Vol. 13 No. 2 September 2026
e-ISSN: 2807-2227
p-ISSN: 2355-4355

The Influence of the Problem Based Learning Model on the Ability to Play Football in Junior High School Students

Irghizza Nazmi Afhani[1], Siswanto[2], Akhmad Dimyati[3]
[123]Pendidikan Jasmani Kesehatan dan Rekreasi, Fakultas Keguruan dan Ilmu Pendidikan, Universitas Singaperbangsa Karawang, Jawa Barat, Indonesia

Authors email: irghizzaafhani@gmail.com, siswanto.media@fkip.unsika.ac.id, akhmad.dimyati@fkip.unsika.ac.id

Correspondent Author: irghizzaafhani@gmail.com

Received: June 05, 2026; Accepted: September 26, 2026; Published: September 30, 2026
Ed: 2026: 433-449

Abstract

This study aims to test the influence of the Problem Based Learning (PBL) model on the football playing ability of grade VIII students of SMPN 2 West Karawang compared to conventional learning. The study used a quantitative approach with a pretest–posttest nonequivalent control group quasi-experimental design. A total of 43 students were involved, consisting of 22 students in the experimental group and 21 students in the control group. The experimental group participated in 12 PBL sessions through the presentation of game problems, discussions, solution formulation, small-sided games practices, feedback, and evaluation. Playing ability was measured using the Game Performance Assessment Instrument (GPAI) in the aspects of decision making, skill execution, and support. The analysis included descriptive statistics, paired-samples t-test, repeated measures ANOVA, and ANCOVA. The results showed that the score of the experimental group increased from 39.68 to 73.32, while the control group increased from 39.52 to 65.14. The mean increase in the groups was 33.64 and 25.62 points, respectively. The paired-samples t-test showed significant improvements in the experimental group, $t(21) = -8.532$, $p < 0.001$, $d = -1.819$, and the control group, $t(20) = -5.758$, $p < 0.001$, $d = -1.256$. Repeated measures of ANOVA showed a significant time effect, $F(1.41) = 99.814$, $p < 0.001$, $\omega^2 = 0.469$, but the time interaction × the group was not significant, $F(1.41) = 1.827$, $p = 0.184$, $\omega^2 = 0.007$. ANCOVA also showed that posttest differences between groups after controlling for the pretest were not significant, $F(1.40) = 2.861$, $p = 0.099$, $\eta^2 = 0.063$. Thus, PBL supports the improvement of playability but has not been shown to produce a statistically greater improvement than conventional learning.

Keywords: *Problem Based Learning*, soccer, tactical awarnes, GPAI, physical education.

INTRODUCTION

Physical education not only serves to develop fitness and movement skills but also provides a learning context that allows for the development of cognitive abilities, problem-solving, social interaction, and decision-making. In this framework, learning is not enough geared toward students' ability to reproduce movement techniques, but it needs to give them the opportunity to understand situations, choose actions, try solutions, and evaluate the consequences of those actions. Problem-Based Learning (PBL) is relevant to these needs because it places authentic problems as the starting point for learning and encourages students to learn through processes of inquiry, discussion, decision-making, and reflection. In physical education, PBL is seen as a learning by doing approach that allows teachers to act as facilitators through questions and scaffolding to direct students' thinking processes (Ryan, 2021). This framework also provides space for collaborative learning (Kotsonis, 2022), the development of problem-solving skills (Purnomo et al., 2024), critical thinking (Suherman et al., 2024) and cooperation when these skills are specifically targeted and measured in sports learning (Xia et al., 2025).

These characteristics are important in soccer learning because the success of playing is not only determined by the ability to pass, dribble, shoot, or control the ball separately. Soccer is an invasion game that requires players to constantly recognize spaces, the positions of teammates and

opponents, defensive pressure, and possible actions available before selecting appropriate motor responses. Research on soccer learning shows that student responses and decision-making during games are related to cognitive structures formed through interaction and knowledge construction in game situations (Zghibi et al., 2021). In addition, the success of the attacking and defensive phases is influenced by tactical actions at the individual, small group, and team levels (Barquero-Ruiz et al., 2022). Thus, playability needs to be understood as an integration between situational perception, decision-making, skill execution, and the player's contribution to the continuity of the game.

Although the demands of the game are integrative, the practice of soccer learning in schools can still place mastery of techniques as the focus. Learning models that are less varied and too technique-oriented can limit students' opportunities to understand how skills are used in the context of a match (Putra, 2022). Learning tactics and strategies that are theoretically dominant can also make it difficult for students to understand attack, defense, and game formation patterns (Taningrum et al., 2024). This condition raises pedagogical problems because the ability to perform techniques correctly does not necessarily indicate the ability to determine when, where, and why the technique needs to be used. In high school students, learning football therefore requires experiences that connect technical skills to situational demands and decision-making, rather than just the repetition of movements.

Similar problems arise in the assessment aspect. Technical tests conducted in isolation can describe the quality of movement execution, but do not fully represent the perceptual-cognitive demands of the game. A systematic study by Zhang et al. (2025) shows that game-scenario-based instruments allow the evaluation of technical and tactical skills, actions with and without the ball, and decision-making in more representative situations. This is important because the development of gameplay is also influenced by the context of the practice experienced by students (Segovia & Gutiérrez, 2022). Therefore, learning that aims to develop playing skills is ideally followed by assessments that capture how students choose and carry out actions in real games.

The physical education literature shows the development of more student-centered approaches and game contexts, such as Teaching Games for Understanding (TGfU), Sport Education, nonlinear pedagogy, and the use of small-sided games (SSGs). Nonlinear pedagogy provides opportunities for students to explore movement solutions in representative game tasks and has shown progress on several indicators of soccer game performance of school-age students (Chow et al., 2023). The integration of TGfU and Sport Education has also been used to develop cognitive performance and motor skills in soccer learning (Z.-R. Jia, 2021), while the combination of the two models in school students is reported to support the development of psychomotor aspects as well as some learning psychological processes (Hossini, N S et al., 2024).

SSGs become one of the relevant practice contexts because they simplify the game without eliminating the key relationship between cooperation, opposition, space, and decision-making. Systemically, SSGs can be seen as a form of play that retains the basic characteristics of football at a lower level of complexity (Dos Reis & Corrêa, 2021). Their use can reportedly support the development of football skills and increase students' motivation to participate in football learning (Ridwan et al., 2022). Thus, SSGs provide a context that allows tactical decisions and skill execution to occur in an integrated manner.

PBL can complement the context of the game by providing an explicit structure to the problem-solving process. In football, Santoso and Santoso (2024) reported improvements in basic movement skills and learning activities after the application of PBL in elementary school students.

