



OPEN ACCESS

EDITED BY

Dr. Samsurijal Hasan, MM
Universitas Pahlawan, Indonesia.Assoc. Prof. Dr. Herli Pardilla
Universitas Muhammadiyah Sumatera Utara,
Indonesia.*CORRESPONDENCE
Sandi Achmad Pratama
sandiahmad250591@gmail.comRECEIVED: September 24, 2025
ACCEPTED: December 12, 2025
PUBLISHED: January 27, 2026.

COPYRIGHT © 2026 (Author)

 Sandi Achmad Pratama
Linda Susila
 Erika Mc ClintockThis work is licensed under a Creative
Commons Attribution-ShareAlike 4.0
International License.

Game-Based Learning Approach to Enhance Tactical Understanding and Motivation in School Football Physical Education

Sandi Achmad Pratama^{1*}, Linda Susila¹, Erika Mc Clintock²¹STKIP Yapis Dompu, Indonesia.²Physical Education and Sport, Herzen University, Russia.

ABSTRACT

Background & objective: This quasi-experimental study examined the effectiveness of a GBL approach in improving tactical understanding and intrinsic motivation among secondary school students in football physical education classes in Kabupaten Dompu, Nusa Tenggara Barat, Indonesia.**Materials & Methods:** Eighty-four students (mean age = 14.6 ± 1.2 years; 52 males, 32 females) from two secondary schools participated in an 8-week intervention (16 sessions, 2x/week). The experimental group (n=42) received GBL-based instruction using modified small-sided games and tactical questioning, while the control group (n=42) followed traditional skill-drill methods. Tactical understanding was assessed using the Game Performance Assessment Instrument (GPAI), and motivation was measured using the Sport Motivation Scale (SMS) adapted for physical education. Data were analyzed using paired t-tests, ANCOVA, and Cohen's d effect sizes.**Results:** The GBL group demonstrated significantly greater improvements in tactical understanding (decision-making: 42.3%; skill execution: 31.8%; support: 38.5%) compared to the control group (15.2%, 18.4%, 12.7% respectively; all $p < 0.001$). Regarding motivation, the GBL group showed significant increases in intrinsic motivation ($d = 1.24$, $p < 0.001$), identified regulation ($d = 0.89$, $p < 0.001$), and decreased amotivation ($d = -1.02$, $p < 0.001$), while the control group showed minimal changes. ANCOVA revealed significant between-group differences favoring GBL on all measures (F-values ranging from 32.45 to 58.72, all $p < 0.001$, partial $\eta^2 = 0.28-0.42$).**Conclusions:** The GBL approach using TGfU principles significantly enhanced both tactical understanding and autonomous motivation in secondary school football education. These findings support the implementation of game-centered pedagogies in Indonesian physical education contexts and suggest that GBL may address common challenges of student disengagement in traditional skill-focused instruction. Future research should explore long-term retention effects and implementation across diverse cultural and educational settings.

Keywords

game-based learning; teaching games for understanding; tactical understanding; motivation; physical education; football; Indonesia.

CITATION APA STYLE 7:

Pratama, S. A., Susila, L., & Mc Clintock, E. (2026). Game-Based Learning Approach to Enhance Tactical Understanding and Motivation in School Football Physical Education. *INSPIREE: Indonesian Sport Innovation Review*, 7(01), 23-32. <https://doi.org/10.53905/inspire.v7i01.163>

INTRODUCTION

Global and Theoretical Context

Physical education (PE) contributes to young people's motor competence, cognitive development, psychosocial well-being, and engagement in physical activity (Bergmann, F., et al (2021)). Within team sports, however, effective learning requires more than the acquisition of isolated technical skills. Students must recognize tactical situations, anticipate opponents' actions, identify available space, and select and execute appropriate responses under changing game conditions. Football provides a particularly relevant context for developing these competencies because successful performance depends on the continuous integration of technical execution, tactical decision-making, and interaction with teammates and opponents (Harvey et al., 2009; Oslin et al., 1998). Consequently, instructional approaches that emphasize technical proficiency without adequately addressing the tactical demands of authentic gameplay may not sufficiently prepare students to

transfer learned skills into competitive situations (Kirk & MacPhail, 2002; Práxedes et al., 2018).

Teaching Games for Understanding (TGfU) offers an alternative to technique-first instruction by placing tactical problems and modified games at the centre of the learning process (Light, R., & Fawns, R. (2003)). Rather than requiring students to master isolated techniques before participating meaningfully in games, TGfU engages learners in developmentally appropriate game situations that encourage tactical awareness, decision-making, skill execution, and reflection (Kirk, D., 2005; Oslin et al., 1998). Small-sided games can increase opportunities for meaningful participation, while tactical questioning helps students interpret game situations and evaluate possible solutions. These principles are consistent with situated learning, which emphasizes the development of knowledge through participation in contexts that reflect its practical application (Kirk & MacPhail, 2002; Layton, M. E., et al. (2023)). They also align with nonlinear pedagogical

perspectives, in which learning emerges through interactions among learners, task constraints, and the performance environment (Tan et al., 2011).

The potential benefits of game-based learning (GBL) extend beyond tactical competence to students' motivation to participate in PE. Self-Determination Theory (SDT) provides a complementary explanation for this relationship (Mercan, G., & Selçuk, Z. V. (2024). According to Deci and Ryan (2000) and Ryan and Deci (2000), motivation varies in its degree of self-determination, ranging from amotivation to externally regulated and more autonomous forms of motivation, including identified regulation and intrinsic motivation. Learning environments that support autonomy, competence, and relatedness are expected to facilitate more autonomous motivation Ezeddine, et al. 2025. In game-centred instruction, autonomy may be supported through opportunities to make tactical decisions, competence through appropriately challenging tasks and informative feedback, and relatedness through cooperative interaction with teammates (Gil-Arias et al., 2017; Sierra-Díaz et al., 2019). Accordingly, GBL may influence tactical understanding and motivation through related but distinct mechanisms: contextualized practice supports the interpretation and application of tactical knowledge, whereas meaningful participation and perceived competence may encourage more self-determined engagement.

Critical Review of Existing Evidence

Existing research provides encouraging, although heterogeneous, evidence for game-centred approaches in sport and PE. In American high-school soccer, Harvey et al. (2009) examined TGfU using the Game Performance Assessment Instrument (GPAI), providing context-specific evidence concerning game performance in school-based football. Práxedes et al. (2016) investigated a questioning-based teaching programme intended to improve tactical actions among young footballers, while Práxedes et al. (2018) examined nonlinear pedagogy in relation to decision-making and execution in youth soccer. Together, these studies support the relevance of instructional designs that connect decision-making with skill execution rather than treating them as independent learning outcomes Serra-Olivares, J., et al. (2015). Nevertheless, findings from youth football programmes cannot automatically be generalized to compulsory school PE, where students may differ in prior experience, learning needs, and opportunities for sustained practice.

