ahmad & Wilkins (2025), purposive sampling is suitable when the researcher selects participants who best represent the characteristics relevant to the study's objectives. The selected class represented a heterogeneous group of students with varying levels of physical education competence and technological literacy. The research was conducted in three main phases over one semester.

1. **Phase 1: Pre-Implementation (Weeks 1-2)**

During this phase, preliminary observations were conducted and the pretest was administered to measure students' baseline learning motivation. Coordination with school administrators and physical education teachers was established to ensure the smooth implementation of the blended learning model.

2. **Phase 2: Implementation (Weeks 3-14)**

The blended learning model was implemented for 12 weeks, combining face-to-face instruction with online learning activities. The implementation schedule consisted of:
   a. Face to face sessions: Two meetings per week (60 minutes each), focusing on practical physical activities, motor skill development, and direct instruction.
   b. Online sessions: Asynchronous learning activities delivered through learning management platforms, including video tutorials, interactive quizzes, discussion forums, and assignment submissions.

The blended learning activities were structured as follows:
   a. Pre class online activities; Students accessed instructional videos and reading materials before face-to-face sessions
   b. In class activities; Practical physical education exercises, group activities, and skill demonstrations
   c. Post-class online activities, Reflection assignments, peer discussions, and supplementary practice exercises

3. **Phase 3: Post Implementation (Weeks 15-16)**

The posttest was administered to measure changes in students' learning motivation after the intervention. Data analysis and interpretation were also conducted during this phase. The primary instrument used in this study was a learning motivation questionnaire adapted from the ARCS (Attention, Relevance, Confidence, Satisfaction) model developed by Keller (2009). The questionnaire consisted of 40 items measured

using a 5-point Likert scale, ranging from 1 (strongly disagree) to 5 (strongly agree). The instrument assessed four dimensions of learning motivation:

1. Attention (10 items), Measures students' interest and curiosity in learning activities.
2. Relevance (10 items), Assesses the perceived usefulness and connection to students' needs.
3. Confidence (10 items), Evaluates students' belief in their ability to succeed.
4. Satisfaction (10 items), Measures students' sense of accomplishment and enjoyment.

The instrument underwent validity testing using expert judgment and was piloted with 30 students from a different school. Reliability testing using Cronbach's alpha yielded a coefficient of 0.89, indicating high internal consistency (Taber, 2018). Data were collected through direct administration of the learning motivation questionnaire at two time points: before (pretest) and after (posttest) the implementation of the blended learning model. Additional observational notes were recorded throughout the intervention period to provide contextual supporting for quantitative findings. Data analysis was performed using SPSS version 26.0 software and involved several procedures:

1. Descriptive Statistics, Mean, standard deviation, frequency distribution, and percentages were calculated to describe students' learning motivation levels
2. Normality Test, The Kolmogorov-Smirnov test was used to assess the normality of data distribution
3. Homogeneity Test, Levene's test was employed to examine the homogeneity of variance
4. Hypothesis Testing, A paired sample t-test was conducted to determine significant differences between pretest and posttest scores
5. Effect Size, N-Gain analysis was performed to measure the magnitude of change in learning motivation, calculated using the formula:

N-Gain = (posttest score - pretest score) / (maximum score - pretest score).

The significance level was set at $\alpha = 0.05$ for all statistical tests.

RESULTS
A. Descriptive Statistics of Learning Motivation

The analysis of students' learning motivation revealed substantial improvements following the implementation of the blended learning model. Table 1 presents the summary of descriptive statistics for both pretest and posttest measurements.

Table 1. Descriptive Statistics of Student Learning Motivation

Measurement	N	Mean	SD	Minimum	Maximum	Difference	N-Gain	Category
Pretest	21	27.04	9.255	12	42	10.96	0.68	Moderate
Posttest	21	38.00	3.619	30	45			

The results showed that the mean score of learning motivation increased from 27.04 (SD = 9.255) in the pretest to 38.00 (SD = 3.619) in the posttest, representing a gain of 10.96 points. The N-Gain value of 0.68 falls within the moderate category ($0.70 > g \geq 0.30$), indicating that the blended learning intervention resulted a meaningful improvement in students' learning motivation (Hake, 1999). Furthermore, the reduction in standard deviation from 9.255 to 3.619 indicates that students' motivation levels became more homogeneous after the intervention, with fewer extreme variations in scores.

