Embodied learning and academic motivation: physical activity intervention for students with low learning interest

Aprendizaje corporal y motivación académica: intervención de actividad física para estudiantes con bajo interés por el aprendizaje

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Abstract

Introduction: Low learning interest among adolescents negatively affects academic engagement, participation, and concentration during learning activities. Physical activity and embodied learning approaches are believed to enhance motivation and active learning.
Objective: This study examined the effectiveness of a physical activity intervention based on embodied learning principles in improving learning interest among junior high school students with low learning interest.
Methodology: A one-group pretest–posttest experimental design involved 253 junior high school students in Yogyakarta, Indonesia. The intervention consisted of 10 movement-based learning sessions integrating psychoeducational activities with collaborative games, reflective walking, stretching exercises, kinesthetic tasks, and role-play activities. Data were collected using observation, interviews, and a Learning Interest Scale and analyzed using the Wilcoxon Signed Ranks Test.
Results: Learning interest scores increased significantly from 48.7 to 71.2 (Z = -13.421, p = .000). Students also demonstrated improved participation, concentration, peer interaction, and enthusiasm during learning activities.
Conclusions: Embodied learning integrated with physical activity effectively enhances students' learning interest and academic motivation through active participation and experiential learning processes.

Keywords

Embodied learning; physical activity; academic motivation; learning interest; movement-based learning; junior high school students; adolescent education.

Resumen

Introducción: El bajo interés por el aprendizaje en adolescentes afecta negativamente su compromiso académico, participación y concentración durante las actividades de aprendizaje. Se cree que la actividad física y los enfoques de aprendizaje vivencial mejoran la motivación y el aprendizaje activo.
Objetivo: Este estudio examinó la efectividad de una intervención de actividad física basada en los principios del aprendizaje vivencial para mejorar el interés por el aprendizaje en estudiantes de secundaria con bajo interés por el aprendizaje.
Metodología: Se utilizó un diseño experimental pretest-postest con un solo grupo, en el que participaron 253 estudiantes de secundaria en Yogyakarta, Indonesia. La intervención consistió en 10 sesiones de aprendizaje basadas en el movimiento, que integraron actividades psicoeducativas con juegos colaborativos, caminata reflexiva, ejercicios de estiramiento, tareas cinestésicas y juegos de rol. Los datos se recopilaron mediante observación, entrevistas y una Escala de Interés por el Aprendizaje, y se analizaron mediante la prueba de rangos con signo de Wilcoxon.
Resultados: Las puntuaciones de interés por el aprendizaje aumentaron significativamente de 48,7 a 71,2 (Z = -13,421, p = 0,000). Los estudiantes también demostraron una mayor participación, concentración, interacción con sus compañeros y entusiasmo durante las actividades de aprendizaje. Conclusiones: El aprendizaje vivencial integrado con la actividad física mejora eficazmente el interés por el aprendizaje y la motivación académica de los estudiantes a través de la participación activa y los procesos de aprendizaje experiencial.

Palabras clave

Aprendizaje corporal; actividad física; motivación académica; interés por el aprendizaje; aprendizaje basado en el movimiento; estudiantes de secundaria; educación adolescente.

Introduction

Learning interest is an essential factor influencing students' academic engagement, classroom participation, concentration, and learning achievement (Lasekan, et al., 2024). Students with high learning interest tend to demonstrate greater curiosity (Ainley, 2019), persistence, and active involvement during educational activities, whereas students with low learning interest often experience boredom, passive participation, reduced concentration, and declining academic performance (Tze, Daniels & Klassen, 2016). Among adolescents, particularly junior high school students, low learning interest has become an increasingly important educational concern due to the rapid development of digital technology, monotonous instructional approaches, academic pressure, and limited opportunities for active learning experiences (Abdillah et al., 2020).

Adolescence represents a critical developmental stage characterized by significant cognitive, emotional, and social changes (Uktamovna, 2025). During this period, students require learning environments that encourage active participation, emotional engagement, and meaningful interaction (Aji Mulya Pratama et al., 2023; Andriyanti, Hidayah, & Hambali, 2017). However, traditional classroom instruction often emphasizes passive and teacher-centered learning approaches that focus primarily on cognitive achievement while overlooking students' physical and emotional involvement in the learning process (Amirova, 2025). Such approaches may reduce students' motivation and contribute to low classroom engagement.

