

The Effect of Problem Based Learning Asisted by ICT TPACK Media on PJOK Roll Gymnastic at SMP Negeri 1 Singaraja

Ni Komang Kristina Dewi^a, Made Agus Wijaya^b, I Komang Sukarata Adnyana^c, I Made Satyawan^d,
 Hendra Mashuri^e

^{abcde}Universitas Pendidikan Ganesha, Indonesia

Correspondence: kristina.dewi@student.undiksha.ac.id

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Abstract

This study aims to determine the effect of the Problem Based Learning (PBL) model assisted by ICT TPACK media on the learning outcomes of Physical Education, Sports, and Health (PJOK) in floor roll gymnastics material for eighth-grade students at SMP Negeri 1 Singaraja. This quasi-experimental study used a posttest-only control group design. The population consisted of 378 students, with a sample of 74 students selected through simple random sampling. Data were collected using multiple-choice tests for the cognitive domain and performance tests for forward and backward rolls for the psychomotor domain. Data analysis included normality tests, homogeneity tests, and an independent sample t-test at a 0.05 significance level. The results showed that the data were normally distributed and homogeneous, with a significance value of $0.00 < 0.05$, indicating that the PBL model assisted by ICT TPACK media significantly affects PJOK learning outcomes in floor roll gymnastics for eighth-grade students at SMP Negeri 1 Singaraja.

Keywords: pbl; ict tpack; physical education; floor gymnastics; learning outcomes

1. Introduction

Education is a fundamental component in the development of human resources because it functions as a foundation in shaping an individual's intellectual abilities, skills, attitudes, and character (Purwaningsih *et al.*, 2019). Education is one of the most important needs for humans, as education serves to prepare human resources to be ready to face life's challenges and to advance the nation and the country (Made Satyawan *et al.*, 2020). Education is not only understood as a process of transferring knowledge, but also as an effort to humanize people by fully developing the potential and dignity of learners (Ujud *et al.*, 2023). Quality education is capable of fostering an awareness of human values, social responsibility, and mutual respect (Mashuri *et al.*, 2022). The current reality of education shows a decline in students' interest and motivation to learn, particularly at higher levels of education, which is influenced by learning approaches that are less relevant to the needs and characteristic of student (Wijaya *et al.*, 2021).

Education at the Junior High School (SMP) level plays a strategic role because students are in a phase of significant physical, emotional, and cognitive development. This condition demands the implementation of adaptive, contextual, and meaningful learning approaches bermakna (Mulya *et al.*, 2024). The subject of Physical Education, Sports, and Health (PJOK) contributes to supporting the goals of holistic education through the development of physical fitness, character, discipline, cooperation, as well as critical thinking skills (Hakimy *et al.*, 2025).

Technological developments and sedentary lifestyles affect the decrease in students' physical activity, making PJOK learning important in instilling the habit of kritis (Hakimy *et al.*, 2025).

In terms of knowledge, students are in the good category because they are able to understand the concepts, stages of movement, and basic principles of forward and backward rolls. Based on the results of observations with the PE teacher, it was stated that in terms of skills, they are still in the sufficient category, which indicates that students still face difficulties in mastering the initial position techniques, performing movements, and achieving the final position optimally. Low achievement in the aspect of skills is influenced by several factors, including fear during practice, lack of self-confidence, and limited mastery of basic techniques. Nevertheless, the implementation of the PBL model assisted by 'TPACK ICT' media has been proven to increase active involvement, motivation, and students' courage in participating in learning.

The Problem Based Learning (PBL) model is considered capable of increasing student engagement and understanding through real problem-solving, discussion, and group collaboration (Julianingsih; Nur Rahmah; Ida Fitria, 2022). (Artana *et al.*, 2025) PBL encourages the development of critical and creative thinking skills through the process of analyzing and solving problems relevant to learning (Kusasih, Ihsan Hutama Satria & Gusmanel, 2024). The use of Information and Communication Technology (ICT) based on Technological Pedagogical Content Knowledge (TPACK) enables teachers to design learning that is effective, engaging, and in accordance with the characteristics of students (Fitria & Mustika, 2024). Video- and animation-based learning media have been proven effective in improving student understanding and learning outcomes in physical education learning (Purwo Adhi *et al.*, 2025). PJOK (Physical Education, Sports, and Health) learning is part of educational sports that support the achievement of the goals of the National Sports Grand Design (DBON) as outlined in Presidential Regulation Number 86 of 2021. Based on observations, interviews, and previous research studies, it is explained that although learning media are available, their utilization in PJOK learning has not been optimal. Learning that is still monotonous impacts the low learning outcomes of students (Sani Susanti, 2024). Therefore, further research is needed to examine the effectiveness of implementing innovative and technology-based learning models.