B. Assumption Testing

1. Normality Test

The Kolmogorov-Smirnov test was conducted to assess whether the data met the assumption of normal, which is a prerequisite for conducting parametric statistical analysis.

Table 2. Normality Test Results

Data	Kolmogorov-Smirnov Statistic	df	Sig.	Distribution
Pretest	0.122	21	0.144	Normal
Posttest	0.134	21	0.104	Normal

The normality test results indicated that both pretest (sig. = 0.144) and posttest (sig. = 0.104) score were normally distributed, as their significance values exceeded the 0.05 threshold. This finding confirmed that the data satisfied the assumptions required for parametric analysis, thereby allowing for the use of paired sample t-test (Field, 2024).

2. Homogeneity Test

Levene's test was conducted to examine the homogeneity of variance between pretest and posttest groups.

Table 3. Homogeneity Test Results

Levene Statistic	df1	df2	Sig.	Interpretation
0.899	1	40	0.129	Homogeneous

The homogeneity test produced a significance value of 0.129 (> 0.05), indicating that the variances between the two measurements were homogeneous. This result further supported the appropriateness of using parametric testing procedures (Tabachnick & Fidell, 2019).

3. Hypothesis Testing

A paired-sample t-test was conducted to determine whether the observed increase in learning motivation was statistically significant.

Table 4. Paired Sample T-Test Results

Paired Differences	Mean	SD	SE Mean	95% CI Lower	95% CI Upper	t	df	Sig. (2-tailed)
Pretest - Posttest	-10.960	9.550	2.084	-15.308	-6.612	-5.260	20	0.000

The results showed a significant difference between pretest and posttest scores ($t = -5.260$, df = 20, $p = 0.000$). The negative t-value indicates that posttest scores were significantly higher than pretest scores. With a significance level of $p < 0.05$, the null hypothesis (H_0) was rejected, and the alternative hypothesis (H_1) was accepted, confirming that the blended learning model had a significant positive effect on students' learning motivation in physical education. The effect size, calculated using Cohen (2013) was 1.51, which is considered a large effect according to conventional standards (Cohen, 2013). This suggests that the blended learning intervention not only produced statistically significant results but also had a substantial practical impact on students' learning motivation.

4. Analysis by Motivation Dimensions

To provide deeper insights, changes in each dimension of the ARCS model were analyzed separately.

Table 5. Mean Scores by Motivation Dimensions

Dimension	Pretest Mean	Posttest Mean	Difference	N-Gain
Attention	6.52	9.33	2.81	0.65
Relevance	6.81	9.57	2.76	0.71
Confidence	6.43	9.29	2.86	0.66
Satisfaction	7.28	9.81	2.53	0.73

All four dimensions showed moderate to high N-Gain values, with Satisfaction demonstrating the highest gain (0.73), followed by Relevance (0.71), Confidence (0.66), and Attention (0.65). This balanced improvement across all dimensions inidcates that the blended learning model effectively enhanced multiple components of learning motivation in a comprehensive manner.

Discussion

A. The Effectiveness of Blended Learning on Learning Motivation

The findings of this study provide robust evidence that the implementation of a blended learning model significantly enhances learning motivation among fifth-grade students in physical education. The substantial increase in mean scores from 27.04 to 38.00, alongside a statistically significant p-value of 0.000, indicates that combining face-to-face instruction with online learning activities creates a more engaging and motivating learning environment for young learners. These results align with previous research in blended learning contexts. Graham et al., (2013) emphasized that blended learning environments offer increased flexibility, improved access to learning materials, and enhanced opportunities for student engagement, all of which contribute to higher motivation. Similarly, Kintu et al., (2017) found that well-designed blended learning experiences positively influence student motivation by providing multiple learning opportunities that accommodate diverse learning styles and preferences.

The moderate N-Gain value of 0.68 indicates that while the intervention was effective, there is still room for further optimization. This finding aligns with the work of Hrastinski (2019), who noted that the effectiveness of blended learning depends on careful integration of online and face-to-face components, adequate technological infrastructure, and sufficient teacher preparation. Since this study employed a One-Group Pretest-Posttest design without a control group, the changes observed following the intervention cannot be fully attributed to the blended learning model alone; external factors may also have influenced the results. This limitation should be acknowledged when interpreting the findings.

B. Addressing Motivational Challenges in Online Physical Education

The context of physical education during the COVID-19 pandemic presents unique challenges that the blended learning model successfully addressed. Traditional online learning in physical education often struggles to maintain student engagement due to the inherently practical nature of the subject (Varea & González-Calvo, 2021).The interviewed teacher's observation that students found distance learning "very boring" and were "less motivated to participate" reflects a common challenge in remote physical education setting (Mercier et al., 2021).