Recent studies have shown that physical activity positively contributes to cognitive functioning, emotional regulation, academic motivation, and learning readiness (Bai et al., 2021). Physical activity stimulates brain activation, improves concentration, reduces stress, and enhances emotional well-being, all of which support more effective learning processes (León et al., 2025). In educational settings, movement-based activities also increase classroom participation and encourage collaborative interaction among students (Ahadinasrikin, Indreswari, & Muslihati, 2021). Consequently, integrating physical activity into learning processes has emerged as a promising strategy to improve student engagement and academic motivation (Saputra et al., 2026).

The concept of embodied learning emphasizes that learning occurs not only through cognitive processing but also through bodily movement and physical experience (Stolz, 2015). Embodied learning theory suggests that students understand and retain information more effectively when learning activities involve active physical participation (Kosmas, Ioannou & Zaphiris, 2019). Movement-based learning approaches such as collaborative games, reflective walking, kinesthetic learning tasks, stretching exercises, and role-play activities can create more dynamic and engaging educational experiences (Budiyono, Indreswari, & Eva, 2024). These activities enable students to become physically, emotionally, and socially involved during learning processes, thereby increasing motivation and learning interest (Jang, 2008).

Previous research has demonstrated that movement-based learning improves students' attention, academic engagement, emotional involvement, and classroom behavior. Physical activity interventions have also been associated with increased self-confidence, peer interaction, and intrinsic motivation among adolescents. Nevertheless, most educational interventions targeting learning interest remain predominantly discussion-based and cognitively oriented, with limited integration of structured physical activity into classroom learning activities, particularly in Indonesian junior high school contexts.

Although previous studies have demonstrated the positive effects of physical activity and movement-based learning on student engagement, most existing studies have focused on general academic outcomes, classroom behavior, or cognitive performance. Limited research has specifically examined how embodied learning interventions can enhance learning interest among adolescents with low academic motivation, particularly within Indonesian junior high school settings. This limitation is important because learning interest serves as a foundational determinant of academic engagement, persistence, and long-term educational success. Therefore, investigating the effectiveness of embodied learning for students with low learning interest is both theoretically and practically relevant.

Despite growing evidence regarding the benefits of physical activity in educational settings, relatively few studies have specifically examined embodied learning interventions for students with low learning interest. This study addresses this gap by integrating structured physical activity into movement-based

educational interventions among junior high school students in Yogyakarta, Indonesia. The novelty of this study lies in: (1) applying embodied learning principles to improve learning interest; (2) integrating structured physical activity into psychoeducational learning activities; and (3) examining the effectiveness of movement-based learning among adolescents with low academic motivation.

The present study is grounded in embodied learning theory, which posits that cognitive processes are closely connected with bodily movement and physical experiences. In this framework, structured physical activities are expected to increase students' physical engagement, emotional involvement, social interaction, and cognitive activation during learning activities. These processes subsequently contribute to higher levels of learning interest and academic motivation.Therefore, this study aims to examine whether embodied learning integrated with physical activity can significantly improve learning interest and academic motivation among junior high school students with low learning interest.

Method

This study employed a one-group pretest–posttest experimental design to examine the effectiveness of an embodied learning intervention integrated with physical activity in improving learning interest among junior high school students. This design was selected to evaluate changes in students' learning interest before and after participation in the intervention program, allowing participants to serve as their own controls during the intervention process.

The participants consisted of 253 junior high school students from several public schools in Yogyakarta, Indonesia. The participants were selected using purposive sampling based on preliminary screening results using the Learning Interest Scale and teacher recommendations. Only students categorized as having low learning interest were included in the study.