This study aims to determine the effect of the Problem Based Learning (PBL) model assisted by ICT-based media using the TPACK approach on PJOK learning outcomes for floor gymnastics roll material in grade VIII students at SMP Negeri 1 Singaraja. TPACK comprehensively in floor gymnastics learning at the junior high school level. This study not only emphasizes improving learning outcomes in movement skills, but also the development of critical thinking abilities, problem-solving, and the pedagogical use of technology. Thus, the results of this study are expected to provide theoretical contributions to the development of physical education knowledge as well as practical contributions for PE teachers in designing innovative, effective learning that meets the demands of 21st-century education.

2. Method

Experimental research is a type of experimental research that aims to determine the effect of a treatment on a particular variable without full control over all variables that may influence the experiment. The design used in this research was the Posttest-Only Control Group Design, in which

two groups were involved: an experimental group that received treatment using the Problem Based Learning (PBL) model assisted by ICT-based TPACK media and a control group that received conventional learning. The population of this study consisted of all eighth-grade students of SMP Negeri 1 Singaraja in the academic year 2025/2026.

Population is a generalization area consisting of objects or subjects that have certain qualities and characteristics determined by researchers to be studied and then conclusions are drawn. The sample in this study was selected using a purposive sampling technique, which is a sampling technique based on certain considerations determined by the researcher. The sample consisted of two classes: one class as the experimental group and one class as the control group.

Data collection in this study was conducted through learning outcome tests on the floor gymnastics roll material in Physical Education, Sports, and Health (PJOK) subjects. According to, a test is a series of questions or exercises used to measure skills, knowledge, intelligence, abilities, or talents possessed by individuals or groups. The instrument used in this research was a learning outcome test that measured students' understanding and performance in performing the roll movement in floor gymnastics.

The procedure of this research consisted of several stages: (1) determining the research sample, (2) preparing learning instruments and research instruments, (3) implementing the learning process using the Problem Based Learning (PBL) model assisted by ICT-based TPACK media in the experimental class and conventional learning in the control class, (4) conducting a posttest to measure students' learning outcomes, and (5) analyzing the collected data.

The data obtained from the posttest results were then analyzed using statistical analysis techniques. The analysis included descriptive statistics, normality tests, homogeneity tests, and hypothesis testing using the independent sample t-test to determine whether there was a significant effect of the Problem Based Learning (PBL) model assisted by ICT-based TPACK media on students' learning outcomes in floor gymnastics roll material.

3. Result

The results of this study were obtained through treatments in the form of a Problem Based Learning (PBL) model assisted by ICT TPACK media in the experimental group and a direct learning model in the control group. The data analyzed were the posttest results of students on the material of forward roll and backward roll floor exercises in the eighth grade of SMP Negeri 1 Singaraja. The focus of the study was on the differences in cognitive and psychomotor learning outcomes between the two groups.

Descriptive Analysis Results: Based on the results of the descriptive analysis, a general overview of learning outcomes shows that the experimental group treated with the PBL model assisted by ICT TPACK media achieved higher average scores compared to the control group. In addition, the maximum and minimum scores in the experimental group also tended to be better, while the standard deviation in both groups indicates relatively homogeneous score variations. Overall, students in the experimental group appeared more active, enthusiastic, and confident in practicing forward rolls and backward rolls compared to those in the control group.

Prerequisite Analysis Test Results: The results of the normality test indicate that the learning outcome data in both the experimental group and the control group are normally distributed, as evidenced by the significance value (Sig.) being greater than 0.05.

Table 1. Test of normality

	Kolmogorov-Smirnov			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
Hasil Belajar Kelompok Eksperimen	.131	37	.109	.944	37	.061
Hasil Belajar Kelompok Kontrol	.162	37	.065	.947	37	.075

It is shown that the probability value (p) in the Kolmogorov-Smirnov statistic for the experimental group is 0.10 and for the control group is 0.06. These probability values (p) are greater than 0.05, so H_0 is accepted. This indicates that the distribution of learning outcomes in floor gymnastics (forward roll and backward roll) in the experimental group and the control group is normally distributed.

Homogeneity Test: The results of the homogeneity test indicate that the variances of the two groups are homogeneous, as the significance value is greater than 0.05; therefore, the data meet the assumptions required to proceed with hypothesis testing using the t-test.

