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Changes in forward roll skill following project-based learning and the role of movement creativity among junior high school students

Perubahan keterampilan roll depan setelah penerapan project-based learning dan peran kreativitas gerak pada siswa sekolah menengah pertama

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ABSTRACT

Background: Learning the forward roll in junior high school physical education is often challenged by limited technical proficiency, restricted movement exploration, and the continued use of teacher-centered instructional approaches.
Objective: This study aimed to examine changes in forward-roll performance following the implementation of Project-Based Learning (PjBL) and to investigate the relationship between movement creativity and forward-roll skill outcomes among junior high school students.
Methods: A pre-experimental one-group pretest–posttest design was employed involving 32 eighth-grade students selected through purposive sampling. Data were collected using a questionnaire assessing students' perceptions of PjBL implementation, a movement creativity performance rubric, and a forward-roll performance rubric. Data analysis included descriptive statistics, a paired-samples t-test, normalized gain (N-Gain), simple linear regression, and multiple linear regression.
Results: The mean forward-roll score increased from 55.19 at pretest to 88.25 at posttest, with an N-Gain of 0.74. The pretest–posttest difference was statistically significant, $t(31) = 18.542$, $p < 0.001$. Movement creativity was also strongly associated with forward-roll performance, with $R^2 = 0.982$, while the regression model including perceived PjBL implementation and movement creativity showed a significant simultaneous association with skill outcomes.
Conclusion: These findings indicate that PjBL implementation was accompanied by improved forward-roll performance and that movement creativity was closely associated with students' skill achievement. Future studies should employ control groups and larger samples to provide stronger evidence regarding causal effects.

ABSTRAK

Latar belakang: Pembelajaran keterampilan guling depan pada siswa sekolah menengah pertama sering menghadapi kendala berupa rendahnya penguasaan teknik, keterbatasan eksplorasi gerak, dan dominasi pendekatan pembelajaran yang berpusat pada guru.
Tujuan: Penelitian ini bertujuan untuk menganalisis perubahan keterampilan guling depan setelah penerapan *Project-Based Learning* (PjBL) serta menguji hubungan kreativitas gerak dengan hasil keterampilan guling depan pada siswa sekolah menengah pertama.
Metode: Penelitian menggunakan desain *pre-experimental one-group pretest–posttest* yang melibatkan 32 siswa kelas VIII yang dipilih melalui *purposive sampling*. Data dikumpulkan menggunakan kuesioner persepsi penerapan PjBL, rubrik kreativitas gerak, dan rubrik penilaian keterampilan guling depan. Analisis data meliputi statistik deskriptif, *paired-samples t-test*, *normalized gain (N-Gain)*, regresi linier sederhana, dan regresi linier berganda.
Hasil: Rata-rata skor keterampilan guling depan meningkat dari 55,19 pada *pretest* menjadi 88,25 pada *posttest*, dengan *N-Gain* sebesar 0,74. Perbedaan *pretest* dan posttest signifikan secara statistik, $t(31) = 18,542$, $p < 0,001$. Kreativitas gerak juga menunjukkan hubungan yang kuat dengan skor keterampilan guling depan, dengan $R^2 = 0,982$, sedangkan model regresi yang memasukkan persepsi penerapan PjBL dan kreativitas gerak menunjukkan hubungan simultan yang signifikan dengan hasil keterampilan.

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Kesimpulan: Temuan ini menunjukkan bahwa penerapan PjBL disertai peningkatan performa guling depan dan bahwa kreativitas gerak berkaitan erat dengan capaian keterampilan. Penelitian dengan kelompok kontrol dan sampel yang lebih besar diperlukan untuk memperkuat inferensi kausal.

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Highlights

- ✓ Project-Based Learning was accompanied by substantial improvement in forward-roll performance.
- ✓ Forward-roll scores increased from 55.19 at pretest to 88.25 at posttest, with an N-Gain of 0.74.
- ✓ Movement creativity was strongly associated with post-intervention forward-roll performance ($R^2 = 0.982$).

