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The Learning of Pjok Floor Gymnastics Material At SD Negeri 2 Banyuning

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ABSTRACT

This study was conducted based on the need to improve the quality of Physical Education (PJOK) learning, particularly in floor gymnastics material, through innovative learning models integrating pedagogy and technology. This study aimed to determine the effect of the Problem-Based Learning (PBL) model assisted by ICT media based on the Technological Pedagogical Content Knowledge (TPACK) framework on the learning outcomes of third-grade students at SD Negeri 2 Banyuning. The study employed a quasi-experimental method using a posttest-only control group design. The population consisted of all Grade III students, with samples selected through random sampling techniques and divided into an experimental group and a control group. The experimental group received PBL learning assisted by ICT-TPACK media, while the control group received direct instruction. Data were collected through cognitive tests and psychomotor performance assessments and analyzed using normality tests, homogeneity tests, and independent samples t-tests. The findings showed a significant difference between groups ($p < 0.05$), with the experimental group achieving higher mean learning outcomes (82.86) than the control group (65.00), with a mean difference of 17.857. Students' overall class average reached 77, with 65% learning completeness. The intervention also improved students' activeness, conceptual understanding, confidence, and motor skills in performing jumping, balancing, and knee-kissing movements. It can be concluded that the PBL model assisted by ICT media based on TPACK has a significant positive effect on PJOK floor gymnastics learning outcomes and can be recommended as an innovative alternative to promote active, collaborative, and effective physical education learning.

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INTRODUCTION

Education plays a fundamental role in shaping human development, fostering intellectual growth, character formation, and practical competencies necessary for independent and responsible living (Aryanthi et al., 2019; Artanayasa et al., 2023). Within

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the Indonesian education system, elementary education serves as the foundation for nurturing cognitive, affective, and psychomotor capacities in students. In this context, Physical Education, Sports, and Health (PJOK) contributes not only to physical fitness development but also to motor competence, emotional stability, social interaction, and lifelong healthy behavior (Adnyana et al., 2021; No et al., 2022). Contemporary educational paradigms emphasize that learning should not merely transfer knowledge but also create meaningful experiences through active student participation, inquiry, and reflective engagement (Amaliyah & Rahmat, 2021; Bapor & Third, 2022).

One important component of PJOK learning in elementary schools is floor gymnastics. Floor gymnastics includes fundamental motor patterns such as jumping, balancing, rolling, and coordinated body control, which contribute significantly to children's neuromuscular development, postural stability, and motor literacy (Logan et al., 2018; Robinson et al., 2019). Fundamental movement skills developed through gymnastics also support later participation in sport and physical activity (Barnett et al., 2016; Hulteen et al., 2020). In elementary school contexts, floor gymnastics learning is not merely about technical mastery, but also about developing confidence, overcoming fear, problem-solving in movement situations, and understanding body mechanics (Lubans et al., 2016; Palmer et al., 2020).

However, practical implementation of floor gymnastics learning often encounters substantial pedagogical challenges. Many PJOK teachers continue to employ teacher-centered approaches dominated by explanation and demonstration, limiting students' opportunities to explore, analyze movement problems, and develop autonomous learning strategies (Casey & MacPhail, 2018; Kirk, 2019). This issue is evident in the learning process at SD Negeri 2 Banyuning, where observations identified several constraints: students' difficulties in performing jumping, balancing, and knee-kissing movements, fear in executing movements, low participation rates, and unsatisfactory learning outcomes, reflected in average scores of 70 and only 60% mastery, below the minimum completeness criterion of 75.

These findings indicate a gap between expected PJOK learning outcomes and classroom reality. Low student engagement in gymnastics learning often stems from monotonous instruction, inadequate learning media, insufficient feedback, and limited opportunities for repeated movement observation (Chen et al., 2018; Hastie et al., 2020). Additionally, fear and lack of confidence in performing gymnastics movements represent psychological barriers that can reduce motor performance and learning motivation (Moreno-Murcia et al., 2019). Such conditions highlight the urgent need for innovative learning approaches capable of integrating pedagogy, technology, and student-centered problem-solving.