Evidence from broader PE settings also suggests that game-centred approaches can support game performance and student engagement. Farias et al. (2015) examined game performance and understanding within a hybrid Sport Education season, whereas Gil-Arias et al. (2017) investigated the motivational implications of a hybrid TGfU–Sport Education unit. These studies are complementary but address different instructional configurations and outcomes. Their findings therefore should not be interpreted as demonstrating that every GBL implementation produces equivalent tactical and motivational benefits. Similarly, Estero et al. (2020) examined the effects of a brief TGfU teaching period on game performance, knowledge, and psychosocial variables in elementary PE, illustrating the importance of considering intervention duration and educational level when interpreting evidence. Differences in programme design, instructional implementation, population, and outcome measurement may partly explain variations across studies.

Evidence syntheses reinforce the promise of game-centred pedagogy while highlighting implementation and measurement challenges. Harvey and Jarrett (2014) reviewed research on game-centred approaches to teaching and coaching, and Barba-Martin

et al. (2020) systematically reviewed applications of TGfU in PE. These contributions provide a broader basis for understanding the approach, but the diversity of pedagogical models and assessment practices complicates direct comparisons across studies. In particular, tactical decision-making, technical execution, and overall game performance are related but distinct constructs. The GPAI was developed to assess observable game-performance behaviours (Oslin et al., 1998), while subsequent work has highlighted issues requiring attention in its application and interpretation (Mummert & Harvey, 2008). Consequently, conclusions about tactical learning depend partly on the specific performance indicators selected and the quality of observational assessment.

Motivational evidence presents a similar need for construct-specific interpretation. Research informed by SDT has investigated motivation in PE (Ntoumanis, 2001; Standage et al., 2005), while Sierra-Díaz et al. (2019) synthesized evidence concerning psychosocial factors associated with models-based practice. However, intrinsic motivation, identified regulation, and amotivation should not be treated as interchangeable indicators of a single motivational response. Their distinct patterns may provide a more informative assessment of whether an instructional approach supports autonomous engagement Sotos-Martínez, V. J., et al. (2025). Moreover, findings from hybrid pedagogical models cannot isolate the contribution of GBL or TGfU alone when additional instructional components are incorporated.

Although these studies establish a credible theoretical and empirical foundation, the available literature does not justify assuming a uniform effect across educational contexts. Differences in age, sporting experience, programme duration, comparator conditions, assessment procedures, and study design limit straightforward cross-study comparisons. The cited evidence also does not provide a consistent basis for comparing intervention effect magnitudes across all relevant studies. Further controlled investigations using explicit comparator conditions, established measures, and clearly defined intervention procedures are therefore warranted.

Research Gap, Novelty, and International Contribution

Despite growing evidence supporting game-centred pedagogy, it remains unclear whether a structured GBL intervention can simultaneously improve observable tactical performance and autonomous motivational outcomes among secondary-school students receiving football instruction in an Indonesian school context. Existing studies have examined tactical learning, motivational responses, and hybrid pedagogical models, but these findings do not fully resolve whether an eight-week TGfU-informed programme outperforms traditional skill-drill instruction across both domains within the same school-based intervention. This question is relevant because tactical competence and motivation represent complementary dimensions of PE learning, yet improvements in one cannot be assumed to guarantee improvements in the other.

The present study addresses this gap by comparing a structured GBL intervention with traditional skill-drill instruction among secondary-school students in Kabupaten Dompu, Indonesia. The intervention integrates modified small-sided games, tactical questioning, and progressive tactical problems over eight weeks, with equivalent scheduled instructional time in both groups. Tactical performance is assessed through the GPAI components of decision-making, skill execution, and support, while motivation is examined using the Sport Motivation Scale (SMS). The combination of these measures enables the study to evaluate behavioural performance and motivational responses within a common intervention framework. Its contribution lies in examining

the applicability of established game-centred and motivational theories in an underrepresented educational setting, rather than proposing a new learning theory or claiming that the findings are universally generalizable. Given the quasi-experimental design and allocation of intact schools to different conditions, the findings must also be interpreted in light of potential school-level and teacher-related confounding.

Objectives and Hypotheses

The primary objective of this study was to examine whether an eight-week GBL approach informed by TGfU principles produced greater improvements in tactical performance and more favourable motivational outcomes than traditional skill-drill instruction among secondary-school students participating in football PE in Kabupaten Dompu, Indonesia. Specifically, the study compared changes in GPAI decision-making, skill execution, and support; examined changes in intrinsic motivation, identified regulation, and

amotivation; and estimated the magnitude of between-group differences after accounting for baseline scores. Based on TGfU and SDT, the following hypotheses were formulated:

H₁: Students receiving GBL instruction will demonstrate greater improvements in GPAI decision-making, skill execution, and support scores than students receiving traditional skill-drill instruction.

H₂: Students receiving GBL instruction will demonstrate greater increases in intrinsic motivation and identified regulation than students receiving traditional skill-drill instruction.

H₃: Students receiving GBL instruction will demonstrate a greater reduction in amotivation than students receiving traditional skill-drill instruction.

These hypotheses specify directional expectations for the study's measured outcomes and provide a basis for evaluating the comparative effectiveness of GBL within the quasi-experimental design.

MATERIALS METHODS

Participants

This study employed a quasi-experimental design with a pretest-posttest control group structure. The independent variable was the instructional approach (GBL vs. traditional), while the dependent variables were tactical understanding and sport motivation.

Experimental Group (GBL/TGfU Approach). The experimental group received 8 weeks of football instruction (16 sessions, 2 sessions per week, 60 minutes per session) based on TGfU principles. Each lesson followed a consistent structure adapted from Mitchell et al. (2006) and Griffin et al. (1997): (1) Modified game introduction (10 minutes): Students engaged in a small-sided game (4v4 or 5v5 on 30m × 20m pitch with small goals) designed to highlight a specific tactical problem (e.g., creating space, maintaining possession, transitioning attack to defense); (2) Tactical discussion and questioning (10 minutes): The instructor used guided questions to help students identify the tactical problem, discuss potential solutions, and connect tactics to necessary skills; (3) Game-based practice activities (25 minutes): Students engaged in modified games and practice activities designed to develop tactical awareness and associated skills; (4) Culminating game (15 minutes): Students applied learned tactics and skills in a more complex game situation with ongoing instructor feedback via questioning.

The GBL approach emphasized tactical problems in the following progression: Weeks 1-2 (maintaining possession: passing, receiving, support); Weeks 3-4 (penetrating/attacking: moving into space, creating passing lanes); Weeks 5-6 (defending and winning the ball: pressuring, marking, covering); Weeks 7-8 (transition play and combined tactics: quick counter-attacks, defensive organization). Questioning focused on 'what to do' (tactical decisions) before 'how to do it' (skill execution).