Introduction

Physical education plays an important role in providing learning experiences that support the development of movement skills, motor competence, and students' ability to adapt to a variety of physical activity demands. One area that requires complex whole-body coordination is floor gymnastics, particularly the forward roll. This skill requires coordinated hand placement, head flexion, body rounding, displacement of the center of mass, and the ability to maintain balance through the completion of the movement. In school-based learning contexts, mastery of gymnastics skills is influenced not only by physical ability but also by the quality of the learning experience and the opportunities students have to explore and refine their movements. Research on gymnastics skills suggests that different instructional approaches may produce different patterns of motor development; for example, Nurwahid et al. (2026) reported improved straddle-jump performance following eight sessions of game-based learning conducted over four weeks.

The teaching of the forward roll is particularly important because inversion-based movements can be challenging for students who have not yet developed adequate coordination, spatial orientation, or confidence in their movement ability. Preliminary observations of Grade VIII students at SMP Negeri 1 Cireunghas (Cireunghas 1 Public Junior High School) indicated that forward-roll performance remained below the expected standard. Common errors included inappropriate hand placement, unsafe head positioning, insufficient body rounding, and difficulty completing the movement in a controlled manner. Learning that relies predominantly on direct instruction and repeated practice may also limit opportunities for students to analyze errors, engage in discussion, and explore alternative solutions to movement tasks. These conditions highlight the need for an instructional model that not only provides opportunities for practice but also actively engages students in movement problem-solving.

Project-Based Learning (PjBL) is one approach that may address these needs because it positions students as active participants in planning, completing, and evaluating learning projects. In physical education, Simonton et al. (2021) described the potential of PjBL as an instructional model capable of integrating knowledge, problem-solving, collaboration, and authentic learning experiences. Emerging empirical evidence also supports its application. Suwiwa et al. (2023), for example, found that students who received flashcard-assisted PjBL achieved better learning outcomes in pencak silat than those who received conventional instruction in a study using experimental and control groups. Darmawan et al. (2025) subsequently reported that PjBL in volleyball learning supported both cognitive and psychomotor outcomes, while Mashud et al. (2025) demonstrated the relevance of PjBL for developing movement independence and physical literacy. Collectively, these findings indicate that PjBL may be applicable not only to conceptual learning but also to the development of movement skills.

Research in gymnastics also suggests that learning success is influenced by the extent to which students are given opportunities to understand, explore, and adapt their movements. Hasan et al. (2025) found that different instructional models produced different patterns of change in rhythmic gymnastics outcomes among junior high school students, indicating that the structure of the learning experience plays an important role in gymnastics skill development. In another gymnastics context, Nurwahid et al. (2026) reported improved skill scores following instruction that incorporated variations in movement tasks. Meanwhile, Makadada et al. (2024) showed that task manipulation and physical characteristics were associated with forward-roll performance. Taken together, these findings suggest that the quality of gymnastics learning depends not only on repetition but also on how movement experiences are organized.

In addition to pedagogical approaches, movement creativity is a relevant variable for understanding individual differences in students' ability to respond to motor tasks. Movement creativity refers to the capacity to generate and explore a range of movement responses that are appropriate to task demands. Marinšek and Lukman (2022) showed that instructional strategies encouraging exploration can support both movement creativity and motor skill proficiency, while Thomaidou et al. (2021) found that creative movement programs were associated with improvements in motor creativity and motor competence. Orth et al. (2024) further demonstrated that skill level and changes in environmental constraints influence movement variability and exploratory tendencies. These findings support the possibility that students with greater movement creativity may also be more flexible in meeting skill demands. However, in the present study, movement creativity is conceptualized as a participant characteristic associated with skill outcomes rather than as evidence of a specific biomechanical mechanism responsible for improved performance.

Despite this growing body of literature, several research gaps remain. First, PjBL studies in physical education have largely focused on pencak silat, ball games, physical literacy, or teacher education, whereas its application to floor gymnastics skills, particularly the forward roll, remains limited. Second, previous gymnastics research has tended to compare instructional models or manipulate movement tasks without simultaneously considering movement creativity as an individual learner characteristic. Third, the movement-creativity literature has primarily focused on creative dance, games, or open motor tasks, leaving limited evidence regarding its relationship with relatively closed skills such as the forward roll among junior high school students. Fourth, few studies have simultaneously documented changes in performance before and after PjBL implementation while also examining the relationship between movement creativity and post-learning skill outcomes. Therefore, the relationship among project-based learning experiences, movement creativity, and gymnastics skill performance requires more specific empirical investigation.