Santoso et al. (2024) also showed that PBL and TGfU can both affect fundamental soccer skills. At different levels of education, Jia et al. (2024) integrated PBL with screen-based simulation and found developments in tactical decision-making, tactical skills, and student engagement. Taningrum et al. (2024) used PBL-based animated videos to help students understand attack patterns, defensive patterns, and soccer formations. The effectiveness of visual representation in tactical learning is also supported by the study of Chen et al. (2021), while Diekhoff (2024) shows that video-assisted discussions can facilitate students' conversations about tactical and technical considerations. Recent developments have even shown that technological support can strengthen knowledge learning and tactical decision-making (Miao et al., 2025).

Although the findings provide a promising basis, there are several research gaps. First, specific evidence regarding PBL in football learning is still spread across different levels and outputs. Santoso and Santoso (2024) and Santoso et al. (2024) focus on elementary school students and especially fundamental skills, while Taningrum et al. (2024) examine high school students with a focus on critical thinking and understanding of tactical materials. Jia et al. (2024) engage students and combine PBL with screen-based simulations. Thus, the direct application of PBL to junior high school students, especially grade VIII, is still relatively underrepresented.

Second, previous research has often placed technical skills, tactical knowledge, decision-making, engagement, or cognitive abilities as stand-alone outputs. In fact, in real games these components operate in an integrated manner. Evidence regarding cognitive structure in playing decisions (Zghibi et al., 2021) the association of different levels of tactical action with game success (Barquero-Ruiz et al., 2022), the influence of practice context on gameplay development (Segovia et al., 2022), and the need for game situation-based assessment (Zheng et al., 2025) suggest the need for more contextual performance measurement. Third, improved learning outcomes cannot only occur through PBL. Other game approaches, structured exercises, technique practices, and competitions can also result in the development of football skills (Chow et al., 2023; Izhanov et al., 2025; Putra, 2022). Therefore, PBL evaluation needs to involve a comparison group so that the increase that occurs is not directly interpreted as a specific effect of PBL.

Based on these gaps, this study aims to examine the influence of Problem-Based Learning on the ability to play football of grade VIII students of SMP Negeri 2 West Karawang compared to conventional learning. The novelty of the research lies in three aspects. First, PBL is applied directly in the context of football learning of junior high school students which is still relatively limited in the literature. Second, tactical decision-making is placed as a conceptual mechanism that connects the identification of game problems with the implementation of actions. Third, playing ability is evaluated contextually using the Game Performance Assessment Instrument (GPAI), especially in the components of decision making, skill execution, and support, so that performance is not reduced to technical skills that are tested separately. The scope of the study is limited to the playing performance observed through these three components; this study does not directly measure critical thinking, cooperation, communication, or tactical understanding as separate psychological constructs.

METHODS

Research Design

This study uses a quantitative approach with a quasi-experimental pretest–posttest nonequivalent control group design. This design was chosen because the research was carried out in

a pre-formed class so that individual randomization of participants was not carried out. Two classes were used as research groups, namely the experimental group that obtained football learning using Problem-Based Learning (PBL) and the control group that followed conventional football learning. Conceptually, the design of the experimental group was expressed as O_1–X–O_2, while the control group was O_1'–O_2', with O_1/O_1' being the initial measurement, X being the PBL intervention, and O_2/O_2' being the final measurement. The independent variable in the study was the PBL learning model, while the dependent variable was the ability to play football observed in game situations.

The selection of quasi-experimental designs corresponds to the research character of physical education interventions carried out in the available classroom structure. A similar approach has been used to evaluate football skills interventions in educational settings (Wu et al., 2021) and compare changes before and after sports interventions in groups that acquired different learning conditions (Li et al., 2024). Football-based studies in schools also use intervention groups and regular learning groups to evaluate changes in learning outcomes after a program has been given (Şendil et al., 2026).

Participants

The research population consisted of 400 students in grade VIII of SMP Negeri 2 West Karawang who participated in Physical Education, Sports, and Health (PJOK) learning, especially football materials. The research sample amounted to 43 students from two whole classes. A total of 22 students were placed as an experimental group and 21 students as a control group. Class selection was carried out using purposive sampling, considering the suitability of the class for the implementation of the research intervention. Thus, the grouping unit followed the classes that were already available and did not randomize individually between students. The information was maintained in accordance with the source text.

The use of existing class groups is a pragmatic choice in educational research because interventions need to take place in a normal learning environment without substantially changing the classroom organization. Previous research on football skills interventions has also applied treatments to some school classes in a quasi-experimental framework (Wu et al., 2021), while school-based soccer research compared program groups with groups that remained under a regular physical education curriculum (Şendil et al., 2026). Such an approach allows the evaluation of interventions to be carried out in learning conditions that are close to daily educational practices.

Procedure

The research consisted of 14 stages, namely one pretest, 12 intervention sessions, and one posttest. In the pretest, both groups participated in small-sided games to get an initial picture of their playing ability. Their performance was assessed through three components of GPAI, namely decision making, skill execution, and support. The intervention of the experimental group was then divided into four learning focuses which each lasted for three meetings. Treatment 1–3 focused on passing and decision making in a 4 vs 4 game. The teacher presented problems regarding the right selection of passes, students analyzed the situation and discussed alternative solutions, then applied them in the game. Treatment 4–6 focused on dribbling and decision making, where students determined when dribbling was the choice of action that suits the game situation. Treatment 7–9 was directed at shooting and decision making, including the analysis of attack solving problems and the selection of actions before shooting. Furthermore, Treatment 10–12 integrates skills learned in more complex game situations, with attention to decision making, skill execution, and support. The structure of the intervention corresponds to the procedural details in the main manuscript.

Table 1. PBL procedure

Stage/Focus	Learning Activities	Assessment/Observation Focus
Pretest	Students played *small-sided games* without PBL treatment to get an idea of their early playing ability.	GPAI: *decision making, skill execution,* dan *support*.
Treatment 1-3: Passing and decision making (4 vs 4)	The teacher presents problems related to the selection of the right passing. Students analyze the problem, discuss alternative solutions, and then apply it through small-sided games. The teacher provides observations, feedback, and evaluations.	Accuracy of decision-making and passing execution in game situations.
Treatment 4-6: Dribbling and decision making (4 vs 4)	The teacher gives problems regarding the use of dribbling in game situations. Students discuss, determine solutions, and test them in the game, then evaluate with the teacher.	The selection and implementation *of dribbling* according to the game situation.
Treatment 7-9: Shooting and decision-making	Students analyze problems related to final completion, determine alternative actions, and practice solutions through small-sided games. Learning ends with evaluation and drawing conclusions.	Accuracy of decisions and *shooting* execution in game situations.
Treatment 10-12: game situation	The teacher presents the problem in a more integrated game situation. The student discusses and implements the solution by integrating the skills that have been learned. The teacher observes and evaluates the performance of the game.	Integration *of decision making, skill execution,* and *support* using GPAI.
Posttest	Students perform *small-sided games* with the same game procedure as *the pretest* to measure playability after the intervention.	GPAI: *decision making, skill execution,* dan *support*.