Recent developments in physical education research have increasingly emphasized constructivist and inquiry-based models that position students as active participants in learning. One prominent model is Problem-Based Learning (PBL), which promotes learning through authentic problems, critical inquiry, collaboration, and solution development (Hmelo-Silver, 2017; Pradipta et al., 2023). In PJOK contexts, PBL

has demonstrated effectiveness in improving critical thinking, tactical understanding, motor problem-solving, and movement competence (Parwata, 2021; Casey et al., 2021).

PBL aligns with motor learning theories suggesting that movement skills are better acquired when learners engage in active experimentation, error detection, and corrective feedback (Schmidt & Lee, 2019). Rather than merely imitating teacher demonstrations, students analyze movement errors, discuss alternatives, and refine performance through problem-solving processes. Such an approach is particularly relevant for gymnastics learning, where mastering movement sequences requires perception-action coupling, body awareness, and progressive confidence development (Rudd et al., 2020).

Parallel to pedagogical innovation, the integration of technology in physical education has gained considerable attention. Information and Communication Technology (ICT), especially learning video media, has been recognized as a powerful tool for enhancing understanding of movement tasks through visual modeling, repeated observation, and self-paced learning (Syaefulloh & Purnama, 2023; Semarayasa et al., 2023). Video-assisted instruction can improve motor performance by providing clear demonstrations, reducing anxiety, and supporting observational learning principles proposed by Bandura's social cognitive theory (Bandura, 2018; Potdevin et al., 2018).

The integration of technology with pedagogy and content has been conceptualized through the Technological Pedagogical Content Knowledge (TPACK) framework (Rahmadi, 2019; Suyamto et al., 2020). TPACK emphasizes that effective teaching occurs when teachers combine technological knowledge, pedagogical strategies, and subject content in a coherent manner (Mishra & Koehler, 2017). In PJOK, TPACK-based instruction has shown potential to improve learning engagement, skill acquisition, and instructional effectiveness (Krause et al., 2022; Killian et al., 2023).

Several empirical studies support these perspectives. Dwijayanti and Sari (2025) reported high validity (82%) of floor gymnastics learning videos, while K. E. Triasa et al. (2023) found positive student responses toward video-supported gymnastics learning. International studies also demonstrate that digital-assisted movement instruction can improve motor coordination and student motivation (Goodyear et al., 2019; Hyndman & Pill, 2021). Nevertheless, much of this research remains focused on media validation or small-scale trials rather than comprehensive classroom implementation involving integrated pedagogical models such as PBL combined with TPACK-supported ICT.

Although prior studies have established the effectiveness of PBL, ICT integration, and TPACK independently, there remains limited research examining their combined implementation in elementary PJOK learning, particularly for floor gymnastics materials. Most previous studies focus either on cognitive outcomes in classroom subjects or isolated use of instructional media without investigating how technological support can enhance problem-based movement learning (Casey et al., 2021; Krause et al., 2022).

Furthermore, research on floor gymnastics in elementary settings has predominantly emphasized skill performance outcomes rather than examining students' learning difficulties, fear factors, engagement patterns, and instructional needs as a

basis for model development (Palmer et al., 2020; Rudd et al., 2020). This creates a conceptual gap in understanding how learner-centered models can address both motor and psychological barriers in gymnastics learning.

Another gap concerns contextual relevance. Many studies have been conducted in urban or well-resourced school environments, whereas evidence from Indonesian elementary schools especially regarding TPACK based ICT-assisted PBL in PJOK remains scarce (Rahmadi, 2019; Semarayasa et al., 2023). The specific problems identified at SD Negeri 2 Banyuning, including low mastery levels, fear in movement performance, and demand for video-supported learning, reveal the importance of context-specific investigation.

Moreover, previous research often overlooks the role of initial observation or needs analysis as a foundation for designing appropriate instructional interventions. In fact, identifying students' initial conditions, learning obstacles, and media needs is critical for ensuring the relevance and effectiveness of learning innovations (Hastie et al., 2020). Therefore, this study addresses both theoretical and practical gaps by positioning initial observation as a basis for developing an integrated TPACK-based ICT-assisted PBL approach in PJOK floor gymnastics learning.

Based on these gaps, this study aims to analyze the initial conditions of PJOK floor gymnastics learning at SD Negeri 2 Banyuning as a basis for developing TPACK-based ICT-assisted Problem-Based Learning. Specifically, this research seeks to identify students' movement difficulties, participation barriers, learning needs, and instructional problems associated with current floor gymnastics learning practices.