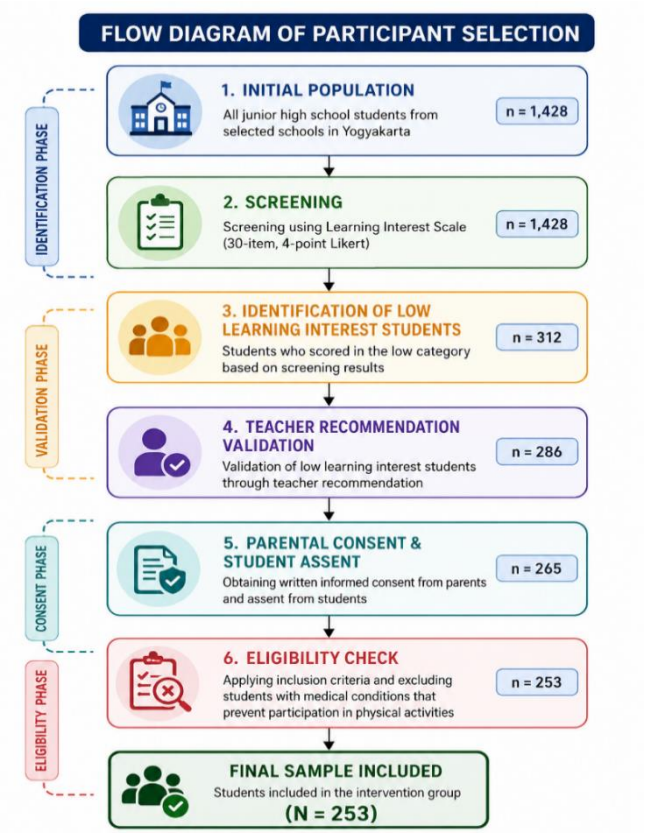
The participants were adolescents aged 12 to 15 years who showed low classroom engagement, limited participation in learning activities, and reduced academic motivation.

Inclusion criteria were: (1) enrolled as active students in junior high school, (2) identified as having low learning interest based on screening results, and (3) provided informed consent from parents and assent from students. Exclusion criteria included students with medical conditions that prevented participation in physical activities.

Table 1. Participant Characteristics and Selection Criteria

Component	Description
Total initial population	Students from selected junior high schools in Yogyakarta
Screening tool	Learning Interest Scale + teacher recommendation
Final sample size	253 students
Age range	12–15 years
Sampling technique	Purposive sampling
Inclusion criteria	Low learning interest, active students, consent obtained
Exclusion criteria	Medical conditions preventing physical activity

Figure 1. Participant Selection Flow Diagram



The intervention consisted of 10 structured movement-based learning sessions conducted over five weeks. Each session lasted approximately 60–90 minutes and integrated psychoeducational learning activities with structured physical activity designed to enhance cognitive engagement, emotional involvement, and classroom participation.

Table 2. Structure of Embodied Learning Intervention

Component	Description
Duration	5 weeks
Number of sessions	10 sessions
Session length	60–90 minutes
Approach	Embodied learning + physical activity
Learning strategy	Movement-based psychoeducation
Core activities	Games, walking, stretching, role-play, kinesthetic tasks

The physical activity components included: Collaborative movement games, Reflective walking activities, Stretching and body activation exercises, Kinesthetic learning tasks, Group interaction activities, Movement-based role-play.

Each intervention session followed three main stages:

1. Warm-up and physical activation
2. Core embodied learning activities integrated with educational discussion
3. Reflection and feedback session

The intervention was designed to create an active and participatory learning environment that encouraged students to become physically, emotionally, and socially engaged during learning activities.

Three data collection methods were used in this study:

1. Observation

Observation was conducted systematically during intervention sessions to assess students' behavioral engagement, including participation, enthusiasm, concentration, social interaction, and task involvement. An observation checklist was used to ensure consistency across sessions.

2. Semi-Structured Interviews

Semi-structured interviews were conducted with selected students and teachers to explore qualitative changes in learning motivation, classroom participation, emotional engagement, and perceived benefits of movement-based learning. Interviews were recorded and transcribed for thematic analysis.

3. Learning Interest Scale

Students' learning interest was measured using a 30-item Learning Interest Scale based on a four-point Likert format ranging from strongly disagree to strongly agree. The scale measured six dimensions: attention during learning, curiosity, participation in classroom activities, learning enthusiasm, academic persistence, and enjoyment in learning activities. The instrument demonstrated good reliability with a Cronbach's alpha coefficient of .89.

Quantitative data were analyzed using descriptive statistics and the Wilcoxon Signed Ranks Test using IBM SPSS Statistics. The Wilcoxon Signed Ranks Test was chosen because the study used a one-group pretest–posttest design with non-parametric data characteristics, and the normality assumption was not strictly required for ordinal Likert-scale data. This test is appropriate for comparing two related samples (pretest and posttest scores) to determine whether a statistically significant difference exists.

Descriptive statistics (mean, standard deviation, and gain score) were used to describe changes in learning interest before and after the intervention.

Qualitative data obtained from observations and interviews were analyzed using descriptive thematic analysis to identify patterns of behavioral and motivational changes during the intervention process. These findings were used to complement and interpret quantitative results.