Control Group (Traditional Skill-Drill Approach). The control group received 8 weeks of traditional football instruction following a technique-first model commonly used in Indonesian physical education. Each 60-minute session consisted of: (1) Warm-up (10 minutes): General cardiovascular activities and dynamic stretching; (2) Skill demonstration and explanation (10 minutes): The instructor demonstrated and explained specific technical skills (e.g., passing technique, dribbling, shooting) with emphasis on proper form; (3) Isolated skill drills (30 minutes): Students practiced skills in controlled, non-game contexts (e.g., passing in pairs, dribbling through cones, shooting at goal); (4) Scrimmage game

(10 minutes): Unstructured game play with minimal instructor intervention.

The traditional approach followed a linear progression from basic to advanced skills: Weeks 1-2 (passing and receiving), Weeks 3-4 (dribbling and ball control), Weeks 5-6 (shooting and finishing), Weeks 7-8 (heading and combined skills). Both groups had equivalent total practice time (960 minutes over 8 weeks) and were taught by qualified physical education teachers with similar experience levels (8-10 years) who received training on their respective instructional protocols.

Test and Measurement Procedures

Game Performance Assessment Instrument (GPAI):

Tactical understanding was assessed using the GPAI (Osline et al., 1998), which evaluates game performance through observation of match play. The GPAI assesses both off-the-ball (tactical awareness) and on-the-ball (skill execution) behaviors across three components relevant to invasion games: (1) Decision-making: appropriateness of tactical choices during play; (2) Skill execution: efficiency of technical skill performance; (3) Support: off-the-ball movement to create passing options. Students were video-recorded during standardized 4v4 small-sided games (two 8-minute halves, 30m × 20m pitch) at pretest and posttest. Three trained observers (inter-rater reliability ICC = 0.89-0.92) independently coded student behaviors using a binary scoring system (appropriate/inappropriate decision, efficient/inefficient execution, adequate/inadequate support). Performance indices were calculated as: $\text{Index} = (\text{appropriate or efficient behaviors}) / (\text{appropriate or efficient} + \text{inappropriate or inefficient behaviors}) \times 100\%$. The GPAI has demonstrated acceptable validity and reliability in previous football research (Barquero-Ruiz et al., 2023; Harvey et al., 2010).

Sport Motivation Scale (SMS):

Student motivation was assessed using the SMS (Pelletier et al., 1995) adapted for physical education contexts (Granero-Gallegos et al., 2014). The SMS measures seven motivational constructs based on Self-Determination Theory: three forms of intrinsic motivation (IM-to know, IM-to accomplish, IM-to experience stimulation), three forms of extrinsic motivation (identified regulation, introjected regulation, external regulation), and amotivation. The questionnaire comprises 28 items (4 per subscale) rated on a 7-point Likert scale (1 = does not correspond at all, 7 = corresponds exactly).

The SMS was administered in Indonesian (Bahasa Indonesia)

using a validated translation. Students completed the questionnaire in classroom settings before and after the intervention. The Indonesian version demonstrated good internal consistency in this sample (Cronbach's $\alpha = 0.78-0.89$ across subscales) and acceptable test-retest reliability over a 2-week period (ICC = 0.82-0.87).

Data Collection Procedures

Data collection occurred during three phases: (1) Pretest (Week 0): Students completed the SMS questionnaire and participated in GPAI assessment games one week before the intervention commenced; (2) Intervention (Weeks 1-8): Students participated in their assigned instructional programs; (3) Posttest (Week 9): Students completed the SMS and GPAI assessments one week following intervention completion using identical protocols to pretest. Research assistants blind to group assignment conducted all assessments. Video recordings for GPAI analysis were randomized and coded without identifier information. Data entry was performed independently by two researchers with discrepancies resolved through discussion.

Statistical Analysis.

Data were analyzed using SPSS version 26.0 (IBM Corp.,

Armonk, NY). Descriptive statistics (means, standard deviations) were calculated for all variables. Data distribution normality was assessed using Shapiro-Wilk tests and visual inspection of Q-Q plots. All variables met parametric assumptions. Within-group changes from pretest to posttest were examined using paired-samples t-tests. Between-group differences in posttest scores were analyzed using one-way Analysis of Covariance (ANCOVA) with pretest scores as covariates to control for baseline differences. Effect sizes were calculated using Cohen's d (within-group: $d = \frac{M_{post} - M_{pre}}{SD_{pooled}}$

and partial eta squared η^2 for ANCOVA results, with interpretations of small ($d = 0.20$, $\eta^2 = 0.01$), medium ($d = 0.50$, $\eta^2 = 0.06$), and large ($d = 0.80$, $\eta^2 = 0.14$) (Lachenbruch & Cohen, 1989). Statistical significance was set at $\alpha = 0.05$ (two-tailed). Post-hoc power analysis confirmed adequate power ($1-\beta > 0.85$) for detecting medium-to-large effects.

Ethical Approval and Informed Consent

The study was conducted during the 2024 academic year and received ethical approval from the STKIP Ypis Dompu (Protocol No. 045/EDU-KD/2024).

RESULTS

Participant Characteristics

Table 1 presents the demographic and baseline characteristics of participants in both groups. There were no significant differences between groups in age, gender distribution, prior football experience, or baseline academic performance in physical education (all $p > 0.05$), supporting the comparability of groups despite the quasi-experimental design.

Table 1. demographic and baseline characteristics of participants in both groups

Characteristic	GBL Group (n=42)	Control Group (n=42)
Age (years)	14.5 $\pm$ 1.1	14.7 $\pm$ 1.3
Gender (M/F)	26/16	26/16

Football experience (years)	3.2 $\pm$ 1.8	3.5 $\pm$ 1.9
PE grade (0-100)	78.4 $\pm$ 8.2	77.1 $\pm$ 7.9

Note: Demographic and baseline characteristics of participants. Values are mean $\pm$ SD. M = male; F = female; PE = physical education. No significant differences between groups (all $p > 0.05$).

Visual inspection of the Q-Q plot indicated that the data points were closely aligned with the diagonal reference line, suggesting that the distribution of the data approximated normality. No substantial deviations were observed at the tails, supporting the assumption of normal distribution.