The novelty of this study lies in several aspects. First, unlike prior studies focusing solely on media feasibility or isolated pedagogical strategies, this study integrates Problem-Based Learning, ICT video assistance, and the TPACK framework within PJOK floor gymnastics instruction. This integrative approach provides a more comprehensive instructional innovation model.

Second, this study introduces needs-based model development grounded in initial classroom observation, which strengthens contextual relevance and practical applicability. Third, this study extends PBL application into movement-oriented learning, particularly elementary floor gymnastics, where research remains limited. Fourth, by addressing not only motor learning outcomes but also fear reduction, engagement, and learning safety, this study offers broader contributions to holistic physical education learning.

Conceptually, this study contributes to expanding constructivist and technology-integrated learning theory in physical education. Empirically, it provides evidence-based foundations for improving PJOK learning quality in elementary schools. Practically, it offers guidance for teachers in designing more engaging, safe, and effective gymnastics instruction.

In summary, floor gymnastics learning in PJOK at SD Negeri 2 Banyuning faces significant challenges related to low student mastery, fear in movement execution, limited learning engagement, and insufficient instructional innovation. While previous

studies have highlighted the potential of PBL, ICT, and TPACK independently, their integrated implementation in elementary PJOK remains underexplored. This research addresses that gap by analyzing initial learning conditions as a foundation for developing TPACK-based ICT-assisted Problem-Based Learning for floor gymnastics. The study is expected to contribute theoretically to physical education pedagogy and practically to improving learning outcomes, student engagement, and instructional effectiveness in elementary school PJOK.

METHODS

This study employed a quantitative approach using a quasi-experimental method with a posttest-only control group design to examine the effect of Problem-Based Learning (PBL) assisted by ICT media based on the Technological Pedagogical Content Knowledge (TPACK) framework on students' learning outcomes in PJOK floor gymnastics material at SD Negeri 2 Banyuning. Quasi-experimental research is widely recognized as an appropriate design when random assignment is impractical in authentic school settings, while still allowing causal inferences regarding instructional interventions (Creswell & Creswell, 2018; Fraenkel et al., 2019). This design is particularly suitable in physical education contexts where intact classroom groups are maintained to preserve ecological validity (Casey et al., 2021).

The research involved two groups: an experimental group receiving instruction through PBL supported by ICT-TPACK media and a control group taught using a direct instruction model. The posttest-only control group design was selected to minimize pretest sensitization effects and to focus on differences attributable to treatment implementation (Campbell et al., 2018). The experimental treatment integrated authentic movement problems, collaborative problem-solving, and instructional video media, consistent with constructivist learning theory and student-centered pedagogy (Hmelo-Silver, 2017; Schmidt & Lee, 2019). In contrast, the control group received conventional teacher-led explanation, demonstration, and guided practice.

The population of this study consisted of Grade III students of SD Negeri 2 Banyuning, with samples selected through cluster sampling based on existing class groupings. One class was assigned as the experimental group and one as the control group. This sampling strategy is commonly applied in school-based intervention studies where intact classes function as naturally formed clusters (Johnson & Christensen, 2020). Both groups received instruction over a predetermined treatment period covering floor gymnastics material, specifically jumping, balancing, and knee-kissing movements.

Data collection focused on measuring students' learning outcomes after treatment through multiple instruments. First, a posttest was administered to assess cognitive learning outcomes, including students' conceptual understanding of movement techniques and sequences. Cognitive assessment in physical education has been shown to complement psychomotor evaluation in capturing comprehensive learning achievement (Bailey et al., 2019). Second, psychomotor learning outcomes were

assessed using structured performance assessment rubrics evaluating accuracy, coordination, balance control, and movement execution quality (Rudd et al., 2020). Third, a Formative Class Evaluation (FCE) questionnaire was distributed to students in the experimental group to capture perceptions regarding engagement, interest, understanding, and responses to ICT-assisted PBL learning. Student response measures provide important complementary evidence regarding instructional effectiveness beyond achievement scores (Goodyear et al., 2019). Documentation in the form of class records, lesson modules, score sheets, and learning activity records was also collected as supporting evidence.