The novelty of the present study lies in integrating two perspectives that are commonly examined separately: changes in forward-roll performance following the implementation of PjBL and the role of movement creativity in explaining variation in students' skill outcomes. Movement creativity was not treated as part of the PjBL intervention but rather as an individual learner

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variable whose association with post-learning performance was analyzed. This distinction is important because all participants received the same PjBL intervention, whereas movement creativity varied across individuals. Based on these gaps, this study aimed to (1) analyze changes in forward-roll performance before and after the implementation of PjBL and (2) examine the relationships of movement creativity and students' perceptions of PjBL implementation with forward-roll skill outcomes. Theoretically, this study is expected to extend the evidence base regarding PjBL and movement creativity in motor-skill learning. Practically, the findings may help physical education teachers design gymnastics instruction that is more student-centered, collaborative, and supportive of movement exploration and problem-solving.

Materials and Methods

Study Design

This study employed a quantitative approach using a pre-experimental one-group pretest–posttest design. All participants completed an assessment of forward-roll skill before the intervention (pretest), then participated in learning activities using Project-Based Learning (PjBL), and subsequently completed the same skill assessment after the intervention (posttest). This design was used to evaluate changes in forward-roll performance within the same group before and after the implementation of PjBL.

Participants

The study was conducted at SMP Negeri 1 Cireunghas (Cireunghas 1 Public Junior High School), Sukabumi Regency, involving Grade VIII students during the 2025/2026 academic year. The study population comprised approximately 100 Grade VIII students distributed across four parallel classes. The sample consisted of 32 students from one class selected using purposive sampling. The reported participation criteria were enrollment in Grade VIII, willingness to participate in the study, and completion of the entire PjBL learning sequence from beginning to end.

Instruments

Three main instruments were used: a questionnaire assessing students' perceptions of PjBL implementation, a movement creativity rubric, and a forward-roll skill assessment rubric. The original manuscript stated that all three instruments had been validated and tested for reliability; however, the procedures and validity and reliability coefficients were not reported in sufficient detail.

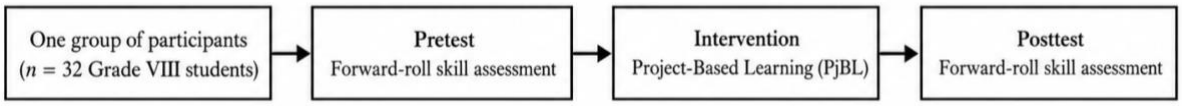


Figure 1. Study flow of the pre-experimental one-group pretest–posttest design

Students' perceptions of PjBL implementation were measured using a closed-ended questionnaire with a 4-point Likert scale. The resulting score represented how students evaluated their learning experiences during the PjBL intervention and was used as one of the predictor variables in the regression analyses. This perception score should be distinguished from the PjBL intervention itself: all students received the same intervention, whereas perception scores varied across individuals.

Movement creativity was assessed using a performance-based test grounded in divergent movement thinking. According to the manuscript, the movement creativity construct comprised four dimensions: fluency, flexibility, originality, and elaboration. The movement creativity score was subsequently used as a predictor variable to examine its relationship with forward-roll skill performance.

Forward-roll learning outcomes were assessed using a psychomotor performance test covering three phases of the movement: the initial position, the execution or rolling phase, and the final position. The rubric included aspects such as hand and head placement, body rounding and leg drive during the rolling phase, and the ability to complete the movement with controlled balance. The same instrument was used for both the pretest and posttest to ensure consistent comparison of changes in performance.

Statistical analysis

Data were analyzed using SPSS software with the significance level set at $\alpha = 0.05$. The analysis began with descriptive statistics to characterize the distribution of the study variables. Assumption checks conducted in the original study included the Kolmogorov–Smirnov test for normality, Levene's test for homogeneity of variance, and linearity tests for the relationships between predictor variables and forward-roll skill outcomes. Changes in forward-roll performance before and after the implementation of PjBL were analyzed using a paired-samples t-test because the pretest and posttest measurements were obtained from the same participants. The magnitude of descriptive change was also evaluated using normalized gain (N-Gain). Probability values were reported according to standard statistical conventions; therefore, SPSS outputs reported as $p = 0.000$ were presented as $p < 0.001$.