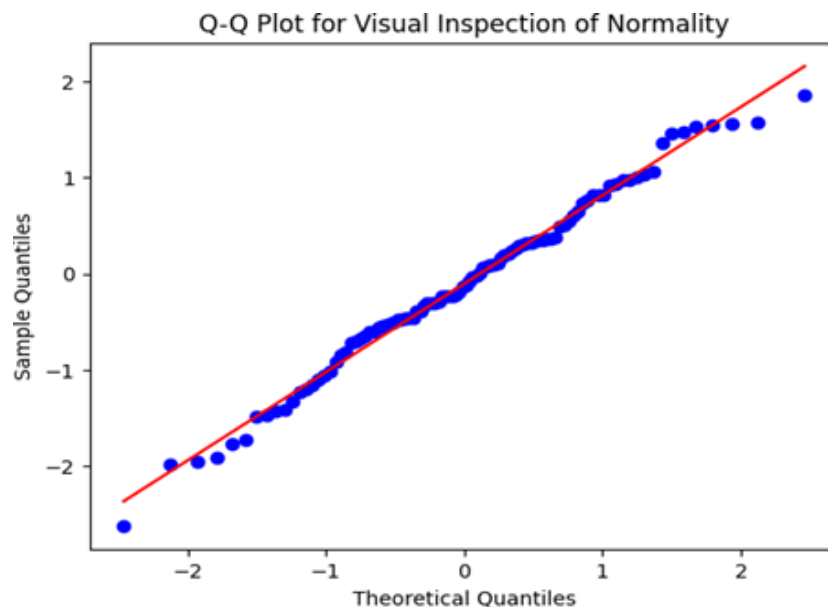


Figure 1. Q-Q plot of residuals for normality assessment

Tactical Understanding Outcomes

Table 2 presents descriptive statistics and within-group comparisons for GPAI components. The GBL group demonstrated significant improvements from pretest to posttest across all three tactical understanding components: decision-making (42.3%

increase), skill execution (31.8% increase), and support (38.5% increase), all with large effect sizes ($d = 1.38-1.62$). The control group showed smaller but statistically significant improvements in decision-making (15.2%, $d = 0.48$) and skill execution (18.4%, $d = 0.58$), but minimal change in support (12.7%, $d = 0.41$).

Table 2. Descriptive statistics and within-group comparisons for GPAI components

Variable	Pretest	Posttest	t-value	p-value	d
GBL Group					
Decision-making (%)	46.8 ± 9.2	66.6 ± 8.5	13.24	<0.001***	1.62
Skill execution (%)	52.3 ± 10.1	68.9 ± 9.3	10.87	<0.001***	1.42
Support (%)	41.2 ± 11.3	57.1 ± 10.2	9.62	<0.001***	1.38
Control Group					
Decision-making (%)	48.1 ± 9.8	55.4 ± 10.2	4.31	<0.001***	0.48
Skill execution (%)	53.7 ± 11.2	63.6 ± 10.8	5.42	<0.001***	0.58
Support (%)	42.6 ± 12.1	48.0 ± 11.8	3.18	0.003**	0.41

Note: Descriptive statistics and within-group comparisons for tactical understanding (GPAI components). Values are mean ± SD. GBL = Game-Based Learning. Paired t-tests (df = 41). **p < 0.01, ***p < 0.001. Effect size interpretation: small (d ≥ 0.20), medium (d ≥ 0.50), large (d ≥ 0.80).

ANCOVA Results

Table 3. ANCOVA Results for GPAI Components Controlling for Pretest Scores

GPAI Component	Group Comparison	F-value	p-value	Partial η^2	Effect Size (Cohen)
Decision-making	GBL vs Control	58.72	< 0.001	0.42	Large
Skill execution	GBL vs Control	42.18	< 0.001	0.34	Large
Support	GBL vs Control	36.94	< 0.001	0.31	Large

Note. ANCOVA = Analysis of Covariance; GPAI = Game Performance Assessment Instrument; GBL = Game-Based Learning. Pretest scores were used as covariates. Effect size interpretation followed Cohen's criteria (partial $\eta^2 \geq 0.14$ = large effect).

Table 3 revealed significant between-group differences in posttest scores for all GPAI components after controlling for pretest performance. The GBL group achieved significantly higher posttest scores than the control group in decision-making ($F = 58.72$, $p < 0.001$), skill execution ($F = 42.18$, $p < 0.001$), and support ($F = 36.94$, $p < 0.001$), all representing large effect sizes according to Cohen's criteria (Lachenbruch & Cohen, 1989).

Motivation Outcomes

Table 4. Changes in Sport Motivation Scale Subscales Between GBL and Control Groups

Motivation Subscale	GBL Group (Change)	Effect Size (d)	Interpretation	Control Group (Change)	Effect Size (d)	Interpretation
Intrinsic Motivation – To Know	Increase	1.24	Large	Slight decrease	–	Trivial
Intrinsic Motivation – To Accomplish	Increase	1.10	Large	Slight decrease	–	Trivial
Intrinsic Motivation – To Experience Stimulation	Increase	0.89	Large	Slight decrease	–	Trivial
Identified Regulation	Increase	0.97	Large	Minimal change	–	Trivial
External Regulation	No change	~0.00	None	Increase	0.32	Small
Amotivation	Decrease	-1.02	Large	Minimal change	–	Trivial

Note. Effect sizes were calculated using Cohen's d (0.2 = small, 0.5 = medium, 0.8 = large). Positive values indicate increases from pretest to posttest, whereas negative values indicate decreases. GBL = Game-Based Learning.

Table 4 presents changes in Sport Motivation Scale subscales. The GBL group demonstrated significant increases in all three intrinsic motivation subscales (IM-to know, IM-to accomplish, IM-to experience stimulation) and in identified regulation, with effect sizes ranging from $d = 0.89$ to $d = 1.24$. External regulation remained unchanged, while amotivation significantly decreased ($d = -1.02$). In contrast, the control group showed minimal changes across most motivation subscales, with only small improvements

in external regulation ($d = 0.32$) and slight decreases in intrinsic motivation forms. Between-group comparisons using ANCOVA (Table 3) indicated that the GBL group reported significantly higher posttest scores in composite intrinsic motivation ($F = 52.36$, $p < 0.001$, partial $\eta^2 = 0.39$) and identified regulation ($F = 32.45$, $p < 0.001$, partial $\eta^2 = 0.28$), and significantly lower amotivation ($F = 45.82$, $p < 0.001$, partial $\eta^2 = 0.36$) compared to the control group after controlling for baseline scores.

DISCUSSION

Principal Findings

This study examined whether an eight-week Game-Based Learning (GBL) intervention informed by Teaching Games for Understanding (TGfU) principles could improve tactical performance and motivation more effectively than traditional skill-drill instruction among secondary-school students participating in football physical education (PE). The findings were consistent with the three hypotheses. Compared with traditional instruction, GBL was associated with greater improvements in decision-making, skill execution, and support, alongside increases in intrinsic motivation and identified regulation and a reduction in amotivation. These findings extend the evaluation of game-centred pedagogy beyond technical performance to include behavioural and motivational outcomes within the same intervention framework.

The tactical findings were particularly notable. The GBL group demonstrated reported improvements of 42.3% in decision-making, 31.8% in skill execution, and 38.5% in support, compared with 15.2%, 18.4%, and 12.7%, respectively, in the control group.

Between-group ANCOVA results favoured GBL across the reported GPAI components, with partial eta-squared values ranging from .31 to .42. These estimates indicate substantial statistical differences under conventional interpretive benchmarks, although they do not independently establish educational importance or causal effectiveness. The practical significance of these changes requires consideration of the quality of measurement, uncertainty around the estimates, and the extent to which the improvements transfer to more complex game situations.