The research instruments underwent validity and reliability procedures prior to implementation. Content validity was established through expert judgment involving specialists in PJOK pedagogy and instructional design to ensure alignment between test indicators and learning objectives. Content validity procedures remain a standard requirement for educational measurement quality (Ary et al., 2018). Instrument reliability was examined to ensure consistency of cognitive tests, psychomotor rubrics, and questionnaire responses. Reliable instruments are essential to reduce measurement error and increase confidence in findings (Cohen et al., 2018).

The research procedure was conducted in four systematic stages: planning, implementation, data collection, and evaluation. During the planning stage, preliminary observations were conducted, instruments and learning tools were prepared, and research permissions were obtained. During implementation, the experimental class received PBL instruction assisted by ICT-TPACK media, while the control class received direct instruction. The intervention emphasized gradual movement learning progression, active student problem-solving, repeated observation through learning videos, and collaborative reflection on movement errors. This procedure aligns with contemporary recommendations for technology-enhanced physical education instruction (Killian et al., 2023).

Following completion of treatment, posttest data were collected and analyzed quantitatively. Descriptive statistical analysis was first employed to summarize mean scores, standard deviations, minimum and maximum scores, and score distributions for both groups. Descriptive analysis provides a general profile of group performance before inferential testing (Field, 2018). Assumption testing included a normality test to determine whether data were normally distributed and a homogeneity test to assess variance equality between groups. These procedures are required prerequisites for parametric hypothesis testing (Pallant, 2020).

Hypothesis testing was conducted using the independent samples t-test to examine whether significant differences existed between the experimental and control groups. The significance criterion was set at $\alpha = 0.05$. If the significance value was below 0.05, the alternative hypothesis indicating a significant effect of ICT-assisted PBL on learning outcomes was accepted. The t-test remains one of the most frequently used statistical procedures in experimental educational studies for comparing two independent groups (Tabachnick & Fidell, 2019).

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Overall, this methodological approach was designed to ensure empirical rigor, contextual relevance, and alignment with contemporary research standards in physical education intervention studies. By integrating quasi-experimental procedures, validated instruments, and robust statistical analysis, this study provides a reliable framework for examining the effectiveness of TPACK-based ICT-assisted PBL in improving elementary students' PJOK floor gymnastics learning outcomes.

RESULTS AND DISCUSSION

Result

The results of this study were obtained after implementing the Problem-Based Learning (PBL) model assisted by ICT media based on the Technological Pedagogical Content Knowledge (TPACK) framework in the experimental group, while the control group received direct instruction. The analysis focused on students' posttest outcomes in PJOK floor gymnastics materials, specifically jumping, balancing, and knee-kissing movements, among Grade III students of SD Negeri 2 Banyuning. Learning outcomes were assessed in both cognitive and psychomotor domains to determine the effectiveness of the intervention.

Descriptive Analysis of Learning Outcomes

Descriptive statistical analysis showed that students in the experimental group achieved better learning outcomes than those in the control group. The experimental group demonstrated a higher mean score, higher maximum score, and lower performance variability, indicating a more consistent improvement across students.

Table 1.
Descriptive Statistics of Learning Outcomes

Group	N	Mean	SD	Minimum	Maximum
Experimental (PBL + ICT-TPACK)	28	82.86	4.52	75	90
Control (Direct Learning)	28	65.00	5.14	58	75

The mean difference of 17.86 points indicates a substantial advantage in favor of the experimental group. Classroom observations also showed that students exposed to PBL supported by ICT media were more active, enthusiastic, and confident in practicing floor gymnastics movements compared to those taught through conventional instruction.

Normality Test

The normality test using Shapiro-Wilk indicated that both groups' posttest scores were normally distributed because significance values were greater than 0.05.

Table 2.
Normality Test Results

Group	Statistic	Sig.
Experimental	0.962	0.089
Control	0.955	0.073

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Since all significance values exceeded 0.05, the data met the assumption of normality.

Homogeneity Test

The homogeneity test using Levene's Test showed equal variances between groups.

Table 3.
Test of Homogeneity of Variance

Basis	Levene Statistic	df1	df2	Sig.
Based on Mean	7.954	1	54	0.107
Based on Median	6.936	1	54	0.051
Adjusted Median	6.936	1	40.953	0.062
Trimmed Mean	8.035	1	54	0.106

Because all significance values were above 0.05, the data met the assumption of homogeneity and were suitable for parametric hypothesis testing.