Relationship analyses were conducted separately from the pretest–posttest change analysis. Simple linear regression was used to examine the relationship between movement creativity and post-intervention forward-roll skill scores. Multiple linear regression was then used to examine the simultaneous relationships of students' perceptions of PjBL implementation and movement creativity as predictor variables with forward-roll skill scores as the dependent variable. The coefficient of determination (R^2) was interpreted as the proportion of variation in the outcome scores statistically explained by the model within the study sample and was not interpreted as the percentage of skill performance "caused" by the predictor variables.

Results

The Kolmogorov–Smirnov normality test showed that all variables had p-values greater than .05, including the pretest ($p = 0.071$), posttest ($p = 0.075$), perceived PjBL implementation ($p = 0.065$), and movement creativity ($p = 0.085$). Thus, the data distributions did not show significant departures from normality. Levene's test yielded $p = 0.142$, while the linearity tests showed deviation-from-linearity values of .181 for the relationship between perceived PjBL implementation and skill outcomes and 0.590 for the relationship between movement creativity and skill outcomes. These results indicated that the assumptions required for the parametric and regression analyses were satisfied based on the diagnostic tests conducted in this study.

Descriptively, the mean forward-roll skill score increased from 55.19 at pretest to 88.25 at posttest, representing a mean improvement of 33.06 points. The normalized gain analysis yielded an N-Gain value of 0.74, which was classified as high (Table 1).

The paired-samples t-test revealed a statistically significant difference between pretest and posttest scores, with a mean difference of 33.063, SE = 1.783, $t(31) = 18.542$, $p < 0.001$ (Table 2). Thus, students' forward-roll performance improved significantly following the PjBL learning period. However, because the study

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employed a one-group design without a control group, this finding should be interpreted as evidence of change following the intervention rather than as proof that the observed improvement was caused solely by PjBL.

Simple linear regression analysis showed that movement creativity was strongly associated with post-intervention forward-roll performance. The reported results indicated $t = 40.112$, $p < 0.001$, with $R^2 = 0.982$ (Table 3). This means that, within the study sample, approximately 98.2% of the variance in forward-roll skill scores was statistically associated with variation in movement creativity in the analyzed model. This interpretation does not imply that movement creativity caused 98.2% of students' skill achievement. Rather, R^2 represents the proportion of variance in the outcome statistically explained by the model within this sample.

Multiple linear regression analysis was used to evaluate the simultaneous relationships of students' perceptions of PjBL implementation and movement creativity with forward-roll skill scores. The regression ANOVA results reported in Table 4 showed $F(2, 29) = 9502.140$, $p < 0.001$. These results indicate that the overall regression model was statistically significantly associated with forward-roll skill performance.

Table 1
Changes in forward-roll skill scores before and after the intervention

Measurement	Mean	Change	N-Gain	N-Gain category
Pretest	55.19	+33.06	0.74	High
Posttest	88.25			

Table 2
Paired-samples t-test results for forward-roll skill

Observation pair	Mean Difference	SE	*t*	*df*	*p*
Posttest – Pretest	33.063	1.783	18.542	31	< 0.001

Table 3
Simple linear regression of movement creativity on forward-roll skill

Predictor	*t*	*p*	R^2
Movement creativity	40.112	< 0.001	0.982

Table 4
ANOVA for the multiple regression model

Source	Sum of Squares	*df*	Mean Square	*F*	*p*
Regression	4512.455	2	2256.228	9502.140	< 0.001
Residual	6.887	29	0.237		

Discussion

The study yielded three main findings. First, forward-roll performance improved following the implementation of Project-Based Learning (PjBL), with the mean score increasing from 55.19 at pretest to 88.25 at posttest and an N-Gain of 0.74. Second, movement creativity showed a very strong association with post-intervention forward-roll performance, with $R^2 = 0.982$. Third, the regression model incorporating students' perceptions of PjBL implementation and movement creativity showed a statistically significant simultaneous association with skill outcomes. Nevertheless, because the study employed a one-group design without a control group, the pretest–posttest improvement should be interpreted as change following the learning intervention rather than as causal evidence that PjBL alone produced the observed improvement.