Each PBL meeting follows a consistent sequence: (1) presentation of game problems, (2) group analysis and discussion, (3) formulation of alternative solutions, (4) implementation of solutions through games, (5) observation and feedback of teachers, and (6) evaluation of learning outcomes. The use of problems as an organizer of sports learning is also found in PBL interventions in physical education, including when PBL is combined with technological support to facilitate the movement learning process (Lubis et al., 2022).

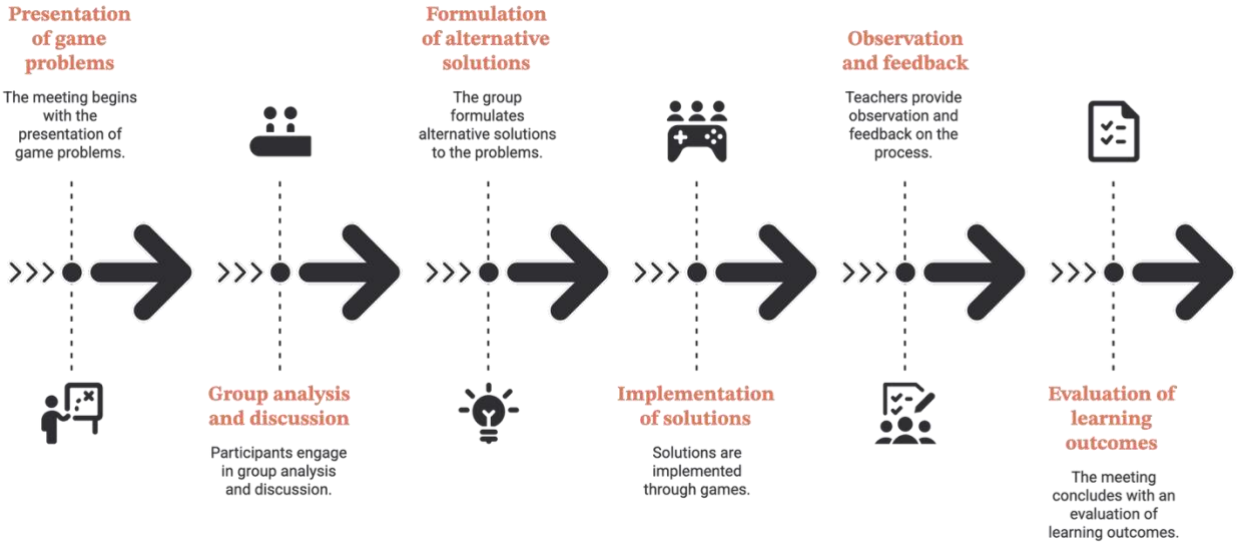

Figure 1. PBL meeting sequence

Small-sided games are used as a context for the application of solutions so that students not only practice techniques but use them when facing game conditions. School experimental studies

show that small-sided recreational football can be organized progressively as part of a physical education intervention (Saha et al., 2025). The use of small-sided soccer games has also been applied in PJOK learning to provide exposure to game tasks under controlled conditions (Hawani et al., 2023). After 12 sessions were completed, the posttest was carried out using the same small-sided game procedure and GPAI components as the pretest.

Instrument

Football playing ability was measured using the Game Performance Assessment Instrument (GPAI). Based on the research design, the assessment was limited to three components, namely decision making, skill execution, and support. Decision making describes the accuracy of students in choosing actions based on game conditions. Skill execution represents the quality of skill execution after a decision is made. Meanwhile, support describes the contribution of players without the ball in providing options and supporting the sustainability of the game. Thus, the instrument is not only oriented towards the implementation of techniques, but also on how skills are used in game situations. The three components are components that are explicitly defined in the source manuscript. The assessment is carried out in the context of the same game between the pretest and posttest so that the change in score represents a change in performance under comparable task conditions.

Data Analysis

Data analysis was performed to determine changes in playability from pretest to posttest and to compare patterns of change between the PBL group and the control group. Descriptive analysis included mean, standard deviation, minimum, and maximum. Distribution assumptions were examined using the Shapiro–Wilk test, while variance similarity was checked using the Levene test. The initial score equivalence of the two groups was analyzed using an independent-samples t-test. Changes in each group were analyzed using a paired-samples t-test, accompanied by Cohen's d to illustrate the magnitude of the change. However, the primary differential effectiveness test was not based solely on the significance of each group's changes. The pretest and posttest were then analyzed using ANOVA repeated-measures, with Time (pretest–posttest) as a factor within the subject and Group (PBL–control) as a factor between subjects. Time x Group interactions were used as the primary test to determine whether the change patterns of the two groups were different.

The use of repeated-measures of ANOVA in the study of football interventions was also found in the study of Saha et al. (2025), while the combination of paired t-test, ANCOVA, repeated-measures ANOVA, and effect size reporting was used in the study of football performance interventions by Choudhary et al. (2025). In addition, ANCOVA was used as an adjunct analysis with posttest scores as dependent variables and pretest scores as covariates to assess differences in final outcomes after initial ability variation was controlled. A baseline value control approach was also used in school-based intervention research (Şendil et al., 2026). The level of significance of the study was set at $\alpha = 0.05$, and effect sizes were reported to complement the statistical interpretation with information regarding the magnitude of the effects obtained.

RESULTS

Based on Table 2, the initial tactical awareness score was relatively similar between the control group (M = 39,524, SD = 15,520) and the experimental group (M = 39,682, SD = 15,767). After the intervention, the average score increased to 65,143 (SD = 13,196) in the control group and 73,318 (SD = 18,406) in the experimental group. Thus, the descriptive change from pretest to posttest was 25,619 points in the control group and 33,636 points in the experimental group. The pattern

showed that performance improvement occurred in both groups, although the numerical increase in the experimental group was larger.

Table 2. Descriptive statistic

	Valid	Missing	Mean	Std. Deviation	Minimum	Maximum
Pre Test Decision Making (ctl)	21	1	1	0.707	0	2
Pre Test Skill Execution (ctl)	21	1	1.095	0.7	0	2
Pre Test Support (ctl)	21	1	0.667	0.73	0	2
Tactical Awareness Pre Test (ctl)	21	1	39.524	15.52	14	71
Post Test Decision Making (ctl)	21	1	1.524	0.512	1	2
Post Test Skill Execution (ctl)	21	1	1.762	0.831	0	3
Post Test Support (ctl)	21	1	1.286	0.717	0	2
Tactical Awareness Post Test (ctl)	21	1	65.143	13.196	43	86
Pre Test Decision Making (exp)	22	0	1	0.69	0	2
Pre Test Skill Execution (exp)	22	0	1	0.535	0	2
Pre Test Support (exp)	22	0	0.773	0.528	0	2
Tactical Awareness Pre Test (exp)	22	0	39.682	15.767	14	71
Post Test Decision Making (exp)	22	0	1.591	0.59	0	2
Post Test Skill Execution (exp)	22	0	2.045	0.844	0	3
Post Test Support (exp)	22	0	1.5	0.512	1	2
Tactical Awareness Post Test (exp)	22	0	73.318	18.406	43	100

The results of the GPAI component provide a more detailed picture of changes in playing performance. In the experimental group, decision making increased from 1,000 to 1,591, skill execution from 1,000 to 2,045, and support from 0.773 to 1,500. However, the control group also experienced an increase in all three components, namely decision making from 1,000 to 1,524, skill execution from 1,095 to 1,762, and support from 0.667 to 1,286. The increase in decision-making in the PBL group was descriptively in line with the finding that problem-based learning in the context of football can facilitate the identification of tactical problems and decision-making, while the increase in skill execution was consistent with research showing the development of football skills after the implementation of PBL (T. Jia et al., 2024; Santoso & Santoso, 2024). The association between individual, small group and team actions with playing success also suggests that changes in the support component are relevant in understanding overall tactical performance (Barquero-Ruiz et al., 2022).