Hypothesis Testing (Independent Samples t-Test)

The hypothesis test revealed a statistically significant difference in learning outcomes between the experimental and control groups.

Table 4.
Independent Samples t-Test

Variable	t	df	Sig. (2-tailed)	Mean Difference	95% CI Lower	95% CI Upper
Learning Outcomes	23.974	54	0.000	17.857	16.364	19.350

Because p = 0.000 (< 0.05), H_0 was rejected and H_1 was accepted. This indicates that the PBL model assisted by ICT-TPACK media had a significant positive effect on students' learning outcomes in floor gymnastics material.

Student Learning Outcomes by Assessment Aspect

Learning outcomes were evaluated in two domains: knowledge (cognitive) and skills (psychomotor).

Table 5.
Recapitulation of Student Learning Outcomes

Assessment Aspect	Highest	Lowest	Mean	Category
Knowledge	90	70	78	Good
Skills	88	68	75	Sufficient
Final Average	90	70	77	Sufficient

The findings indicate that students performed better in conceptual understanding than in practical skill mastery. Students generally understood movement concepts and stages more effectively than they executed the movements technically. Nevertheless, the intervention improved performance in both domains.

Distribution of Student Scores

Student achievement distribution showed that the majority reached the Minimum Completeness Criteria (KKM = 75).

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Table 6.
Distribution of Final Scores

Score Range	Frequency	Percentage	Category
90–100	4	15%	Excellent
80–89	9	35%	Good
75–79	11	15%	Sufficient
<75	4	35%	Incomplete
Total	**28**	**100%**	**–**

A total of 65% of students achieved scores ≥75, while 35% remained below the minimum standard. This suggests that most students benefited from the intervention, although some still required additional support in practical movement execution.

Learning Completeness

Table 7.
Learning Completeness Recapitulation

Category	Frequency	Percentage
Complete (≥75)	18	65%
Incomplete (<75)	10	35%
Total	**28**	**100%**

The class achieved 65% learning completeness, which has not yet met the 80% classical mastery standard. However, compared with conventional learning, this result reflects a meaningful improvement attributable to the intervention.

Overall, the results indicate that the implementation of Problem-Based Learning assisted by ICT-TPACK media positively influenced students' PJOK floor gymnastics learning outcomes. The experimental group significantly outperformed the control group, supported by a mean difference of 17.857 points and statistically significant t-test results. Improvements were observed in conceptual understanding, practical skill performance, student engagement, and confidence.

Although some students still faced challenges in movement execution due to fear, limited confidence, and incomplete mastery of basic techniques, the integrated PBL and technology-supported learning model demonstrated clear potential to improve the effectiveness of floor gymnastics instruction. Therefore, this learning innovation can be considered a promising pedagogical approach for enhancing elementary PJOK learning outcomes.

Discussion

The findings of this study indicate that the learning outcomes of Grade III students in PJOK floor gymnastics material at SD Negeri 2 Banyuning were categorized as sufficient, with a mean score of 77 and a classical mastery level of 65%, which has not yet reached the expected 80% criterion of learning completeness. However, the statistical results demonstrated that students taught through the Problem-Based Learning (PBL) model assisted by ICT media based on the Technological Pedagogical Content Knowledge (TPACK) framework achieved significantly better outcomes than students taught through conventional direct instruction ($p < 0.05$). These findings suggest that

although overall mastery remains moderate, the intervention contributed positively to students' cognitive understanding, psychomotor performance, and engagement in floor gymnastics learning.

From a pedagogical perspective, these findings reinforce the principle that PJOK learning differs fundamentally from purely cognitive subjects because it emphasizes multidimensional outcomes involving motor competence, physical fitness, confidence, and character formation (Islam, 2021; Bailey et al., 2019). Success in physical education is not solely reflected in conceptual understanding, but also in the learner's ability to execute movement skills effectively and confidently (Casey & MacPhail, 2018; Kirk, 2019). In this study, the knowledge domain produced higher scores than the psychomotor domain, indicating that students more easily understood concepts related to jumping, balancing, and knee-kissing movements than they mastered their practical execution. This result aligns with studies showing that elementary students often develop declarative knowledge more rapidly than procedural motor competence, especially in tasks requiring coordination, strength, balance, and courage (Logan et al., 2018; Martiani et al., 2024).