The improvement in skill performance following PjBL is consistent with literature positioning PjBL as an approach that may support active learning experiences in physical education. Simonton et al. (2021) emphasized the potential of PjBL as an instructional model in physical education, while Suwiwa et al. (2023) showed that flashcard-assisted PjBL produced better pencak silat learning outcomes than conventional instruction. In other sport-skill contexts, Darmawan et al. (2025) reported benefits of PjBL for cognitive and psychomotor learning outcomes in volleyball, whereas Mashud et al. (2025) linked PjBL with the development of movement independence and physical literacy. A similar pattern is evident in the studies of Yáñez-Sepúlveda et al. (2023, 2024), which showed that PjBL can be used to create more active, collaborative, and contextually meaningful physical education learning experiences. More broadly, the present findings are also consistent with evidence suggesting that variation in pedagogical models may influence gymnastics skill outcomes. Nurwahid et al. (2026), for example, reported improved straddle-jump performance following game-based learning, while Hasan et al. (2025) showed that different cooperative learning models produced different patterns of change in rhythmic gymnastics learning.

From a pedagogical perspective, the improvement in forward-roll performance following PjBL may be explained by the characteristics of the learning process, which provided greater opportunities for students to engage in problem-solving, discussion, exploration, and movement evaluation. In motor-skill learning, such experiences allow students not only to imitate teacher demonstrations but also to identify technical problems, explore possible solutions, and receive feedback from peers and teachers. Estrada-Oliver et al. (2021) described PjBL as an approach that can be integrated into physical education through meaningful, project-oriented activities, while Gallego et al. (2024) showed that PjBL can be combined with collaborative learning structures. However, the implementation of PjBL also presents practical challenges related to classroom management, time allocation, and student engagement, as noted by Priyohutomo et al. (2025). Therefore, the improvements observed in the present study were likely related not simply to the label of "PjBL" but also to the quality of implementation, project structure, opportunities for practice, peer interaction, and feedback provided throughout the learning process.

The strong association between movement creativity and forward-roll performance may also be understood from the perspective of movement variability and exploration. Marinšek and Lukman (2022) highlighted the importance of instructional strategies that support movement creativity and motor-skill proficiency, while Thomaidou et al. (2021) reported improvements in motor creativity and motor competence following a creative movement program. These findings are further supported by Büning and Lausberg (2023), who showed that divergent motor learning can enhance motor creativity, and Orth et al. (2024), who emphasized the relationship among skill level, functional movement variability, and exploratory tendencies. Other studies

have likewise suggested that learning environments that provide opportunities for exploration may support motor creativity, including Eduball-based approaches (Khorkova et al., 2025), parkour in physical education (Yolcu et al., 2026), and constraints-based frameworks for movement exploration (Konstantinidou, 2026). In the context of the forward roll, students who are better able to explore and adapt their movement patterns may be more likely to identify movement configurations that suit their individual characteristics and task demands. However, because the present study did not directly assess neuromuscular or biomechanical mechanisms, this explanation should be regarded as a pedagogical interpretation rather than direct mechanistic evidence.

Clinical implications

From a practical perspective, the findings suggest that physical education teachers may consider using PjBL in gymnastics instruction by designing projects that encourage students to analyze technique, discuss movement solutions, practice collaboratively, and reflect on performance. Movement creativity may also be considered an important learner characteristic that should be supported through tasks that allow room for exploration rather than simply requiring identical reproduction of movement patterns. This approach is consistent with Coppola et al. (2024), who highlighted the role of physical activity in supporting movement creativity, and with Trecroci et al. (2023), who showed that more varied learning experiences may be associated with students' motor creativity. Nevertheless, teachers should continue to maintain appropriate safety standards, technical quality, and supervision, particularly when teaching gymnastics skills involving inverted body positions.

Study limitations

This study has several limitations. First, the one-group pretest–posttest design without a control group does not allow strong causal attribution to PjBL. Second, the sample consisted of only 32 students from a single class and school, which limits the generalizability of the findings. Third, the duration and implementation details of the PjBL intervention need to be reported more comprehensively to facilitate replication. Fourth, information regarding instrument validity, reliability, and inter-rater reliability requires further strengthening. Fifth, the R^2 value of .982 and F value of 9502.140 are exceptionally high and should be rechecked against the original statistical output to rule out data-entry errors, multicollinearity, or model misinterpretation. Sixth, perceived PjBL implementation and movement creativity were assessed within the same contextual setting as the skill outcome, so potential common-method or shared-context effects should be considered. Future studies should use control groups, larger samples, longitudinal or skill-retention analyses, instruments with well-documented validity and inter-rater reliability, and measures of PjBL implementation fidelity to provide stronger evidence regarding the relationships among pedagogical approach, movement creativity, and gymnastics learning outcomes.