Table 3. Normality test result

		Valid	Missing	Shapiro-Wilk	P-value of Shapiro-Wilk
Tactical Awareness Pre Test	Control	21	0	0.922	0.093
Tactical Awareness Pre Test	Experiment	22	0	0.923	0.088
Tactical Awareness Post Test	Control	21	0	0.884	0.017
Tactical Awareness Post Test	Experiment	22	0	0.91	0.047

Note. Excluded 2 rows from the analysis that correspond to the missing values of the split-by variable Group

The Shapiro–Wilk test showed that the tactical awareness pretest score did not differ significantly from the normal distribution in both the control group ($p = 0.093$) and the experimental group ($p = 0.088$). In contrast, the posttest score resulted in $p = 0.017$ in the control group and $p =$

0.047 in the experimental group. Thus, the distribution of posttest scores showed a deviation from normality based on the $p < 0.05$ criterion.

Table 4. Homogenity test result

Test of Equality of Variances (Levene's)

	F	df_1	df_2	p
Tactical Awareness Pre Test	0.038	1	41	0.847

The Levene test on the initial score yielded $F = 0.038$ and $p = 0.847$. The value showed no evidence of a difference in pretest variance between the control and experimental groups. Thus, the two groups showed relatively comparable initial variability characteristics.

Table 5. Baseline comparability test result

Independent Samples T-Test

	t	df	p	Cohen's d	SE Cohen's d	95% CI for Cohen's d	
						Lower	Upper
Tactical Awareness Pre Test	-0.033	41	0.974	-0.01	0.305	-0.608	0.588

Note. Student's t-test

An independent-samples t-test analysis of the tactical awareness pretest score yielded $t(41) = -0.033$, $p = 0.974$, with Cohen's $d = -0.010$. These results show that there was no significant difference in initial performance between the control and experimental groups. This similarity is important because it shows that the subsequent developmental differences were not preceded by a significant difference in mean scores between the two groups.

Table 6. Adjusted posttest comparison ancova test result

ANCOVA - Tactical Awareness Post Test

Cases	Sum of Squares	df	Mean Square	F	p	η^2	95% CI for η^2	
							Lower	Upper
Group	711	1	711	2.861	0.099	0.063	0	0.247
Tactical Awareness Pre Test	657.8	1	657.8	2.647	0.112	0.058	0	0.24
Residuals	9,939.50	40	248.5					

After the pretest scores were controlled through ANCOVA, the group's effect on posttest tactical awareness resulted in $F(1.40) = 2.861$, $p = 0.099$, $\eta^2 = 0.063$. Thus, the posttest difference between the experimental and control groups after adjustment for the initial score did not reach the level of statistical significance $p < 0.05$. These results suggest that the numerical advantage of the PBL group at the posttest was not sufficient to conclude that PBL was statistically superior after the initial score variation was considered.

Table 7. Descriptive statistic differential pre-post effect

Descriptives

RM Factor 1	Group	N	Mean	SD	SE	Coefficient of variation
Pre	Control	21	39.52	15.52	3.387	0.393
	Experiment	22	39.68	15.77	3.362	0.397
Post	Control	21	65.14	13.2	2.88	0.203
	Experiment	22	73.32	18.41	3.924	0.251

Table 7 confirms the consistency of the descriptive values reported in Table 2 after rounding. The average of the control group changed from 39.52 to 65.14, while the experimental group changed

from 39.68 to 73.32. Thus, the average increase reached 25.62 points in the control group and 33.64 points in the experimental group. The difference in numerical increase of about 8.02 points favored the experimental group, but the significance of the difference in such changes should be determined through the interaction of the time x group, not through a comparison of descriptive changes or significance within each group.

Table 8. Repeated measures ANOVA

Within Subjects Effects

Cases	Sum of Squares	df	Mean Square	F	p	ω²
RM Factor 1	18,862.50	1	18,862.50	99.814	< .001	0.469
RM Factor 1 ✻ Group	345.3	1	345.3	1.827	0.184	0.007
Residuals	7,748.00	41	189			

Note. Type III Sum of Squares

Repeated measures of ANOVA showed a significant time primary effect, F (1.41) = 99.814, p < 0.001, ω² = 0.469. These results showed a strong increase in tactical awareness from pretest to posttest when the two groups were considered together. However, the effect of the interaction time × group was not significant, F (1.41) = 1.827, p = 0.184, ω² = 0.007. These findings are direct tests of differential pre-post effects and show that the data have not provided sufficient statistical evidence that the magnitude of the increase in the PBL group differs from the magnitude of the increase in the control group. Such an interpretation is important because the improvement in performance in football learning does not have to be exclusive to one learning model. The literature suggests that PBL can improve football skills, but other learning approaches can also result in meaningful skill improvements; for example, PBL and *Teaching Games for Understanding* both resulted in the development of football fundamental skills in previous comparative studies (Santoso et al., 2024). Therefore, the significant increase in the PBL group in this study does not in itself prove the superiority of PBL over the comparison group.

Table 9. Paired samples t-test

Paired Samples T-Test

Measure 1	Measure 2	t	df	p	Cohen's d	SE Cohen's d	95% CI for Cohen's d	
							Lower	Upper
TA Pre Test (ctl)	TA Post Test (ctl)	-5.758	20	< .001	-1.256	0.413	-1.824	-0.671
TA Pre Test (exp)	TA Post Test (exp)	-8.532	21	< .001	-1.819	0.373	-2.499	-1.123

Paired-samples analysis of the t-test showed that the control group experienced significant changes from pretest to posttest, t (20) = −5.758, p < 0.001, Cohen's d = −1.256. The experimental group also showed significant changes, t (21) = −8.532, p < 0.001, Cohen's d = −1.819. The absolute magnitude of Cohen's d was numerically higher in the experimental group, but both groups clearly experienced substantial improvements. These findings directly answer the reviewer's concern that the increase in the control group should not be ignored. The increase in the PBL group is consistent with previous studies that reported the development of basic soccer skills and learning activities after the implementation of PBL (Santoso & Santoso, 2024), as well as an increase in tactical decision-making when PBL is used to organize tactical problem-solving in soccer learning (T. Jia et al., 2024). However, because the time × group interactions in this study are not significant, the suitability with

the literature should be understood as support for the possible benefits of PBL, not as evidence that PBL is more effective than the control conditions in this study sample.