Ethical Considerations

Ethical approval was obtained from Ma'arif University Lampung, No. 01/4478/UMALA/LPMNU/I/2026. Permission was also granted by the participating schools in Yogyakarta. Participation was voluntary, and informed consent was obtained from students, teachers, and parents prior to data collection. All participant information was kept confidential, and anonymity was maintained throughout the research process.

Results

Changes in Students' Learning Interest Scores

The analysis of pretest and posttest data revealed a substantial and consistent improvement in students' learning interest following the implementation of an embodied learning intervention integrated with structured physical activity. Beyond mere numerical increases, the findings indicate a meaningful transformation in students' behavioral engagement, particularly in terms of enthusiasm, attention, persistence, curiosity, and active participation during learning processes.

Overall, the intervention appears to have facilitated a shift from passive and externally driven engagement toward more active, internally motivated learning behavior. This suggests that the integration of bodily movement into instructional activities plays an important role in enhancing students' psychological readiness and emotional connection to learning content.

Table 3. Comparison of Pretest and Posttest Learning Interest Scores

Variable	N	Pretest Mean ± SD	Category	Posttest Mean ± SD	Category	Mean Gain
Learning Interest	253	48.7 ± 6.42	Low	71.2 ± 7.15	High	+22.5

The results presented in Table 3 indicate a clear and meaningful improvement in students' learning interest scores. The mean score increased from 48.7 (SD = 6.42), categorized as low, to 71.2 (SD = 7.15), categorized as high, resulting in a gain score of 22.5 points.

This improvement is not only statistically noticeable but also pedagogically significant, as it reflects a categorical transition from low to high learning interest. Such a shift suggests that the embodied learning intervention effectively influenced students' motivational orientation, particularly in increasing their willingness to engage with learning tasks and sustain attention throughout instructional activities.

Importantly, the relatively stable standard deviation across pretest and posttest scores indicates that the improvement occurred consistently across participants, rather than being driven by a small subset of students.

Dimension-Based Interpretation of Learning Interest

Further analysis across learning interest dimensions revealed that the intervention contributed to improvements in several key behavioral indicators, including: sustained attention during learning activities, increased willingness to participate in classroom discussion, improved task persistence and completion, heightened curiosity toward instructional materials, stronger enthusiasm during learning processes. These findings suggest that the intervention operated at both cognitive and affective levels, reinforcing not only students' behavioral engagement but also their intrinsic motivation to learn.

Statistical Analysis of Pretest–Posttest Differences

To determine whether the observed improvement in learning interest was statistically significant, a Wilcoxon Signed Ranks Test was conducted. This non-parametric test was selected due to the paired nature of the data and the ordinal properties of Likert-scale measurements.

The analysis results demonstrated a strong and consistent positive shift in students' scores following the intervention.

Table 4. Wilcoxon Signed Ranks Test of Learning Interest Scores

Variable	N	Positive Ranks	Negative Ranks	Z	p-value	Effect Size (r)	Interpretation
Learning Interest	253	241	7	-13.421	< .001	0.84	Large Effect

The Wilcoxon Signed Ranks Test revealed a statistically significant difference between pretest and posttest scores ($Z = -13.421$, $p < .001$). The distribution of ranks further supports this finding, with 241 participants showing positive gains compared to only 7 participants who experienced a decrease in scores.

The effect size ($r = 0.84$) indicates a large practical effect, suggesting that the embodied learning intervention had a substantial and meaningful impact on students' learning interest. In educational research terms, this magnitude of effect is considered highly robust, reinforcing the intervention's effectiveness not only statistically but also practically in classroom settings.

These findings strongly support the argument that integrating physical activity into instructional design can significantly enhance students' motivational and attentional engagement.

Observational Findings on Behavioral Engagement

In addition to quantitative improvements, qualitative observational data provided rich contextual evidence supporting the statistical outcomes. Classroom observations across multiple intervention sessions revealed a progressive transformation in students' behavioral engagement patterns.

At the initial stage of implementation, students generally exhibited low levels of engagement. Many appeared passive, hesitant to participate, and dependent on teacher direction. Classroom interactions were limited, and students showed minimal spontaneous involvement in learning tasks.

However, as the intervention progressed, a gradual but consistent improvement in engagement was observed. Students became increasingly responsive, socially interactive, and willing to participate in both individual and collaborative activities.

To systematically illustrate these changes, observational results are summarized in Table 5 below.