The motivational findings were similarly encouraging. The GBL group showed increases in intrinsic motivation and identified regulation and a reduction in amotivation, with reported within-group effect sizes of $d = 1.24$, $d = 0.89$, and $d = -1.02$, respectively. This pattern is consistent with a shift toward more autonomous forms of motivation, although the magnitude of within-group change should not be confused with the magnitude of the between-group treatment effect. Furthermore, because motivation was assessed immediately after the intervention, the findings do not

establish whether these changes persist over time or translate into greater participation in physical activity outside school.

Taken together, the findings suggest that GBL may offer a useful instructional approach for developing tactical performance and supporting motivation in school football. Nevertheless, the results should be interpreted as promising comparative evidence from a specific school context rather than definitive proof that GBL is universally superior to traditional instruction (Wardani, S., et al. (2025).

Comparison with International Evidence

The tactical findings are consistent with research examining game-centred approaches in football and invasion games. Harvey et al. (2014) investigated TGfU in American high-school soccer using the Game Performance Assessment Instrument (GPAI), providing a relevant school-based precedent for assessing game performance through observable behaviours. Práxedes et al. (2016) examined a questioning-based teaching programme designed to improve tactical actions among young footballers, while Práxedes et al. (2018) investigated nonlinear pedagogy in relation to decision-making and execution in youth soccer. These studies provide complementary evidence supporting instructional approaches that integrate tactical problem-solving with skill execution rather than treating technical proficiency as an isolated learning objective.

The present findings are particularly relevant to the development of decision-making and support. Effective decision-making requires learners to interpret the changing game environment and select appropriate actions, whereas support involves movement away from the ball to create passing opportunities and maintain team coordination. The GPAI was developed to assess such game-performance behaviours (Oslin et al., 1998; Fernando, J., et al (2024). The observed improvements are therefore consistent with the proposition that repeated participation in modified games can create opportunities to practise tactical responses under representative conditions. However, the current study cannot determine whether modified games, tactical questioning, progressive task constraints, or their combined implementation was primarily responsible for the improvements.

Evidence from hybrid pedagogical models further contextualizes these findings. Mesquita et al. (2012) examined a hybrid Sport Education–Invasion Games Competence Model soccer unit and its effects on decision-making, skill execution, and overall game performance. Farias et al. (2015) investigated game performance and understanding within a hybrid Sport Education season. Although these interventions differ from the present GBL programme, they share an emphasis on developing game competence through more contextualized learning experiences. Their relevance lies in supporting the value of game-centred instructional designs, not in demonstrating that all such models produce equivalent effects.

The systematic review by Barba-Martín et al. (2020) provides a broader account of TGfU applications in PE and underscores the importance of examining the approach across varied educational contexts. Nevertheless, differences in intervention duration, pedagogical components, participant characteristics, and outcome assessment limit direct comparisons of effect magnitudes. The large estimates observed in the present study should therefore not be interpreted as evidence that the intervention outperforms programmes conducted in other countries. Such a conclusion would require comparable outcomes, harmonized effect-size calculations, and adequate uncertainty estimates across studies.

The motivational results also align with international research grounded in Self-Determination Theory (SDT). Gil-Arias et al.

(2017) investigated the motivational implications of a hybrid TGfU–Sport Education unit, while Ntoumanis (2004) examined motivation in PE from a self-determination perspective. Standage et al. (2005) also tested SDT in school PE. These studies provide a theoretical and empirical basis for examining motivation as an important educational outcome rather than assuming that participation in sport automatically produces positive motivational experiences.

In the present study, increases in intrinsic motivation and identified regulation, accompanied by reduced amotivation, are consistent with the expected direction of more autonomous engagement. Sierra-Díaz et al. (2019), in a systematic review and meta-analysis of psychosocial factors associated with models-based practice in PE, provide additional context for considering motivational outcomes in relation to instructional design. However, the present intervention did not directly measure autonomy, competence, or relatedness. Consequently, the findings cannot establish that satisfaction of these psychological needs mediated the observed motivational changes.

The eight-week duration and equivalent scheduled instructional time of 960 minutes in each group strengthen the practical relevance of the comparison. Nevertheless, equal scheduled time does not guarantee equivalent active practice, feedback, engagement, or instructional fidelity. Differences in these factors could contribute to the observed outcomes. Furthermore, findings from elementary PE, youth football programmes, and hybrid instructional models cannot be transferred directly to the present secondary-school context without accounting for differences in educational level, student experience, and implementation.

The Indonesian setting contributes context-specific evidence to an international research area in which the transferability of game-centred approaches remains an important consideration. The study demonstrates the feasibility of implementing a structured GBL programme in two secondary schools in Kabupaten Dompu. However, it does not establish that the same outcomes would occur throughout Indonesia or in other educational systems. The international contribution is therefore best understood as an examination of established pedagogical and motivational frameworks in a specific school context, with implications for further cross-cultural replication.

Theoretical, Methodological, and Practical Implications

Theoretically, the tactical findings are compatible with TGfU and situated learning perspectives Zhang, F., et al. (2017). Kirk and MacPhail (2002) connected TGfU with situated learning, emphasizing the importance of understanding games through meaningful participation and contextualized learning experiences. From this perspective, modified games can provide situations in which learners identify tactical problems, test possible solutions, and refine their decisions in response to changing conditions. The present improvements in decision-making, skill execution, and support are consistent with this explanation.

The results also suggest that contextualized game practice need not exclude technical development. Although traditional skill drills remain useful for practising fundamental movements (Oktarifaldi, O., et al. 2024), GBL provides opportunities to apply techniques while responding to tactical demands. This interpretation is consistent with the game-centred approach described by Griffin et al. (1997) and the emphasis on learning design and nonlinear pedagogy discussed by Tan et al. (2011). Nevertheless, the present study did not isolate individual instructional components; therefore, it cannot establish which component contributed most strongly to the observed changes.

The motivational findings are consistent with SDT, which

proposes that autonomous motivation is facilitated when learning environments support autonomy, competence, and relatedness (Deci & Ryan, 2000; Ryan & Deci, 2000). Modified games may allow students to make meaningful decisions, experience appropriately challenging tasks, and cooperate with teammates. These features offer plausible explanations for the observed motivational pattern. However, because the study did not directly assess psychological need satisfaction or conduct mediation analyses, the findings should be interpreted as consistent with SDT rather than as a direct test of its explanatory mechanism.

Methodologically, combining GPAI and the Sport Motivation Scale (SMS) provides a broader assessment of instructional outcomes than relying exclusively on technical skill tests. The GPAI was developed to evaluate game-performance behaviours (Oslin et al., 1998), although its application requires careful attention to scoring and interpretation, as discussed by Memmert and Harvey (2008). The use of baseline measurements, a comparison group, and video-based observation also strengthens the study's descriptive assessment of change. However, these features cannot compensate fully for limitations arising from the allocation of only one school to each instructional condition.