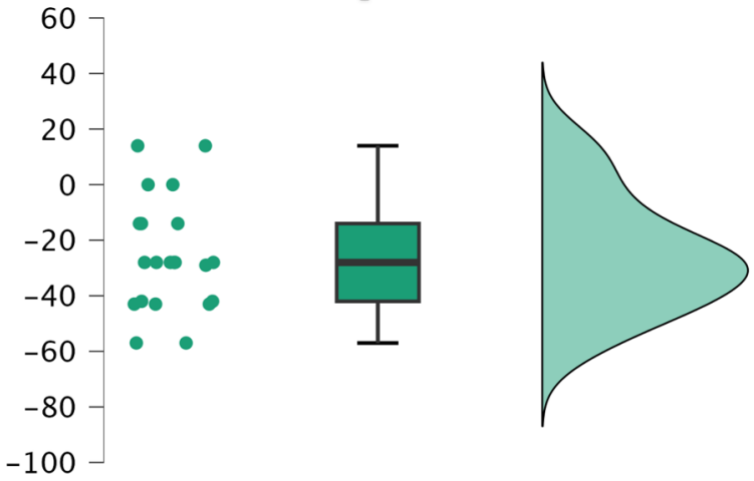

Figure 2. Tactical awareness pre-post test control group

Figure 1 shows a clear improvement in the control group from a *pretest* average of around 39.52 to 65.14 in the *posttest*. This pattern reinforces the *paired-sample t-test* results that the change in the control group is significant. Thus, the improvement in playing performance did not occur exclusively in the PBL group. The finding that various soccer learning experiences can result in skill development is also consistent with studies that found improvement through more than one pedagogical approach (Santoso et al., 2024).

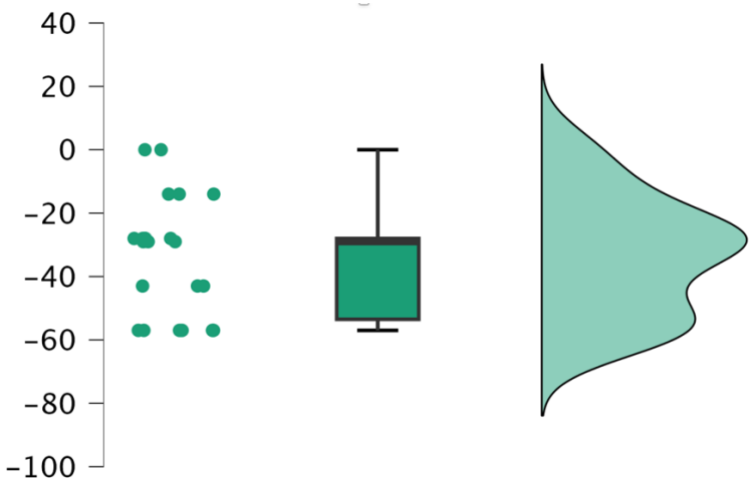

Figure 3. Tactical awareness pre-post test experimental group

Figure 2 shows an increase in the average of the experimental group from 39.68 in the *pretest* to 73.32 in the *posttest*. Visually, the increase in the experimental group was greater than that of the control group. This pattern is descriptively in line with the football PBL literature that reports improvements in basic skills, learning engagement, and tactical decision-making after the implementation of problem-based learning (T. Jia et al., 2024; Santoso & Santoso, 2024; Taningrum et al., 2024). However, such visualizations should not be used as evidence of PBL statistical superiority because direct testing through *the interaction of time* × *group* still shows p = 0.184.

Overall, the results showed three main findings: both groups experienced improved playing performance; the PBL group showed numerical improvements and effect sizes in the larger group; but the difference in change between the PBL and control groups was not statistically significant. Therefore, the most appropriate outcome formulation for publication is that PBL is associated with

improved playing performance and GPAI components but has not been shown to produce statistically greater improvements than the control group in this study.

DISCUSSION

The findings of the study show that the learning process of football, both using Problem-Based Learning (PBL) and conventional learning, is followed by the development of students' playing ability. Although the PBL group showed a greater developmental tendency descriptively, the differences in changes between groups have not provided a sufficient basis to conclude that PBL produces higher improvements than control learning. Therefore, the results of the study are more accurately interpreted as being able to support the development of playing performance, not as evidence that PBL is a consistently superior approach.

The development in the control group has a strong pedagogical rationality. Students in the group still gain soccer learning, exposure to the ball, repetition of movements, opportunities to practice skills, and experience responding to game situations. Thus, performance changes are not only possible when students follow a certain pedagogical model. Milenković et al. (2024), for example, show that a regular organized physical education program for one semester can develop sports skills including soccer in school-age students. Similarly, Ostrowska (2021) emphasizes that the development of soccer skills is inseparable from the quality of the organization of activities, training experiences, and educational processes provided to participants.

Exposure to play-based activities can also result in changes independent of the specific characteristics of PBL. Petrušič et al. (2022) showed that game-based school interventions and small-sided games can cause adaptation in adolescent students when given repeatedly. Although the outputs of the study were mainly in the form of physical fitness, the results showed that additional play experiences alone are a meaningful learning stimulus. The research of Romero-Martínez et al. (2025) also shows that pedagogy that integrates movement activities in a structured manner can result in changes in motor competencies and learning aspects without having to use PBL as the only pedagogical framework.

This interpretation is important because the pretest and posttest in this study take place in the context of a similar game. The experience of the initial measurement has the potential to make students better understand the organization of the game, the demands of the task, and the type of action that will be observed when the next measurement is taken. The influence of this familiarity cannot be empirically separated from the learning effect. In addition, the use of classes that have been formed without individual randomization leads to the possibility of class characteristics, previous play experience, motivations, or variations in abilities that are not fully controlled. Therefore, such uncertainties should be maintained in interpretation and not ignored to strengthen the PBL superiority claim.

The finding that playing ability can be developed through more than one form of learning is in line with the literature showing that various pedagogical strategies can provide benefits in football learning. Hutajulu et al. (2025) found that several teaching styles can improve passing performance, and the combination of guided discovery with practice provides better results than using one style separately. The findings suggest that the quality of the learning process can emerge from a combination of exploration and practice opportunities, rather than solely from the label of a learning model.

The cooperative approach also shows potential in the context of football. Pamungkas and Annasai (2024) developed cooperative learning-based soccer material learning and reported on the development of learning outcomes as well as support for student motivation and cooperation. Meanwhile, Al Aridhee et al. (2023) showed that cooperative learning can aid in the mastery of football-specific skills, and that its effects can be amplified when pedagogical strategies are complemented with appropriate learning assistance. Although the populations and outputs of the two studies differ from this study, they both reinforce the argument that skills advancement can be generated by multiple pedagogical pathways.