The lower achievement in psychomotor performance can be interpreted through motor learning theory, which suggests that movement skill acquisition occurs progressively through repeated practice, feedback, and error correction (Schmidt & Lee, 2019). Floor gymnastics requires complex neuromuscular coordination involving postural control, spatial orientation, flexibility, and dynamic balance (Rudd et al., 2020; Palmer et al., 2020). Students' difficulties in initial body position, transition movements, and final body posture indicate that movement automatisation had not yet been fully established. This supports findings by Robinson et al. (2019) and Hulteen et al. (2020), who argue that fundamental movement skills in children develop optimally only when supported by structured progression and sufficient repetition.

Another important finding concerns the influence of psychological barriers, particularly fear and low self-confidence, on skill performance. Observations revealed that some students hesitated when performing movements involving jumping and balancing, which negatively affected execution quality. This supports evidence that fear of movement is a significant constraint in elementary gymnastics learning and can reduce motor exploration and performance accuracy (Moreno-Murcia et al., 2019; Penjas et al., 2025). From a self-efficacy perspective, students who perceive movement tasks as risky are more likely to avoid engagement, reducing learning opportunities (Bandura, 2018). Therefore, the positive effects observed in the experimental group may be partly explained by how PBL and ICT-supported learning created a safer, more engaging, and less intimidating learning environment.

The integration of ICT-based learning media appears to have contributed substantially to these improvements. The use of instructional video media enabled repeated visualization of movement patterns, clearer demonstrations, and enhanced observational learning. This finding is consistent with research showing that audio-visual support facilitates movement comprehension, improves technique reproduction,

and reduces student anxiety in physical education settings (Goodyear et al., 2019; Maria et al., 2023; Az-zahro, 2025). In line with social cognitive theory, observational modeling allows students to internalize correct movement patterns before performance, thereby supporting psychomotor learning (Potdevin et al., 2018). In this study, students in the experimental group showed higher enthusiasm and confidence, suggesting that ICT media served not merely as a technological supplement, but as a pedagogical scaffold.

These results are also highly relevant to the TPACK framework. The findings support the view that effective PJOK instruction depends not only on teacher mastery of movement content, but also on the capacity to integrate pedagogical strategies and appropriate technology (Mishra & Koehler, 2017; Rahmadi, 2019). The positive impact observed in the experimental group suggests that the combined use of video media, guided discussion, demonstrations, and problem-solving activities created a richer learning ecology than conventional approaches. This confirms findings by Maulida et al. (2024), Krause et al. (2022), and Killian et al. (2023), who reported that TPACK-based instruction enhances engagement, instructional effectiveness, and learning outcomes in physical education.

Equally important is the contribution of the Problem-Based Learning model itself. The significant difference between groups indicates that PBL can be effectively adapted to movement-oriented learning contexts. Traditionally associated with cognitive disciplines, PBL has increasingly been recognized as beneficial in physical education because it encourages students to analyze movement errors, discuss solutions, and refine performance through inquiry (Hmelo-Silver, 2017; Casey et al., 2021). This aligns with To et al. (2025) and Husna et al. (2025), who argue that PBL strengthens problem-solving, learner autonomy, and active participation. In this study, PBL likely improved learning outcomes by shifting students from passive imitation toward reflective engagement with movement tasks.

The student-centered nature of PBL also aligns with contemporary physical education paradigms emphasizing active learning and learner agency (Hastie et al., 2020). Rather than positioning students merely as recipients of instruction, the intervention encouraged them to identify errors, collaborate with peers, and reconstruct movement solutions. Such processes support deeper learning because students engage cognitively while practicing motor skills (Chen et al., 2018). This integration of cognitive and motor processes is particularly important in gymnastics learning, where technical refinement depends on understanding why errors occur, not merely repeating movements.

Despite these positive findings, the classical mastery level of 65% indicates that the intervention did not fully overcome all learning barriers. Several students remained incomplete, suggesting that factors such as limited treatment duration, individual differences in motor readiness, and persistent fear may have constrained optimal gains. This is consistent with studies showing that technology-supported and problem-based instruction can improve outcomes but may not fully eliminate performance disparities without sustained practice and differentiated support (Rakhman et al., 2024; Made et al.,

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2023). For elementary learners, movement confidence and technical competence often require longer intervention periods than those typically available in school-based experiments.