The blended learning approach helped mitigated these challenges by integrating synchronous face-to-face practice sessions with asynchronous online components. This combination allowed students to engage the social interaction and physical activity of traditional physical education while also benefiting from the flexibility, accessibility, and

multimedia resources of online learning (Basilaia & Kvavadze, 2020). Furtheremore, The significant reduction in standard deviation from 9.255 to 3.619 indicates that the model was particularly effective in engaging students who initially showed low motivation, thereby creating a more equitable and inclusive learning environment.

C. Theoretical Implications

The dimensional analysis based on Keller (2009) ARCS model provides valuable theoretical insights. The high gains in all four dimensions, Attention (0.65), Relevance (0.71), Confidence (0.66), and Satisfaction (0.73), demonstrate that the blended learning model comprehensively addressed multiple motivational factors. The particularly strong improvement in Satisfaction (0.73) indicates that students derived considerable enjoyment and sense of accomplishment from the blended learning experience. This finding aligns with Self Determination Theory (Ryan & Deci, 2000), which posits that satisfaction of basic psychological needs for autonomy, competence, and relatedness are fulfilled. The blended format may have increased autonomy by allowing students greater control over their learning pace through online components, increased competence through structured and guided face-to-face practice, and strengthened relatedness through both in-person and virtual peer interactions.

The high Relevance score (0.71) indicates that students perceived the blended approach as meaningful and connected to their needs. This perception is crucial in physical education, where students must understand the relevance of physical activity to their health and well being (Ntoumanis et al., 2021). The integration of technology may have enhanced this relevance by by linking physical education to students' digital environments, making the subject feel more contemporary, accessible, and applicable to their daily lives.

D. Pedagogical Implications for Physical Education Teachers

The success of this intervention offers several practical implications for physical education teachers, particularly in contexts where traditional face-to-face instruction is limited or supplemented by technology.

1. Strategic Integration of Modalities, Teachers should carefully sequence online and face-to-face components to maximize complementarity. For example, online videos demonstrating techniques can prepare students for more effective face-to-face practice sessions (Rasheed et al., 2020).
2. Addressing Technological Barriers, The study context revealed challenges such as parents experiencing "technology stuttering" and lacking tools to support students with assignments. Successful implementation requires addressing these barriers through parent training, simplified technological interfaces, and alternative offline options for students with limited access (Dhawan, 2020).
3. Maintaining Physical Activity Levels, Although blended learning enhances motivation, teachers must ensure that online components supplement rather than replace physical activity. The World Health Organization (WHO) recommends that children engage in at least 60 minutes of moderate-to-vigorous physical activity daily (Bull et al., 2020), a guideline that should inform the balance between online and face-to-face learning.
4. Diversifying Online Applications, The research noted that "learning only utilizes certain applications, not using other applications." Effective blended learning should utilize diverse digital tools including video platforms, interactive quizzes, fitness-

tracking apps, and virtual collaboration spaces to maintain student interest and accommodate different learning preferences (Bower et al., 2015).

E. Comparative Analysis with Existing Research

The findings of this study corroborate and extend previous research on blended learning in physical education. Aunillah et al. (2018) similarly found that blended learning increased student motivation, though their study focused on fluid dynamics rather than physical education. The current study's emphasis on elementary-level physical education addresses an important gap in the literature, as much existing research on blended learning has concentrated on secondary or higher education settings (Dziuban et al., 2018). Manggabarani et al. (2016) reported that students in blended learning environments achieved higher learning outcomes than those in traditional face-to-face instruction. Although the current study did not directly compare blended learning to traditional instruction, the significant pretest posttest difference and the elimination of all "poor" and "fair" motivation categories suggest that blended learning may outperform purely online approaches that were necessitated by pandemic-related restrictions.

Wardani and Laksmita (2019) emphasized that technology-based learning enhances instructional effectiveness when integrated with appropriate pedagogical strategies. The incorporation of the ARCS model as a theoretical framework reinforces this principle, demonstrating that technological integration should be guided by sound motivational theory rather than being implemented for its own sake.