In practical terms, GBL may be considered when teachers aim to develop tactical understanding, technical execution, and cooperative game behaviour within football PE. Small-sided games, progressive tactical problems, and guided questioning provide a feasible structure for integrating these objectives (Alzate, et al. (2024); Garriss, R., et al. (2002). Teachers may begin with possession and support tasks, introduce questions that direct attention to tactical options, and progressively increase the complexity of game situations. Targeted technical drills can be retained when students require additional support with specific skills (Mulbar, U., et al. 2024).

Implementation requires appropriate teacher preparation. Teachers need to design developmentally suitable games, identify relevant tactical problems, and provide feedback without unnecessarily interrupting play. Professional development should therefore address tactical questioning, task modification, formative assessment, and inclusive participation. Because the study was conducted in only two schools, wider adoption should be accompanied by local evaluation rather than assuming that the same effects will occur under all curriculum, facility, and class-size conditions.

Strengths and Limitations

Several strengths support the value of this study. The pretest-posttest comparison design enabled changes to be examined against a traditional instructional condition. Both groups received equivalent scheduled instructional time, and the study combined observable game-performance outcomes with motivational measures. The manuscript also reports inter-rater reliability coefficients of .89–.92 for GPAI coding and describes blinded assessment procedures. These features strengthen the assessment process, although reliability does not eliminate all potential measurement bias.

The most consequential limitation is the allocation of one school to each instructional condition. Differences between schools, teachers, peer environments, or institutional practices may be confounded with the intervention. Nonsignificant baseline differences do not establish equivalence or eliminate unmeasured confounding. Furthermore, if students within each school are treated as independent observations, standard errors may not adequately reflect their shared school environment. With only two schools, reliable estimation of school-level variation is not possible. Accordingly, the reported ANCOVA differences cannot be

attributed exclusively to GBL.

The sample included 84 students from two secondary schools participating in extracurricular football classes. This restricts transferability to regular compulsory PE classes, other age groups, and schools with different resources. Different teachers delivered the two instructional conditions, introducing potential teacher effects despite the reported similarity in teaching experience and protocol training. The intervention's observed effects may therefore reflect a combination of instructional approach, teacher implementation, and school context.

Measurement limitations also warrant consideration. GPAI scoring relies on observers' judgements of game behaviours, and acceptable inter-rater reliability does not establish that all score interpretations are valid or free from systematic bias. Memmert and Harvey (2008) highlighted concerns and potential solutions relating to GPAI development and application. The adapted Indonesian SMS also requires evidence that its constructs are measured consistently across groups and time points. Although the manuscript reports subscale reliability, it does not establish measurement invariance.

The absence of delayed follow-up prevents conclusions about retention, transfer to more complex matches, or sustained physical activity participation. In addition, the manuscript does not report implementation-fidelity measures in sufficient detail to establish the extent to which all sessions followed the intended protocols. Missing-data patterns, participant attrition, and protocol deviations should also be reported transparently rather than assumed to be absent.

Finally, multiple GPAI components and SMS subscales were examined using several statistical tests. Without a clearly reported prespecified primary outcome and multiplicity strategy, the possibility of inflated false-positive risk across the complete set of comparisons should be acknowledged. Confidence intervals should accompany effect estimates to communicate uncertainty. The motivational effect sizes, particularly for amotivation, should also be labelled consistently so that the direction of change is not confused with the favourability of the outcome.

These limitations do not negate the observed differences, but they constrain the strength of the conclusions. The findings are promising and theoretically coherent; however, stronger causal claims require replication with more schools, improved control of confounding, transparent analytical procedures, and longer follow-up.

Future Research

Future research should replicate the intervention across a larger number of schools in different Indonesian provinces and, where feasible, through international collaborations. School-level randomization would be appropriate when instruction is delivered by school or class, provided that enough schools are recruited to estimate between-school variation. Where randomization is infeasible, stronger quasi-experimental designs should document baseline differences and apply analytical methods appropriate to the allocation structure.

Longer studies should include delayed assessments at approximately three, six, and twelve months to examine retention and the durability of motivational changes. Researchers should also investigate whether improved tactical performance transfers from small-sided assessment games to more complex matches and whether motivational changes are associated with voluntary physical activity outside school.

Mechanism-focused research should directly measure autonomy, competence, relatedness, tactical knowledge, and perceived enjoyment. Repeated measurements could support

mediation analyses testing whether psychological need satisfaction helps explain motivational changes. Potential moderators include age, gender, baseline skill, previous football experience, and initial motivation. Such analyses would clarify which students benefit most and under what conditions.

Implementation research should systematically document teacher preparation, lesson adherence, questioning frequency, feedback quality, active practice time, and student participation. Studies should also compare GBL with blended approaches that combine modified games and targeted technical practice. Cost-effectiveness analyses could evaluate teacher training, equipment

requirements, lesson preparation, and the cost per meaningful improvement in learning outcomes. Finally, preregistered protocols, prespecified primary outcomes, transparent reporting of missing data, confidence intervals, appropriate multiplicity procedures, and independent replication would strengthen the evidence base. These approaches would help establish not only whether GBL is associated with better tactical and motivational outcomes, but also how the approach works, for whom it is effective, and whether its implementation is feasible and sustainable across diverse educational settings.

CONCLUSION

This study examined the outcomes of a game-based learning (GBL) approach for tactical understanding and motivation in school football physical education. The findings indicate that students participating in GBL demonstrated greater improvements in decision-making, skill execution, and support than students receiving traditional skill-drill instruction. The GBL group also showed a more favorable motivational profile, including higher intrinsic motivation and identified regulation and lower amotivation. These findings provide evidence supporting the potential value of integrating modified small-sided games and tactical questioning into football instruction. Internationally, the study contributes to the broader discussion of game-centred approaches in physical education by illustrating their relevance to both tactical learning and

student motivation in a school-based setting. However, the findings should be interpreted cautiously because the study involved only two schools, with each instructional condition implemented at a different school. Consequently, school-level and teacher-related differences cannot be fully separated from the observed intervention outcomes, and the results do not establish that GBL alone caused the improvements. The findings may therefore not generalize to other educational settings, age groups, or sports without further evidence. Future multisite studies using stronger allocation procedures, implementation-fidelity assessments, and longer-term follow-up are needed to examine the robustness and sustainability of these outcomes.

DECLARATIONS

Ethical Approval

Ethical approval for this study was granted by STKIP Yapis Dompu (Protocol No. 045/EDU-KD/2024). The study was conducted in accordance with the approved research procedures.

Consent for to Participate

Written parental consent and student assent were obtained before data collection. Participation was conducted in accordance with the approved research procedures.

Consent for Publication

Consent for publication was not applicable because this manuscript does not contain identifiable individual data.

Author Contributions (CRediT)

Based on the contribution codes reported in the original manuscript, the author contributions are stated as follows:

Sandi Achmad Pratama: Study design, data collection, statistical analysis, manuscript preparation, and funding acquisition.

Linda Susila: Study design, data collection, statistical analysis, manuscript preparation, and funding acquisition.

Erika Mc Clintock: Study design, data collection, and statistical analysis.