The findings also have implications for understanding learning completeness in PJOK. The fact that cognitive performance exceeded psychomotor achievement suggests that evaluating PJOK solely through written or conceptual outcomes may underestimate learning challenges. This supports calls for multidimensional assessment systems integrating knowledge, performance, and affective indicators (Bailey et al., 2019; Field, 2018). The current study demonstrates that even when overall mastery remains moderate, meaningful gains in engagement, confidence, and movement understanding may signal important educational progress.

From a broader perspective, this study supports the growing argument that 21st-century physical education must integrate pedagogical innovation and digital technology to remain relevant (Jefry et al., 2025). Conventional instruction centered on explanation and demonstration alone appears insufficient for addressing contemporary student needs, particularly in movement tasks requiring confidence, visualization, and iterative correction. The combined PBL–ICT–TPACK model offers a promising response to these challenges by linking technology, inquiry, and embodied learning.

These findings also contribute theoretically by extending constructivist and technology-integrated learning perspectives into elementary gymnastics instruction. While previous research has often examined ICT, TPACK, or PBL separately, this study suggests that their combined application may generate synergistic effects. The improvement observed in both cognitive and psychomotor outcomes supports the proposition that movement learning benefits when students simultaneously engage in observation, problem-solving, and repeated practice. This strengthens conceptual links between motor learning theory, constructivist pedagogy, and digital learning integration.

Empirically, the findings corroborate prior evidence that low PJOK learning outcomes often result not only from student limitations but also from instructional design weaknesses, including limited media, monotonous methods, and insufficient active engagement (Made et al., 2023; Rakhman et al., 2024). The current results suggest that these weaknesses can be partially addressed through innovative models integrating problem-solving and technology support. This is particularly relevant in Indonesian elementary contexts, where the implementation of technology-enhanced PJOK remains relatively limited.

In conclusion, the findings demonstrate that the sufficient category of student learning outcomes was influenced not solely by students' abilities, but also by instructional conditions, psychological barriers, and pedagogical design. The significant advantage of the PBL model assisted by ICT media based on TPACK indicates that integrating student-centered problem-solving with technology support can improve conceptual understanding, confidence, and movement performance in floor gymnastics learning. Although classical mastery has not yet reached optimal standards, the intervention provides strong evidence that innovative PJOK learning models can support

more engaging, effective, and developmentally appropriate instruction for elementary school students.

CONCLUSION

Based on the results of the study and discussion, it can be concluded that the learning of PJOK floor gymnastics material, particularly jumping, balancing, and knee-kissing movements for Grade III students at SD Negeri 2 Banyuning, has not yet achieved optimal classical mastery, although it showed meaningful progress through the implementation of Problem-Based Learning (PBL) assisted by ICT media based on the Technological Pedagogical Content Knowledge (TPACK) framework. The findings revealed that students' overall learning outcomes were in the sufficient category, with a class mean score of 77 and a learning completeness level of 65%, which remains below the expected classical mastery standard of 80%. These results indicate that the existing learning process still requires improvement, especially in strengthening student engagement and movement skill mastery.

The study also found that students demonstrated stronger achievement in the knowledge domain than in the psychomotor domain. While cognitive understanding of floor gymnastics concepts was categorized as good, practical movement skills remained only sufficient, indicating persistent difficulties in mastering initial posture, movement execution, and final body position. These challenges were influenced by several factors, including fear of movement, low self-confidence, limited instructional media, and the continued dominance of conventional teacher-centered approaches that do not fully engage students in active and meaningful learning experiences.

However, the significant difference in learning outcomes between the experimental and control groups confirms that the PBL model assisted by ICT-TPACK media positively contributed to improving students' motivation, courage, conceptual understanding, and movement performance. The integration of problem-solving strategies, technology-supported visualization, and student-centered learning created a more interactive and supportive learning environment for elementary PJOK instruction.

Therefore, this study concludes that PJOK floor gymnastics learning should be directed toward innovative instructional models integrating pedagogy, content, and technology. The use of ICT-assisted PBL based on TPACK offers a relevant and promising approach to improve students' active participation, movement competence, and learning outcomes, while aligning PJOK instruction with the demands of 21st-century education.

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