Table 2. Test of homogeneity of variance

		Levene statistic	df1	df2	Sig.
Hasil Belajar Kelompok Eksperimen	Based on Mean	1.101	1	72	.290
	Based on Median	1.081	1	72	.290
	Based on Median and With Adjusted df	1.081	1	71.852	.290
	Based on Trimmed Mean	1.137	1	72	.290

The results of the variance homogeneity test for the group using the Problem Based Learning (PBL) model assisted by ICT TPACK Media compared to the group not given the Problem Based Learning (PBL) model assisted by ICT TPACK Media show that the probability value (p) in Levene's statistic indicates a significance level greater than 0.05. This shows that the null hypothesis stating acceptance is accepted, with a probability value (p) of $0.22 > 0.05$, so H_0 is accepted. This indicates that the variance in each group is the same (homogeneous).

Hypothesis Test Results (t-test): The results of the t-test indicate that the significance value (Sig.) is less than 0.05, leading to the rejection of H_0 and the acceptance of H_1 . This finding implies that there is a significant effect of the Problem Based Learning (PBL) model assisted by ICT TPACK media on PJOK learning outcomes in forward roll and backward roll material among eighth-grade students at SMP Negeri 1 Singaraja.

Table 3. Hypothesis test results

		Leven's test for Equality of variances		Hest for equality of means						
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% confidence interval of the difference	
									Lower	Upper
Hasil Belajar Kelompok Eksperimen	Equal Variances Assumed	1.101	.298	18.276	72	.000	17.18919	.94055	15.31424	19.06413
	Equal Variances not Assumed			18.276	71.346	.000	17.18919	.94055	15.31424	19.06413

The probability value (p) of the t-test with equal variances assumed is (p) $0.00 < 0.05$, so H_0 is rejected. This indicates that there is an effect of the Problem Based Learning (PBL) model assisted by ICT TPACK media on the learning outcomes of Physical Education (PJOK) for floor roll material in eighth-grade students at SMP Negeri 1 Singaraja. Based on the mean difference value observed, it is seen that the average normalized gain score of floor exercise learning outcomes (forward roll and backward roll) in the experimental group is greater than in the control group. So, it is concluded that the improvement in floor gymnastics learning outcomes (forward roll and backward roll) in students who were given treatment using the Problem Based Learning (PBL) model assisted by ICT TPACK media is higher than that of students who were not given treatment using the Problem Based Learning (PBL) model assisted by ICT TPACK media. Theoretically, Problem Based Learning (PBL) places students as active subjects who build knowledge through problem-solving. In the context of floor gymnastics, students not only imitate movements, but also understand the relationship between the preparation phase, implementation, and endings. Integration of easy, medium, and difficult movement task videos. Strengthen this process because it provides a concrete visual stimulus. Learners can compare their movements with the correct model, reflect, and independently correct their technique.

Student Learning Outcomes: Student learning outcomes were obtained from assessments of cognitive (knowledge) and psychomotor (skills) aspects. In the experimental group, most students achieved the Minimum Mastery Criteria (KKM) set by the school, which is 77, whereas in the control group there were still several students who had not yet reached the KKM. This indicates that the implementation of the Problem Based Learning (PBL) model assisted by ICT TPACK media has a positive impact on improving student learning outcomes in floor exercise roll material.

Table 4. Student learning outcomes

Hasil Belajar Kelompok Eksperimen			Hasil Belajar Kelompok Kontrol
N	Valid	37	37
	Missing	0	0
Mean		85.1081	67.9189

	Hasil Belajar Kelompok Eksperimen	Hasil Belajar Kelompok Kontrol
Std. Error of Mean	.69618	.63243
Median	84.0000	67.0000
Mode	79.00 ^a	67.00
Std. Deviation	4.23467	3.84692
Variance	17.932	14.799
Range	15.00	16.00
Minimum	78.00	61.00
Maximum	93.00	77.00
Sum	3149.00	2513.00

Regarding the data results from both the experimental and control groups, the data obtained show that the average score of the experimental group is 85.10 while the control group is 67.91, with a standard deviation of 4.23 for the experimental group and 3.84 for the control group. This indicates that the experimental group has a higher average score compared to the control group. The difference in averages suggests that the treatment or learning model applied to the experimental group has a better effect on students' learning outcomes. Meanwhile, the standard deviation values of both groups, which are relatively not too far apart, show that the data distribution in each group is fairly homogeneous or not too widely spread from the average value.