All authors should review and approve this contribution statement and confirm that it accurately reflects their respective roles. The contribution labels should also be aligned with the journal's required CRediT taxonomy.

Funding

This research received no specific grant from any funding agency in the public, commercial, or not-for-profit sectors.

Conflict of Interest

The authors declare no conflicts of interest related to this study. They report no financial relationships with organizations that might have an interest in the submitted work and no other relationships or activities that could reasonably be perceived to have influenced the research.

Data Availability

The data supporting the findings of this study are available from the corresponding author upon reasonable request, subject to applicable ethical and data-protection requirements.

Acknowledgements

The authors gratefully acknowledge the students, teachers, and school administrators in Kabupaten Dompu who participated in and supported this study. The authors also thank the District Education Office of Kabupaten Dompu for its support and the research assistants who contributed to data collection and video analysis.

Generative AI Disclosure

Generative AI (ChatGPT, OpenAI) was used during manuscript revision to assist with language editing, academic phrasing, and the restructuring of selected sections, including the Discussion and Conclusion. The authors are responsible for reviewing and verifying all AI-assisted text, ensuring the accuracy of reported results and interpretations, checking references and citations against the original sources, and approving the final submitted manuscript. Generative AI was not used as a substitute for the authors' scientific judgment or responsibility for the research. No confidential or identifiable participant data were entered into the generative AI tool.

REFERENCES

- Alzate, S. J. G., Sánchez, W. G. V., Espinal, F. E., Bustamante, J., & Arias-Arias, E. (2024). Tactical critical thinking program on the tactical efficiency index, declarative and procedural knowledge in male soccer players: A case study. *Frontiers in Sports and Active Living*, 6, Article 1469347. <https://doi.org/10.3389/fspor.2024.1469347>
- Barba-Martín, R. A., Bores-García, D., Alcalá, D. H., & González-Calvo, G. (2020). The application of the Teaching Games for Understanding in

- physical education: Systematic review of the last six years. *International Journal of Environmental Research and Public Health*, 17(9), Article 3330. <https://doi.org/10.3390/ijerph17093330>
- Barquero-Ruiz, C., Kirk, D., Meroño, L., & Estero, J. L. A. (2024). Psychometric validation of the tactical assessment instrument in football for use in physical education and with youth sport teams. *Perceptual and Motor Skills*, 131(2), 589. <https://doi.org/10.1177/00315125231225579>
- Bergmann, F., Gray, R., Wachsmuth, S., & Höner, O. (2021). Perceptual-motor and perceptual-cognitive skill acquisition in soccer: A systematic review on the influence of practice design and coaching behavior. *Frontiers in Psychology*, 12, Article 772201. <https://doi.org/10.3389/fpsyg.2021.772201>
- Deci, E. L., & Ryan, R. M. (2000). The "what" and "why" of goal pursuits: Human needs and the self-determination of behavior. *Psychological Inquiry*, 11(4), 227–268. https://doi.org/10.1207/S15327965PLI1104_01
- Estero, J. L. A., Jaquero, P., Martínez-López, A. N., & Morales-Belando, M. T. (2020). Effects of two TGfU lessons period on game performance, knowledge and psychosocial variables in elementary physical education. *International Journal of Environmental Research and Public Health*, 17(10), Article 3378. <https://doi.org/10.3390/ijerph17103378>
- Ezeddine, G., Souissi, N., Abaidia, R., Masmoudi, L., Trabelsi, K., Ammar, A., Jahrami, H., Husain, W., Tannoubi, A., Kurnaz, M., Altinkök, M., & Mrayah, M. (2025). Game-based physical education: A pathway to increased student motivation and greater learning outcomes. *Frontiers in Education*, 10, Article 1531651. <https://doi.org/10.3389/educ.2025.1531651>
- Farias, C., Mesquita, I., & Hastie, P. A. (2015). Game performance and understanding within a hybrid sport education season. *Journal of Teaching in Physical Education*, 34(3), 363–383. <https://doi.org/10.1123/jtpe.2013-0149>
- Fernando, J., Idarraga, V., Idarraga, J. F. V., Wilder, & Valencia-Sánchez, G. (2024). Enhancing ball passing creativity and effectiveness in youth women's football: A single-case study. *Journal of Physical Education and Sport*, 24(1). <https://doi.org/10.7752/jpes.2024.01022>
- Garris, R., Ahlers, R. H., & Driskell, J. E. (2002). Games, motivation, and learning: A research and practice model. *Simulation & Gaming*, 33(4), 441–467. <https://doi.org/10.1177/1046878102238607>
- Gil-Arias, A., Harvey, S., Cárceles, A., Práxedes, A., & Álvarez, F. del V. (2017). Impact of a hybrid TGfU–Sport Education unit on student motivation in physical education. *PLOS ONE*, 12(6), Article e0179876. <https://doi.org/10.1371/journal.pone.0179876>
- Granero-Gallegos, A., Baena-Extremera, A., Gómez-López, M., Sánchez-Fuentes, J. A., & Abalde, J. A. (2014). Psychometric Properties of the "Sport Motivation Scale (SMS)" Adapted to Physical Education. *Journal of sports science & medicine*, 13(4), 801–807. <https://pubmed.ncbi.nlm.nih.gov/25435772/>
- Griffin, L. L., Mitchell, S. A., & Oslin, J. L. (1997). Teaching Sport Concepts and Skills—A Tactical Games Approach. Champaign: Human Kinetics
- Harvey, S., Gil-Arias, A., & Rabaz, F. C. (2020). Effects of teaching games for understanding on tactical knowledge development in middle school physical education. *Journal of Physical Education and Sport*, 2020(03). <https://doi.org/10.7752/jpes.2020.03189>
- Harvey, S., Cushion, C. J., & Massa-Gonzalez, A. N. (2010). Learning a new method: Teaching Games for Understanding in the coaches' eyes. *Physical Education and Sport Pedagogy*, 15(4), 361–382. <https://doi.org/10.1080/17408980903535818>
- Harvey, S., Cushion, C. J., Wegis, H., & Massa-Gonzalez, A. N. (2009). Teaching Games for Understanding in American high-school soccer: A quantitative data analysis using the Game Performance Assessment Instrument. *Physical Education and Sport Pedagogy*, 15(1), 29–54. <https://doi.org/10.1080/17408980902729354>
- Harvey, S., & Jarrett, K. (2014). A review of the game-centred approaches to teaching and coaching literature since 2006. *Physical Education and Sport Pedagogy*, 19(3), 278–300. <https://doi.org/10.1080/17408989.2012.754005>
- Kirk, D. (2005). Physical education, youth sport and lifelong participation: The importance of early learning experiences. *European Physical Education Review*, 11(3), 239–255. <https://doi.org/10.1177/1356336X05056649>
- Kirk, D., & MacPhail, A. (2002). Teaching Games for Understanding and situated learning: Rethinking the Bunker-Thorpe model. *Journal of Teaching in Physical Education*, 21(2), 177–192. <https://doi.org/10.1123/jtpe.21.2.177>
- Lachenbruch, P. A., & Cohen, J. (1989). Statistical power analysis for the behavioral sciences (2nd ed.). *Journal of the American Statistical Association*, 84(408), 1096. <https://doi.org/10.2307/2290095>
- Layton, M. E., Taylor, J., & Collins, D. (2023). The measurement, tracking and development practices of English professional football academies. *Journal of Sports Sciences*, 41(18), 1655–1665. <https://doi.org/10.1080/02640414.2023.2289758>
- Light, R., & Fawns, R. (2003). Knowing the game: Integrating speech and action in games teaching through TGfU. *Quest*, 55(2), 161–176. <https://doi.org/10.1080/00336297.2003.10491797>
- Memmert, D., & Harvey, S. (2008). The Game Performance Assessment Instrument (GPAI): Some concerns and solutions for further development. *Journal of Teaching in Physical Education*, 27(2), 220–240. <https://doi.org/10.1123/jtpe.27.2.220>
- Mercan, G., & Varol Selçuk, Z. (2024). Investigating the Impact of Game-Based Learning and Gamification Strategies in Physical Education: A Comprehensive Systematic Review. *Journal of Interdisciplinary Education Theory and Practice*, 6(1), 1–14. <https://doi.org/10.47157/jietp.1389843>
- Mesquita, I., Farias, C., & Hastie, P. A. (2012). The impact of a hybrid Sport Education–Invasion Games Competence Model soccer unit on students' decision making, skill execution and overall game performance. *European Physical Education Review*, 18(2), 205–219. <https://doi.org/10.1177/1356336X12440027>
- Ntoumanis, N. (2001). A self-determination approach to the understanding of motivation in physical education. *British Journal of Educational Psychology*, 71(2), 225–242. <https://doi.org/10.1348/000709901158497>
- Ntoumanis, N., Pensgaard, A.-M., Martin, C. C., & Pipe, K. (2004). An idiographic analysis of amotivation in compulsory school physical education. *Journal of Sport and Exercise Psychology*, 26(2), 197–214. <https://doi.org/10.1123/jsep.26.2.197>
- Oktarifaldi, O., Nopembri, S., Yudanto, Y., & Shahril, M. I. (2024). The fundamental motor skills and motor coordination performance of children in West Sumatera Province, Indonesia. *Pedagogy of Physical Culture and Sports*, 28(1), 4–15. <https://doi.org/10.15561/26649837.2024.0101>
- Oslin, J. L., Mitchell, S. A., & Griffin, L. L. (1998). The Game Performance Assessment Instrument (GPAI): Development and preliminary validation. *Journal of Teaching in Physical Education*, 17(2), 231–243. <https://doi.org/10.1123/jtpe.17.2.231>
- Pelletier, L. G., Tuson, K. M., Fortier, M., Vallerand, R. J., Brière, N., & Blais, M. R. (1995). Toward a new measure of intrinsic motivation, extrinsic motivation, and amotivation in sports: The Sport Motivation Scale (SMS). *Journal of Sport and Exercise Psychology*, 17(1), 35–53. <https://doi.org/10.1123/jsep.17.1.35>
- Práxedes, A., Álvarez, F. del V., Pizarro, D., & Domínguez, A. M. (2018). The impact of nonlinear pedagogy on decision-making and execution in youth soccer players according to game actions. *Journal of Human Kinetics*, 62(1), 185–198. <https://doi.org/10.1515/hukin-2017-0169>
- Práxedes, A., Domínguez, A. M., Sevil-Serrano, J., García-González, L., & Álvarez, F. del V. (2016). A preliminary study of the effects of a comprehensive teaching program, based on questioning, to improve tactical actions in young footballers. *Perceptual and Motor Skills*, 122(3), 742–756. <https://doi.org/10.1177/0031512516649716>
- Rink, J. E., French, K. E., & Tjeerdsm, B. L. (1996). Foundations for the learning and instruction of sport and games. *Journal of Teaching in*