F. Limitations and Contextual Considerations

Several limitations warrant consideration when interpreting these findings. First, the one-semester timeframe provides evidence of short-term motivational gains but does not address whether these improvements persist over extended periods. Motivation can fluctuate based on novelty effects, and longitudinal research is needed to determine whether blended learning can sustains motivation across multiple academic years (Bernard et al., 2014). Second, the small sample size (n = 21) from a single school limits generalizability. Although the results are statistically significant and demonstrate a large effect size, replication with larger, more diverse samples across various geographical and socioeconomic contexts would strengthen confidence in the findings (Creswell & Creswell, 2017)

Third, the pre-experimental design lacks a control group, making it difficult to isolate the specific effects of blended learning from other potential confounding variables such as teacher enthusiasm, novelty effects, or maturation. Future research should employ randomized controlled trial designs to establish stronger causal inferences (Shadish, 2002). Fourth, the study relied exclusively on self-report questionnaires to measure motivation. Although well-validated, self-report instruments are subject to social desirability bias and may not fully capture observable behavioral indicators of motivation such as attendance, quality of participation, or sustained engagement (Paulhus & Vazire, 2007). Mixed-methods approaches incorporating observational data, teacher assessments, and physiological indicators would provide a more comprehensive understanding of motivational changes.

Finally, the specific context of the COVID-19 pandemic may have influenced the results. Students experiencing prolonged isolation and limited physical activity may have been particularly responsive to any return to structured physical education, potentially

amplifying the intervention's effects (Xiang et al., 2020). Building on this study's findings, several avenues for future research emerge,

1. Longitudinal Studies, Examining whether motivational gains persist beyond one semester and investigating how sustained blended learning implementation affects long-term physical activity habits and fitness outcomes.
2. Comparative Effectiveness Research, Conducting randomized controlled trials comparing blended learning with traditional face-to-face instruction and fully online approaches to identify the most effective instructional modality for various learning objectives.
3. Mechanism Studies, Investigating the specific mechanisms through which blended learning enhances motivation whether through increased autonomy, enhanced competence, improved relatedness, or other psychological pathways.
4. Technology Integration Studies, Exploring which technological tools, digital features, and pedagogical strategies within blended learning environments are most effective in motivating students in physical education.
5. Cultural and Contextual Variations, Examining how cultural factors, technological infrastructure, and socioeconomic variables moderate the effectiveness of blended learning in physical education across diverse international contexts.
6. Transfer Studies, Investigating whether motivational gains achieved in physical education through blended learning transfer to other academic subjects or influence students' physical activity engagement outside of school.

CONCLUSION

Fundamental Finding: This study reaffirms that blended learning is highly effective approach for enhancing elementary school students' learning motivation in physical education. By demonstrating consistent gains across all dimensions of the ARCS model, the findings underscore the model's comprehensive impact on students' motivational profiles. Ultimately, integrating face-to-face and digital instruction is not merely an emergency alternative but a powerful pedagogical strategy that strengthens the motivational foundations of physical education. **Implication**: Blended learning can meaningfully strengthen student engagement and motivation in Physical Education. The findings provide practical guidance for educators, especially in situations where traditional face-to-face instruction is constrained by technological developments or global challenges such as pandemics. Rather than viewing online and face-to-face instruction as competing approaches, educators are encouraged to integrate both modalities strategically. By leveraging the strengths of each format, blended learning can offer more flexible, engaging, and effective learning experiences. **Limitation**: This study has several methodological limitations that should be considered when interpreting its results. First, the relatively small sample size limits the generalizability of the findings to a broader population; therefore, the results should be viewed as preliminary and in need of replication across different populations and contexts. Second, the use of a One-Group Pretest-Posttest design without a control group makes it difficult to determine whether the observed changes solely the result of the intervention, as external factors may also have influenced the outcomes. Third, the use of a self-report questionnaire as the primary data collection instrument relies heavily on participants' honesty, subjective perceptions, and personal interpretations, which may introduce potential bias. **Future Research**: Future studies are recommended to employ a longitudinal design to observe changes and

the sustainability of intervention effects over a longer period, thereby providing a more comprehensive understanding of participants' developmental progress. In addition, comparative effectiveness research should be conducted by including a control group or comparing various instructional approaches to determine which intervention yields the most optimal outcomes within specific contexts. Subsequent research is also expected to expand the population and research settings to enhance the generalizability of the findings, as well as to integrated both qualitative and quantitative methods to gain deeper insights into the factors influencing the success of the intervention. Although the present study provides meaningful evidence supporting the effectiveness of blended learning in physical education, these recommended directions underscore the need to strengthen and broaden future investigations.

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