Summary of Student Learning Results

The learning outcomes of students on the Roll material are obtained through assessment in 2 aspects, namely the knowledge aspect and the skills aspect. Assessment is conducted to determine the level of mastery of students over the material that has been taught. The minimum completeness criteria (KKM) used is 77.

1. Recapitulation of Scores for Each Aspect

Table 5. Recapitulation of student learning outcomes on roll material

Aspek Penilaian	Nilai Tertinggi	Nilai terendah	Rata-rata	Kategori
Pengetahuan	90	70	78	Baik
Keterampilan	88	68	75	cukup
Rata-rata akhir	90	70	77	Cukup

Based on the table, it is known that the knowledge aspect has the highest average, which is 78 with a good category, while the skills aspect has an average of 75 with a fair category. The final average of students' learning outcomes is 77, which falls into the fair category and is close to the Minimum Mastery Criteria (KKM) set by the school. These results indicate that students find it easier to understand the concepts and stages of forward roll and backward roll movements in theory compared to mastery of practical skills. In the skills aspect, there are still some students who have not performed optimally in the practice of the starting technique, rolling posture, and the final posture of the movement. Nonetheless, in general, the implementation of the Problem Based Learning (PBL) model assisted by ICT TPACK media can help students understand the material better, especially in the knowledge aspect.

2. Distribution of Student Scores

Table 6. Distribution of final student scores

Rentang Nilai	Jumlah Peserta didik	Presentase	Kategori
90-100	6	15%	Sangat Baik
80-89	13	35%	Baik
75-79	5	15%	Cukup
<75	13	35%	Belum tuntas
Jumlah	37	100%	

Based on the table above, it is known that 24 students (65%) scored ≥ 75 , while 13 students (35%) scored < 75 . This data shows that most students have achieved the Minimum Completion Criteria (KKM) set by the school, which is 77. However, classical learning mastery has not been fully achieved because it has not yet met the minimum completeness standard of 80%. These results indicate that the implementation of the Problem Based Learning (PBL) model assisted by ICT TPACK media has a positive impact on students' learning outcomes on the material of front rolls and back rolls, although there are still some students who require guidance and additional practice, especially in practice skills aspects.

3. Learning Completeness

Table 7. Recap of students' learning completeness

Kategori	Jumlah peserta didik	Presentase
Tuntas (≥ 75)	24	65%
Belum tuntas (≤ 75)	13	35%
Total	37	100%

Based on the results of the learning completeness, it is known that as many as 24 students (65%) have reached the Minimum Completeness Criteria (KKM), while 13 students (35%) have not achieved completeness. This indicates that, classically, learning completeness has not fully met the 80% standard set in learning.

Overall, the learning outcomes of students on the front roll and back roll material are in the sufficient category with a class average of 77 and a completeness level of 65%. In terms of knowledge, students are relatively able to understand the concepts and stages of the movements. However, in terms of skills, several issues are still found in the execution of the initial technique, the rolling process, as well as the final position of the movement. This incompleteness is influenced by several factors, including fear during the movement, lack of self-confidence, and limited mastery of basic techniques. Nevertheless, the implementation of the Problem Based Learning (PBL) model assisted by ICT TPACK media shows an improvement in learning outcomes compared to conventional learning. Therefore, PBL-based learning innovation and technology integration need to continue to be developed so that students are more active, confident, and skilled in performing roll practice, thereby optimizing learning mastery.

4. Discussion

PJOK learning has characteristics that are different from other subjects because it emphasizes mastery of movement skills, physical fitness, as well as attitude formation (Acep Noval Mulzaman *et al.*, 2024). Therefore, the success of PJOK learning is not only measured by the understanding of concepts but also by the students' ability to practice movements correctly and confidently. Based on research results, it was found that students' learning outcomes on the Rolling material in grade VIII at SMP Negeri 1 Singaraja were in the sufficient category, with an average score of 77 and a completeness level of 65%. These results indicate that, on a classical level, learning has not yet reached optimal completeness.

The research results show that the skills aspect received the lowest score compared to the knowledge aspect. These findings indicate that students find it easier to understand the theoretical aspects of floor exercise learning, specifically roll material, but still experience difficulties in applying basic techniques such as the starting position, execution, and finishing position. This condition aligns with the opinion of (Kurniawan *et al.*, 2025).