Table 5. Development of Students' Behavioral Engagement Across Intervention Phases

Behavioral Indicator	Early Sessions	Mid Sessions	Final Sessions	Trend Interpretation
Attention in learning	Low	Moderate	High	Progressive improvement
Participation	Low	Increasing	High	Strong upward trend
Peer interaction	Limited	Moderate	High	Social engagement strengthened
Enthusiasm	Low	Moderate	High	Emotional engagement improved
Classroom engagement	Passive	Improving	Active	Full transition to active learning

The data in Table 3 demonstrate a clear developmental trajectory in students' engagement across intervention phases. All behavioral indicators show a consistent upward trend from early to final sessions, indicating that the intervention effect was not instantaneous but progressively strengthened over time.

Movement-based learning activities such as collaborative games, reflective walking exercises, structured stretching, and role-play tasks appeared to be particularly effective in activating students' engagement. These activities created a learning environment that was not only cognitively stimulating but also physically and emotionally engaging.

Teachers also reported noticeable improvements in classroom dynamics. Students who were previously reluctant to participate became more confident, communicative, and cooperative. The classroom atmosphere shifted from teacher-centered passivity to student-centered interactivity, characterized by higher energy, responsiveness, and emotional involvement.

Integrated Summary of Findings

Taken together, the quantitative and qualitative findings converge to demonstrate that embodied learning integrated with structured physical activity is highly effective in enhancing students' learning interest.

The intervention not only produced a statistically significant increase in learning interest scores but also fostered observable improvements in behavioral engagement, social interaction, and emotional involvement in learning activities. This triangulation of data strengthens the validity of the findings and highlights the multidimensional impact of the intervention.

Overall, the results suggest that movement-based pedagogical strategies offer a holistic approach to addressing low learning interest among students by simultaneously activating cognitive, emotional, social, and physical dimensions of learning. This supports the theoretical assumption that learning is most effective when the body and mind are engaged in an integrated learning experience.

Discussion

Overview of Findings and Hypothesis Testing

This study aimed to examine the effectiveness of an embodied learning intervention integrated with physical activity in improving learning interest among junior high school students with low academic motivation. The findings demonstrated a significant increase in students' learning interest following the intervention, as reflected by the improvement in posttest scores and supported by observational findings.

Based on the results of statistical analysis (Wilcoxon Signed Ranks Test), the difference between pretest and posttest scores was statistically significant ($p < .001$), with a large effect size ($r = .84$). Therefore, the research hypothesis stating that embodied learning integrated with physical activity significantly improves students' learning interest is accepted.

These results indicate that integrating physical activity into learning processes can effectively enhance students' academic engagement, classroom participation, concentration, and enthusiasm during instructional activities.

Embodied Learning and Learning Interest Improvement

The significant improvement in learning interest scores suggests that embodied learning provides a more engaging and meaningful educational experience compared to passive learning approaches (Lindgren et al., 2016). Traditional classroom instruction is often dominated by teacher-centered methods that emphasize cognitive achievement while limiting students' physical and emotional involvement (Porteus, 1976). Such conditions may reduce motivation and contribute to boredom during learning activities (Tibubos, Rohrmann & Ringeisen, 2019).

In contrast, the movement-based intervention implemented in this study encouraged students to become physically, emotionally, and socially involved during the learning process, thereby increasing active participation and intrinsic motivation (Aloizou et al., 2025). This shift suggests that learning becomes more meaningful when students are not only cognitively engaged but also physically active within the instructional process.

Theoretical Implications of Embodied Learning

The findings support the theory of embodied learning, which emphasizes that cognitive processes are strengthened through bodily movement and physical experience (Fugate, Macrine & Cipriano, 2019). Through activities such as collaborative movement games, reflective walking, stretching exercises, and role-play, students were not only required to think cognitively but also to actively experience learning through movement and interaction (Löfstrand & Zakrisson, 2025).

This learning process appears to improve attention, curiosity, and emotional engagement, which are important components of learning interest among adolescents (Bowler, 2010). The results reinforce the idea that cognition is not isolated from physical experience, but rather developed through interaction between the body, environment, and learning context.

Psychological and Emotional Contributions of Physical Activity

Furthermore, physical activity played an important role in improving students' emotional regulation and classroom readiness (Bai et al., 2021). Previous studies have shown that physical activity contributes positively to brain activation, concentration, stress reduction, and emotional well-being, all of which support academic performance and motivation (Trudeau & Shephard, 2010).