Conslusions

The findings showed that students' forward-roll performance improved following the implementation of Project-Based Learning (PjBL), as reflected by higher posttest scores and an N-Gain classified as high. Movement creativity was also very strongly associated with forward-roll performance, while students' perceptions of PjBL implementation together with movement creativity formed a model that was statistically associated with skill outcomes. These findings suggest that project-based learning may be a relevant approach for supporting more active, collaborative, and exploratory gymnastics learning.

However, because the study used a single-group design without a control group, involved only one class, and produced exceptionally high regression values that still require verification, the findings should be interpreted cautiously and not as definitive causal evidence. Future research should include comparison groups, broader samples, instruments with well-documented validity and reliability, and measures of skill retention to strengthen the evidence regarding the effectiveness of PjBL and the role of movement creativity in gymnastics learning.

Author contributions

Conceptualization: I.M., E.F.A., and T.R.; Methodology: I.M., E.F.A., and T.R.; Investigation: I.M.; Data curation: I.M.; Formal analysis: I.M. and E.F.A.; Project administration: I.M.; Supervision: E.F.A. and T.R.; Visualization: I.M.; Writing – original draft: I.M.; Writing – review & editing: I.M., E.F.A., and T.R. All authors have read and approved the final version of the manuscript and agree to be accountable for the integrity and accuracy of the work.

Ethical statement

Formal ethical clearance was not obtained for this study. However, permission to conduct the research was obtained from the participating school, and the study was carried out with due consideration for participants' privacy, confidentiality, and welfare.

Informed consent

Written informed consent was obtained from the parents or legal guardians of all participating students prior to data collection. Student participation was voluntary, and no personally identifiable information was reported in the manuscript.

Declaration of generative AI and AI-assisted technologies in the writing process

During the preparation of this manuscript, the author used ChatGPT (OpenAI) solely to improve language, grammar, and readability. After using this tool, the authors reviewed and edited the content as needed and take full responsibility for the accuracy, integrity, and content of the publication.

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Conflicts of interest

The authors declare no conflicts of interest.

Data availability

The data supporting the findings of this study are available from the corresponding author upon reasonable request, subject to appropriate ethical and privacy considerations.

References

Büning, C., & Lausberg, H. (2023). Divergent motor learning programs improve motor and figural creativity in university sports students. *The Journal of Creative Behavior, 57*(4), 661–673. https://doi.org/10.1002/jocb.609

Coppola, S., Matrisciano, C., & Vastola, R. (2024). Ecological dynamics perspective on the role of physical activity in enhancing creative thinking and motor creativity in students. *Journal of Physical Education and Sport, 24*(11), 1971–1978. https://doi.org/10.7752/jpes.2024.11294

Darmawan, A. T. A., Sukoco, P., Marhaendro, A. S. D., Septiyanto, A., & Hartanto, A. (2025). Project-based learning model for volleyball to improve students' cognitive and psychomotor learning outcomes. *Retos, 65*, 1032–1044. https://doi.org/10.47197/retos.v65.111742

Estrada-Oliver, L., Delgado-Gotay, K., & Colon-Guzman, V. (2021). Project based-learning and sport education: A PETE project! *Strategies, 34*(6), 51–56. https://doi.org/10.1080/08924562.2021.1980304

Gallego, D. B., Linares, A. J. C., & Benjumea, J. M. C. (2024). Proposal for hybridization of cooperative learning and project-based learning in secondary school, through strength training and according to SDG 3. *Retos, 53*, 636–650. https://doi.org/10.47197/RETOS.V53.101882

Hasan, M. L., Royana, I. F., & Zhannisa, U. H. (2025). The effect of peer teaching and think pair share on rhythmic gymnastics learning outcomes. *Physical Education and Sports: Studies and Research, 4*(2), 195–203. https://doi.org/10.56003/pessr.v4i2.619

Khorkova, M., Bojkowski, Ł., Korcz, A., Krzysztoszek, J., Łopatka, M., Adamczak, D., & Bronikowski, M. (2025). Impact of the Eduball method on cognitive creativity, motor creativity, and motor fitness during physical education classes in 8- to 9-year-old children. *Frontiers in Public Health, 13*, 1660650. https://doi.org/10.3389/fpubh.2025.1660650

Konstantinidou, E. (2026). Cultivating creative potential: A constraints-based framework for movement exploration instructions. *The Journal of Creative Behavior, 60*(2), e70106. https://doi.org/10.1002/jocb.70106