In the context of the game, the social aspect and the structure of the task are also relevant. Costa et al. (2024) found that peer teaching strategies in small-format soccer games can increase the involvement of students with lower abilities. This shows that who interacts with students, how groups are organized, and how responsibilities are shared can affect students' chances of participating in the game. Therefore, the development of the control group in this study should not be considered as an unexpected finding, but as a possible consequence of active involvement during soccer learning.

On the other hand, the literature also points to conditions when certain interventions produce more pronounced differences than usual learning. Liang et al. (2023) report that the integration of augmented reality in soccer learning supports motor learning outcomes, motivation, and learning behaviors. Shi et al. (2026) also found that school football programs equipped with sports medicine principles and technology-based feedback resulted in the development of several physical indicators that were greater than standard curricula. The differences between the study and this study indicate that the magnitude of the pedagogical effect may depend on the intensity of the scaffolding, the type of feedback, the character of the participants, the duration of the intervention, and how much the intervention differed significantly from the comparative conditions. Thus, the lack of statistical superiority of PBL in this study does not contradict the potential benefits of PBL but suggests that PBL does not work in isolation from the context of its implementation.

Theoretically, the developmental tendencies of PBL groups can be explained through the relationship between contextual problems, situational analysis, solution selection, action practice, and reflection. Quarmby and Luguetti (2023) identify problem-based learning, contextual learning activities, and interpersonal relationships as important elements of sports-based pedagogical practice. In such a structure, students not only receive answers from the teacher, but are given space to recognize problems and construct responses to situations at hand. This explanation is in line with the research of Rodríguez-Martín and Buscà Donet (2022), who showed that the presentation of contextual problem situations in physical education can encourage students to design and implement solutions cooperatively. In football, this mechanism is relevant because the success of actions is not only determined by the quality of technique, but rather by the ability to connect situational information with motor responses. Bajrami et al. (2022) showed a relationship between cognitive ability and situational motor ability in game sports, which reinforces the view that game performance involves the interaction of cognitive and motor processes.

However, these mechanisms should be placed as theoretical interpretations, not direct measurement results. This study assesses decision making, skill execution, and support as observable performance in a game. This study does not directly measure critical thinking, communication, cooperation, metacognitive processes, or tactical understanding as a separate psychological construct. Therefore, the development of performance scores should not be automatically translated as evidence of the development of all these cognitive or social abilities. In addition, student development is likely

to depend on a combination of problem-solving activities and the quality of practical experience. Shaowei et al. (2022) show that physical education learning designs that combine resources, methods, learning processes, and evaluations can support learning in football courses. These findings support the interpretation that effectiveness is not only determined by the name of the model, but by how teachers organize problems, provide exploration time, provide repetitive practices, provide feedback, and link reflection to subsequent actions.

Practically, PBL can be used by PJOK teachers as a framework for organizing soccer learning, especially to relate game problems to decision and skill execution. Teachers can start from relatively simple problems, such as choosing passing targets or determining when dribbling is used, then increase complexity towards space creation, no-ball support, attack completion, and the integration of multiple skills in the game. The structure retains technique as an important part of learning, but technique is learned in relation to its tactical function.

The results of the study also show that teachers do not need to place PBL as a substitute for all learning strategies. Combinations with demonstrations, directed practices, guided discovery, peer teaching, and cooperative learning can be used according to the goals and characteristics of students. The findings of Hutajulu et al. (2025), Pamungkas and Annasai (2024), and Costa et al. (2024) support the importance of variation and adaptation of strategies so that learning opportunities are not only used by students who already have higher playing skills. Feedback also needs to be directed at the relationship between decisions and actions, not just the incorrect technique. Technology can be used as a complement when available. Huang and Liang (2025), for example, show the potential of sensor technology to recognize movements and provide more targeted information in soccer learning. However, the use of technology is not a prerequisite for PBL, its main function is to clarify information and strengthen feedback.

Finally, teachers need to use the results of this study proportionately. PBL deserves to be considered as an alternative to organizing soccer learning that puts students on authentic game problems, but the evidence of this study has not supported the claim that PBL is always more effective than conventional learning. Subsequent research needs to strengthen randomization or group matching, provide familiarization sessions before the pretest, control for the equivalence of practice exposure, ensure observer reliability, and analyze GPAI components separately. In this way, PBL's specific contribution can be more clearly distinguished from the influence of general practice, playing experience, and familiarity on measurement procedures.

CONCLUSION

This study shows that football learning with the Problem Based Learning (PBL) model and conventional learning both improve the playing ability of grade VIII students of SMPN 2 West Karawang. Descriptively, the group that participated in PBL learning showed greater development in playing ability, including in the aspects of decision making, skill execution, and support measured through the Game Performance Assessment Instrument (GPAI). However, the results of the analysis showed that the difference in improvement between the PBL group and the control group had not reached statistical significance. After the initial ability of the students was controlled, the difference in the results of the two groups also did not show enough evidence to state that PBL was superior to conventional learning. Thus, PBL can be used as an alternative to football learning that supports student involvement in game problem solving, decision-making, skill implementation, and providing support in game situations. However, the effectiveness of PBL in producing greater improvements

than conventional learning still requires further testing with a stronger research design, a larger number of participants, and better control of various factors that can affect the development of students' playability.

RECOMMENDATION

Based on the results of the research, Physical Education, Sports, and Health teachers are advised to use Problem Based Learning as an alternative in soccer learning, especially when the learning objectives emphasize the ability to understand game situations, make decisions, implement skills, and provide support to teammates. The application of PBL should be done through authentic game problems, group discussions, exploration of several alternative solutions, practice in small-sided games, and targeted feedback so that students get active and contextual learning opportunities. However, PBL does not need to be positioned as the only most effective learning model. Teachers still need to consider student characteristics, learning objectives, initial ability level, number of practice opportunities, quality of game assignments, and forms of feedback. Conventional learning and other game approaches can still be used proportionally if they are appropriate for learning needs. For subsequent researchers, it is recommended to use larger sample counts, better randomization or group matching procedures, and familiarization sessions before initial measurements to reduce the impact of experience on the test. The use of consistent and reliable observers also needs to be strengthened. Analysis of GPAI components should be done separately so that the responses of each aspect of performance can be understood more specifically. Future research may also add variables such as tactical understanding, critical thinking, cooperation, or communication, but each of these constructs should be measured using appropriate and validated instruments to make the resulting conclusions stronger and comprehensive. In addition, subsequent studies need to control for the equivalence of learning exposure, previous playing experience, and teacher factors so that the specific contribution of PBL to the development of football performance can be clearly distinguished from the influence of general practice during the learning process.