- Physical Education, 15(4), 399–417.
<https://doi.org/10.1123/jtpe.15.4.399>
- Ryan, R. M., & Deci, E. L. (2000). Self-determination theory and the facilitation of intrinsic motivation, social development, and well-being. *American Psychologist*, 55(1), 68–78. <https://doi.org/10.1037/0003-066X.55.1.68>
- Serra-Olivares, J., González-Villora, S., López, L. M. G., & Araújo, D. (2015). Game-based approaches' pedagogical principles: Exploring task constraints in youth soccer. *Journal of Human Kinetics*, 46(1), 251–261. <https://doi.org/10.1515/hukin-2015-0053>
- Sierra-Díaz, M. J., González-Villora, S., Vicedo, J. C. P., & Sánchez, G. F. L. (2019). Can we motivate students to practice physical activities and sports through models-based practice? A systematic review and meta-analysis of psychosocial factors related to physical education. *Frontiers in Psychology*, 10, Article 2115. <https://doi.org/10.3389/fpsyg.2019.02115>
- Sotos-Martínez, V. J., Ferriz-Valero, A., & Piñol-Vázquez, J. A. (2025). Impulsa tu Éxito: Explorando la Conexión entre Gamificación y Motivación Autores/as. *Cultura Ciencia Y Deporte*, 20(65). <https://doi.org/10.12800/ccd.v20i65.2508>
- Standage, M., Duda, J. L., & Ntoumanis, N. (2005). A test of self-determination theory in school physical education. *British Journal of Educational Psychology*, 75(3), 411–433. <https://doi.org/10.1348/000709904X22359>
- Tan, C. W. K., Chow, J. Y., & Davids, K. (2012). "How does TGfU work?": Examining the relationship between learning design in TGfU and a nonlinear pedagogy. *Physical Education and Sport Pedagogy*, 17(4), 331–348. <https://doi.org/10.1080/17408989.2011.582486>
- Wardani, S., Rahmawati, S., Witanti, A., & Riasti, B. K. (2025). Integrating Digital Technology into Traditional Game-Based Learning to Cultivate Local Wisdom Values among Elementary School Students in Bantul, Indonesia. *International Journal of Information and Education Technology*, 15(10), 2128–2139. <https://doi.org/10.18178/ijiet.2025.15.10.2411>
- Mulbar, U., Husniati, A., & Naufal, M. A. (2024). Integrating Local Wisdom with Project-Based Learning to Enhance 21st-Century Skills in the Society 5.0 Era. *Journal of Ecohumanism*, 3(7), 1821–1831. <https://doi.org/10.62754/joe.v3i7.4341>
- Zhang, F., Kaufman, D., Schell, R., Salgado, G., Seah, E. T. W., & Jeremic, J. (2017). Situated learning through intergenerational play between older adults and undergraduates. *International Journal of Educational Technology in Higher Education*, 14(1), Article 5. <https://doi.org/10.1186/s41239-017-0055-0>