From observation and interviews, it was found that some students feel afraid and lack confidence when performing rolls. This fear becomes the main obstacle in learning motor skills. In physical education learning, psychological factors such as courage and motivation greatly influence the success of mastering techniques. (Made *et al.*, 2023)) emphasizes that physical education learning must create a safe and enjoyable environment so that students are willing to actively participate in physical activities. If students do not feel comfortable, their participation and learning outcomes will be low. Besides student factors, the use of media and learning models also affects learning outcomes. Research findings indicate that learning is still tending to be conventional and has not fully utilized technology-based media. In fact, PE learning in the digital era needs to integrate ICT to help with movement visualization (Wulandari *et al.*, 2024).

The results of this study are also related to the TPACK concept, namely the integration of technology, pedagogy, and content. Teachers not only need to master the content, but also must be able to choose appropriate learning strategies and media. (Putri Andini *et al.*, 2024) that the implementation of TPACK-based learning can create a more interactive learning experience and increase student engagement. In the context of PE, TPACK helps teachers combine videos, demonstrations, discussions, and field practice in a balanced way so that learning is not monotonous (Made *et al.*, 2023). In addition to the utilization of technology, the learning model also plays an important role. The results of this study indicate that students are still passive during the initial activities and practice, which impacts their low skills (Siregar Nurhamida Sari, 2023).

This condition is relevant to the opinion (Kusasih, Ihsan Hutama Satria & Gusmanel, 2024) states that Problem Based Learning (PBL) can optimize students' thinking abilities and engagement through group work and problem-solving. In PJOK, PBL can be used to encourage students to analyze technique errors, discuss solutions, and try the movements again with improvements. (Widiadnyana *et al.*, 2025) The study also found that PBL trains students to understand concepts through real-life situations and to solve problems independently. This is very much in line with the characteristics of PJOK, which require students to learn from direct experience. When students

are faced with problems such as suboptimal throwing distance or body position what is wrong, they are not only given the answers, but are encouraged to find solutions through discussion and practice. The findings of this study reinforce previous research results which stated that low learning outcomes in PJOK are often caused by less varied learning, limited media, and insufficient active involvement of students. Therefore, PJOK learning needs to be directed towards an approach that places students at the center of learning (student-centered learning). In the roll material, this can be done by combining demonstrations, audiovisual media, group discussions, step-by-step exercises, as well as reflection on practice results (Alsaudi et al., 2024) Thus, this discussion shows that the learning outcomes of students, which are still in the sufficient category, are not solely caused by the abilities of the students, but are also influenced by the design of the PJOK learning itself. The integration of the ICT TPACK-assisted PBL model becomes a relevant alternative solution because it can enhance students' motivation courage, technical understanding, and motor skills. This aligns with the demands of 21st-century PJOK learning, which emphasizes activity, creativity, collaboration, and the use of technology.

5. Conclusion and Recommendation

Based on the results of the research conducted at SMP Negeri 1 Singaraja, it can be concluded that the implementation of the Problem Based Learning (PBL) model assisted by ICT-based TPACK media has a significant effect on students' learning outcomes in the floor gymnastics roll material in Physical Education, Sports, and Health (PJOK) subjects. This study used a Posttest-Only Control Group Design involving two groups, namely the experimental group and the control group. The experimental group received learning using the Problem Based Learning (PBL) model assisted by ICT-based TPACK media, while the control group received conventional learning methods. The results of the study showed that the average learning outcomes of students in the experimental group were higher than those of the students in the control group. This indicates that the integration of the Problem Based Learning model with ICT-based TPACK media can improve students' understanding and mastery of movement skills in PJOK learning, especially in performing floor gymnastics roll movements, including forward roll and backward roll.

The application of the Problem Based Learning model encourages students to be more active and involved in the learning process through problem-solving activities, group discussions, and interactive learning experiences. The use of ICT-based media also helps students understand the correct techniques of the roll movement more clearly through visual explanations and demonstrations. As a result, students are able to improve their understanding of the material and their ability to perform the movements properly.

Based on these findings, PJOK teachers are recommended to apply the Problem Based Learning (PBL) model assisted by ICT-based TPACK media as an alternative learning strategy to improve students' learning outcomes, particularly in practical learning materials such as floor gymnastics. Schools are also expected to support the implementation of technology-based learning by providing adequate facilities and infrastructure to optimize the use of ICT in the learning process.

This research was limited to eighth-grade students at SMP Negeri 1 Singaraja and focused only on the floor gymnastics roll material. Therefore, future researchers are recommended to conduct further

studies involving larger samples, different educational levels, or different learning materials in Physical Education. In addition, further research can examine other variables that may influence learning outcomes, such as motor ability, learning motivation, interest in learning, and physical fitness, so that the results can provide broader insights into improving the quality of Physical Education learning.

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