REFERENCES

Al Aridhee, W. S. H., Kahat, T. H., & Abdallah, W. M. (2023). Effect of the cooperative learning strategy on the learning of the soccer throw-in in university students. *Sport TK*, *12*. Scopus. https://doi.org/10.6018/sportk.556971

Bajrami, V., Ibri, L., & Sabotic, B. (2022). Influence of Cognitive and Situational Motor Skills in Sports Games on Primary School Students. *Human Research in Rehabilitation*, *12*(2), 159–161. Scopus. https://doi.org/10.21554/hrr.092207

Barquero-Ruiz, C., Sánchez-De-San-Pedro, S., & Arias-Estero, J. L. (2022). Influence of Tactical Levels in School and Extracurricular Football. *Apunts. Educacion Fisica y Deportes*, (150), 67–73. Scopus. https://doi.org/10.5672/apunts.2014-0983.es.(2022/4).150.08

Chen, C.-H., Rekik, G., Belkhir, Y., Huang, Y.-L., & Chen, Y.-S. (2021). Gender differences in attention adaptation after an 8-week fifa 11+ for kids training program in elementary school children. *Children*, *8*(9). Scopus. https://doi.org/10.3390/CHILDREN8090822

Choudhary, P. K., Choudhary, S., Gorgan, C. M., Saha, S., & Astuti, Y. (2025). Effects of an eight-week neuromuscular training program on performance variables in female university football players. *Pedagogy of Physical Culture and Sports*, *29*(6), 511–523. Scopus. https://doi.org/10.15561/26649837.2025.0602

Chow, J. Y., Meerhoff, L. A., Choo, C. Z. Y., Button, C., & Tan, B. S. (2023). The Effect of Nonlinear Pedagogy on the Acquisition of Game Skills in a Territorial Game. *Frontiers in Psychology*, *14*. https://doi.org/10.3389/fpsyg.2023.1077065

Costa, J. C. M., Ribeiro, J., Batista, P. M. F., Ribeiro, V., Fonseca, M., & Barreira, D. (2024). Teaching Football For Student Diversity: A Study In The Context of A Physical Education School Placement. *Journal of Physical Education (Maringa)*, *35*(1). Scopus. https://doi.org/10.4025/jphyseduc.v35i1.3546

Diekhoff, H. (2024). 'I can show you; here's the video'–video-supported student-led debates in game-based approaches. *Cogent Education*, *11*(1). Scopus. https://doi.org/10.1080/2331186X.2024.2398842

Dos Reis, M. A. M., & Corrêa, U. C. (2021). Small-sided games as holons in the football: A hierarchical systems approach. *Revista Brasileira de Cineantropometria e Desempenho Humano*, *23*. Scopus. https://doi.org/10.1590/1980-0037.2021V23E74081

Hawani, A., Chikha, A. B., Zoghlami, W., Souissi, M. A., Trabelsi, O., Mrayeh, M., & Muscella, A. (2023). Working Memory in Overweight Boys during Physical Education Classes. *Children*, *10*(5). Scopus. https://doi.org/10.3390/children10050805

Hossini, N S, R., Fasanghari, J., & Amini, M. (2024). Unlocking Athletic Excellence: Role of Cutting-Edge Sport Technologies on Athletic Sports Development. *Journal of New Studies in Sport Management*, (Online First). https://doi.org/10.22103/jnssm.2024.22995.1269

Huang, G., & Liang, J. (2025). Study on Skills Enhancement Strategy Based on Sensing Technology in College Sports Football Teaching. *Annals of the Entomological Society of America*, *10*(1). Scopus. https://doi.org/10.2478/amns-2025-1103

Hutajulu, P. T., Lubis, J., & Tirto, A. (2025). Understanding the Influence of Combined Teaching Styles on Football Passing Performance among PETE Freshmen Students. *Physical Education Theory and Methodology*, *25*(3), 594–600. Scopus. https://doi.org/10.17309/tmfv.2025.3.15

Izhanov, Z., Seisenbekov, Y., Kokebayeva, R., Abishev, K., Orazov, S., & Tastanov, A. (2025). Scientific and methodological foundations of the formation of football playing skills in middle school students. *Sport TK*, *14*. Scopus. https://doi.org/10.6018/sportk.659021

Jia, T., Sitthiworachart, J., & Morris, J. (2024). Screen-based Simulation Supporting Problem-based Learning to Improve Football Tactics. *Open Sports Sciences Journal*, *17*. Scopus. https://doi.org/10.2174/011875399X311682240419063944

Jia, Z.-R. (2021). Effects of teaching games for understanding integrated sport education model on college students' football cognitive performance and motor skills. *Revista de Cercetare Si Interventie Sociala*, *72*, 274–287. Scopus. https://doi.org/10.33788/rcis.72.17

Kotsonis, A. (2022). Educating for Collaboration: A Virtue Education Approach. *Ethics and Education*. Scopus. https://doi.org/10.1080/17449642.2022.2111485

Li, Y.-F., Gao, T., Luo, L.-P., & He, S. (2024). Comparative effects of open-skill and closed-skill sports on executive function in university students: A 16-week quasi-experimental study. *Frontiers in Psychology*, *15*. Scopus. https://doi.org/10.3389/fpsyg.2024.1457449

Liang, L., Zhang, Z., & Guo, J. (2023). The Effectiveness of Augmented Reality in Physical Sustainable Education on Learning Behaviour and Motivation. *Sustainability (Switzerland)*, *15*(6). Scopus. https://doi.org/10.3390/su15065062

Lubis, J., Haqiyah, A., Kusumawati, M., Irawan, A. A., Hanief, Y. N., & Riyadi, D. N. (2022). Do problem-based learning and flipped classroom models integrated with Android applications based on biomechanical analysis enhance the learning outcomes of Pencak Silat? *Journal of Physical Education and Sport*, *22*(12), 3016–3022. Scopus. https://doi.org/10.7752/jpes.2022.12381

Miao, C., Zhang, S., & Liu, K. (2025). Comparing AI-assisted and traditional tactical instruction: A crossover experimental study among male college students. *Acta Psychologica*, *259*. Scopus. https://doi.org/10.1016/j.actpsy.2025.105431

Milenković, D., Radonjić, J., Nikić, N., & Zubić, I. (2024). The Influence of Physical Education Over A Semester on the Psycho-Physical Development in Elementary School Students. *Physical Education Theory and Methodology*, *24*(1), 87–94. Scopus. https://doi.org/10.17309/tmfv.2024.1.11

Ostrowska, M. (2021). Effect of the quality of sport education based on the example of selected physical activities class at a school community center. *Journal of Physical Education and Sport*, *21*, 1172–1178. Scopus. https://doi.org/10.7752/jpes.2021.s2148

Pamungkas, G., & Annasai, F. (2024). Development of a physical education learning model football game materials based on cooperative learning to increase student motivation and cooperation. *Fizjoterapia Polska*, *2024*(1), 23–30. Scopus. https://doi.org/10.56984/8ZG2EF8900

Petrušič, T., Trajković, N., & Bogataj, S. (2022). Twelve-Week Game-Based School Intervention Improves Physical Fitness in 12–14-Year-Old Girls. *Frontiers in Public Health*, *10*. Scopus. https://doi.org/10.3389/fpubh.2022.831424