In this study, students appeared more focused, enthusiastic, and confident during sessions involving movement-based learning activities (Aloizou et al., 2025). Physical movement may help reduce learning fatigue and passive behavior, creating a more positive and stimulating classroom atmosphere (Lynch, O'Donoghue & Peiris, 2022). These findings highlight that physical activity is not merely a supporting element but a functional mechanism that enhances readiness for learning.

Social Interaction and Collaborative Learning

Another important finding of this study was the improvement in peer interaction and social participation among students (Richter & Tjosvold, 1980). During the intervention sessions, students became more communicative, collaborative, and willing to participate in group activities (Herrmann, 2013).

Physical activity components encouraged students to interact actively with peers and teachers, fostering stronger social connectedness and cooperative learning experiences (Silva, Farias & Mesquita, 2021). These findings indicate that movement-based learning not only supports cognitive engagement but also enhances social and emotional aspects of learning, which are essential during adolescence (Savina et al., 2016).

Effect Size and Practical Significance

The large effect size obtained in this study further demonstrates the substantial impact of integrating physical activity into educational interventions (Watson et al., 2017). This suggests that movement-based learning can serve as an effective strategy for addressing low learning interest among adolescents, particularly in educational settings where students experience passive learning environments and reduced motivation (Aloizou, et al., 2025).

The findings also strengthen previous research indicating that physical activity contributes positively to academic engagement and educational outcomes (Owen et al., 2016). From a practical standpoint, the

magnitude of the effect indicates that the intervention is not only statistically significant but also educationally meaningful and applicable in real classroom contexts.

Practical Implications for Educational Practice

From a practical perspective, the findings suggest that teachers and schools should consider incorporating structured physical activity into classroom instruction and psychoeducational programs (Norris et al., 2020). Simple movement-based activities such as stretching exercises, collaborative games, role-play, and kinesthetic learning tasks can create more dynamic and student-centered learning environments (Nafratilova & Degeng, 2025).

Integrating physical activity into educational practice may help increase students' motivation, concentration, and classroom participation while reducing boredom and passive learning behavior (Vazou et al., 2012). This approach is particularly relevant for adolescents who require active and experiential forms of learning to maintain engagement.

Contribution to Educational Psychology

This study contributes to the interdisciplinary field of educational psychology and physical education by demonstrating that embodied learning integrated with physical activity can effectively improve learning interest among junior high school students. The study also expands the application of movement-based educational interventions within Indonesian school contexts, particularly among adolescents with low academic motivation.

Limitations and Future Research Directions

However, several limitations should be acknowledged. The use of a one-group pretest–posttest design without a control group limits the ability to establish stronger causal conclusions. In addition, the study focused only on students in Yogyakarta, which may limit the generalizability of the findings to other educational contexts.

Future research is recommended to employ randomized experimental designs, include control groups, and examine the long-term effects of embodied learning interventions on academic achievement, emotional well-being, and school engagement.

Conclusion of Discussion

Overall, the findings indicate that embodied learning integrated with physical activity provides a holistic and effective approach to improving students' learning interest and academic motivation. Physical activity functions not merely as a complementary component of instruction but as an important mechanism that strengthens cognitive engagement, emotional involvement, and social interaction during learning processes.

Conclusions

This study concludes that embodied learning integrated with structured physical activity significantly improves learning interest among junior high school students with low academic motivation. The findings demonstrated a substantial increase in students' learning interest scores following the intervention, supported by observable improvements in classroom participation, concentration, enthusiasm, peer interaction, and overall academic engagement.

The integration of physical activity into learning activities created a more dynamic, participatory, and emotionally engaging learning environment. Movement-based strategies such as collaborative games, reflective walking, stretching exercises, and role-play facilitated students' active involvement in the learning process, both cognitively and socially. These results indicate that physical activity serves as a key mechanism in strengthening students' emotional readiness, sustaining attention, and enhancing intrinsic motivation during learning activities.

Furthermore, this study underscores embodied learning as a holistic instructional approach that integrates cognitive, physical, emotional, and social dimensions of learning. The findings suggest that learning becomes more effective when students are actively engaged through bodily experience rather than relying solely on passive forms of instruction.

From a practical perspective, the results highlight the importance for teachers and schools to incorporate structured physical activity into classroom instruction and psychoeducational programs. Such integration may help improve student motivation, reduce passive learning behavior, and create more engaging classroom environments. Therefore, embodied learning can be considered an effective and innovative instructional strategy for addressing low learning interest among adolescents in school settings.

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