Makadada, F. A., Hadjarati, H., Berhimpong, M. W., Piri, N., Baan, A. B., Mangolo, E. W., Perdana, G. S., Ndayisenga, J., & Ilham. (2024). The effects of game-based passive, static stretching, and trunk flexibility on the execution of forward roll in floor exercise: A factorial experimental design. *Journal of Physical Education and Sport, 24*(4), 872–885. https://doi.org/10.7752/jpes.2024.04100

Marinšek, M., & Lukman, N. (2022). Teaching strategies for promoting motor creativity and motor skill proficiency in early childhood. *Economic Research-Ekonomska Istraživanja, 35*(1), 2645–2653. https://doi.org/10.1080/1331677X.2021.1974306

Mashud, Arifin, S., Warni, H., Rachman, A., Amka, Fadillah, M., Pebriyandi, Prima Putra, M. F., Indra Bayu, W., & Yanti, N. (2025). Developing students' movement independence: Internalizing physical literacy in project-based physical education learning. *Physical Education Theory and Methodology, 25*(3), 524–532. https://doi.org/10.17309/tmfv.2025.3.07

Nurwahid, F., Fauzi, R. A., & Sudrazat, A. (2026). The effect of game-based learning variations on elementary school students' straddle jump gymnastics skills. *Physical Education and Sports: Studies and Research, 5*(1), 57–67. https://doi.org/10.56003/pessr.v5i1.705

Orth, D., van der Kamp, J., Memmert, D., & Savelsbergh, G. (2024). Skill shapes functional movement variability and exploration tendencies: The effect of skill under changing environmental constraints on the emergence of creative action in a divergent kickboxing task. *International Journal of Sport and Exercise Psychology, 22*(2), 446–466. https://doi.org/10.1080/1612197X.2023.2280108

Priyohutomo, A., Komarudin, & Sridadi. (2025). The perspective of physical education teachers: Challenges within the project-based learning model. *Physical Education Theory and Methodology, 25*(3), 511–517. https://doi.org/10.17309/tmfv.2025.3.05

Simonton, K. L., Layne, T. E., & Irwin, C. C. (2021). Project-based learning and its potential in physical education: An instructional model inquiry. *Curriculum Studies in Health and Physical Education, 12*(1), 36–52. https://doi.org/10.1080/25742981.2020.1862683

Suwiwa, I. G., Astra, I. K. B., Yoda, I. K., & Satyawan, I. M. (2023). The effect of project based learning assisted with flashcards towards students' learning outcomes in learning Pencak Silat. *Physical Education and Sport: Studies and Research, 2*(2), 72–82. https://doi.org/10.56003/pessr.v2i2.235

Thomaidou, C., Konstantinidou, E., & Venetsanou, F. (2021). Effects of an eight-week creative dance and movement program on motor creativity and motor competence of preschoolers. *Journal of Physical Education and Sport, 21*, 3268–3277. https://doi.org/10.7752/jpes.2021.s6445

Trecroci, A., Signorini, G., Scurati, R., Colella, D., Raiola, G., Rigon, M., & Invernizzi, P. L. (2023). Effects of musical classes on motor creativity according to age, sex, and weight status in young students: A music-oriented versus conventional education plan. *Children, 10*(2), 200. https://doi.org/10.3390/children10020200

Yáñez-Sepúlveda, R., Hinojosa-Torres, C., & Zavala-Crichton, J. P. (2023). Project-based learning as a strategy in physical education teacher training: Creating a cultural route promoting active commuting. *European Journal of Educational Research, 12*(3), 1219–1231. https://doi.org/10.12973/eu-jer.12.3.1219

Yáñez-Sepúlveda, R., Hinojosa-Torres, C., Cortés-Roco, G., & Zavala-Crichton, J. P. (2024). Project-based learning and gamification as learning strategies in physical education teacher training. Retos, 60, 1–11. https://doi.org/10.47197/retos.v60.107939

Yolcu, O., Hürmeriç Altunsöz, I., İnce, M. L., & Kriellaars, D. J. (2026). Use of parkour in primary school physical education to develop motor creativity, divergent thinking, movement competence, and perceived motor competence. *Physical Education and Sport Pedagogy, 31*(5), 726–739. https://doi.org/10.1080/17408989.2024.2400094