Purnomo, E., Jermaina, N., Marheni, E., Gumilar, A., Widarsa, A. H., Elpatsa, A., & Abidin, N. E. Z. (2024). Enhancing Problem-Solving Skills Through Physical Education Learning: A Comprehensive Analysis Mejora de las habilidades para resolver problemas mediante el aprendizaje de educación física: Un análisis integral. *Retos*, *58*, 435–444. Scopus. https://doi.org/10.47197/retos.v58.106838

Putra, A. N. (2022). The Effect of Teaching Game Approach to Improve Football Passing. *International Journal of Human Movement and Sports Sciences*, *10*(4), 709–715. Scopus. https://doi.org/10.13189/saj.2022.100411

Quarmby, T., & Luguetti, C. (2023). Rethinking pedagogical practices with care-experienced young people: Lessons from a sport-based programme analysed through a Freirean lens. *Physical Education and Sport Pedagogy*, *28*(3), 276–290. Scopus. https://doi.org/10.1080/17408989.2021.1976742

Ridwan, M., Prakoso, B. B., & Putranta, H. (2022). Small-Sided Games in Building Female Students' Motivation for Practising Football in Physical Education. *Physical Education Theory and Methodology*, *22*(3), S59–S63. Scopus. https://doi.org/10.17309/tmfv.2022.3s.08

Rodríguez-Martín, B., & Buscà Donet, F. (2022). Mathematical Competence Development in Primary School Physical Education Contexts. *Revista Internacional de Medicina y Ciencias de La Actividad Fisica y Del Deporte*, *22*(88), 807–825. Scopus. https://doi.org/10.15366/rimcafd2022.88.006

Romero-Martínez, J., Menescardi, C., Ortega-Benavent, N., Montalt-García, S., Barnett, L. M., García-Massó, X., & Estevan, I. (2025). Effects of a classroom-based intervention to promote physical literacy in children: The randomized and controlled ALPHYL Study. *Journal of Science and Medicine in Sport*. Scopus. https://doi.org/10.1016/j.jsams.2025.05.006

Ryan, T. G. (2021). Problem-based learning opportunities within Ontario (Canada) elementary health and physical education. *Journal of Pedagogical Sociology and Psychology*, *3*(2), 66–74. Scopus. https://doi.org/10.33902/JPSP.2021270046

Saha, S., Khati, A., Pepe, O., Manamkandath, M. P., Bayiroğlu, G. B., & Çimen, M. (2025). Effects of an 8-Week Supervised Small-Sided Recreational Football Intervention on Physical and Psychological Outcomes in Adolescent Girls: A Randomized Controlled Trial. *International Journal of Kinesiology and Sports Science*, *13*(3), 51–58. Scopus. https://doi.org/10.7575/aiac.ijkss.v.13n.3p.51

Santoso, N., Pambudi, A. F., Prayadi, H. Y., Utami, N. S., Yudhistira, D., & Virama, L. O. A. (2024). How do the Learning Models of Teaching Game for Understanding and Problem-Based Learning Influence Fundamental Football Skills in Physical Education? Conducting an Analysis in the Elementary School Context. *Physical Education Theory and Methodology*, *24*(5), 793–798. Scopus. https://doi.org/10.17309/tmfv.2024.5.15

Santoso, N., & Santoso, N. P. (2024). Case study: Problem-based learning model for soccer basic movement skills and learning activity. *Retos*, *61*, 578–582. Scopus. https://doi.org/10.47197/retos.v61.109754

Segovia, Y., & Gutiérrez, D. (2022). Using Sport Education to Implement Game-Based HIIT in Physical Education. *Strategies*, *35*(2), 19–29. Scopus. https://doi.org/10.1080/08924562.2022.2030831

Şendil, A. M., Canlı, U., Larsen, M. N., Tarantino, G., Krustrup, P., & Aldhahi, M. I. (2026). Effects of the 11 for Health program on physical performance and executive functions in schoolchildren. *Scientific Reports*, *16*(1). Scopus. https://doi.org/10.1038/s41598-026-38837-5

Shaowei, S., Zainudin, Z. A., & Kun, H. (2022). The Blended Teaching Design and Practice for Physical Education Specialized Course. *International Journal of Human Movement and Sports Sciences*, *10*(3), 510–523. Scopus. https://doi.org/10.13189/saj.2022.100319

Shi, K., Ye, Y., Zheng, T., Tang, K., Bin, J., Wei, L., & Wang, L. (2026). Effect of a sports-medicine–guided football program on physical fitness in adolescents: A controlled school-based trial. *Medicine (United States)*, *105*(21), 1–14. Scopus. https://doi.org/10.1097/MD.0000000000048649

Suherman, W. S., Nugroho, S., Setyawan, H., Pambudi, D. K., Puri, L. W., Septiantoko, R., Hermawan, Y., García-Jiménez, J. V., Pavlovic, R., Eken, Ö., Pranoto, N. W., Darmawan, A., Aziz Purnomo Shidiq, A., & Rahmatullah, M. I. (2024). Achievement of Physical Education Learning Results Based on Gender Review and Learning Motivation on High School Students in the Yogyakarta Region, Indonesia. *Retos*, *55*, 1045–1052. Scopus. https://doi.org/10.47197/retos.v55.106831

Taningrum, N., Kriswanto, E. S., Pambudi, A. F., & Wahyudwi, W. D. Y. (2024). Improving Critical Thinking Skills Using Animated Videos Based on Problem-Based Learning Mejora de las habilidades de pensamiento crítico mediante vídeos animados basados en el aprendizaje basado en problemas. *Retos*, *57*, 692–696. Scopus. https://doi.org/10.47197/retos.v57.103297

Wu, H., Eungpinichpong, W., Ruan, H., Zhang, X., Wang, S., & Ding, C. (2021). Protocol for a quasi-experimental study examining the effect of a ball skills intervention on four domains of preschooler development. *Primary Health Care Research and Development*, *22*. Scopus. https://doi.org/10.1017/S1463423621000645

Xia, Y., Tasi, K.-C., Chen, F., & Yu, H.-C. (2025). Fostering teamwork skills through PBL volleyball courses: A social psychological study of Chinese vocational college students. *Environment and Social Psychology*, *10*(4). Scopus. https://doi.org/10.59429/esp.v10i4.3575

Zghibi, M., Sahli, H., Ben Khalifa, W., Ghouili, H., Gharbi, M., & Haddad, M. (2021). Modalities of student responses in football games according to players' cognitive structures. *Sustainability (Switzerland)*, *13*(18). Scopus. https://doi.org/10.3390/su131810193

Zheng, T., Kong, R., Liang, X., Huang, Z., Luo, X., Zhang, X., & Xiao, Y. (2025). Effects of plyometric training on jump, sprint, and change of direction performance in adolescent soccer player: A systematic review with meta-analysis. *PLoS ONE*, *20*(4 April). Scopus. https://doi.org/10.1371/journal.pone.0319548