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SYSTEMATIC LITERATURE REVIEW

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Sport Pedagogy Approaches for Enhancing Motor Skills and Learning Motivation in Physical Education: A Systematic Literature Review

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ABSTRACT

The purpose of the study. This systematic literature review aimed to critically examine and synthesize existing empirical evidence on sport pedagogy approaches and their effects on motor skill development and learning motivation in physical education (PE) settings across school-age and early post-secondary populations.

Materials and methods. A systematic search was conducted across ERIC, SPORTDiscus, Web of Science, and PubMed databases for peer-reviewed studies published between 2015 and 2024. Studies were eligible if they employed experimental or quasi-experimental designs, reported quantitative or mixed-methods outcomes, and examined at least one identifiable sport pedagogy model. The PRISMA 2020 guidelines directed the selection and reporting process. Quality appraisal used the PEDro scale and Mixed Methods Appraisal Tool (MMAT). A total of 63 studies meeting all inclusion criteria were retained.

Results. The evidence strongly supports game-centred approaches (Teaching Games for Understanding, Sport Education Model), constraints-led and ecological dynamics frameworks, cooperative learning, and self-regulated learning strategies as effective means of improving both motor proficiency (effect sizes d = 0.41–0.92) and autonomous motivation (d = 0.48–0.89). Integrated models combining tactical, social, and self-determination theory-aligned elements demonstrated the most consistent outcomes across school levels and sport disciplines.

Conclusions. Sport pedagogy models that balance motor skill acquisition with motivational climate creation are superior to traditional direct instruction in producing sustained learning outcomes. Practitioners, curriculum designers, and policy-makers should prioritise evidence-based, student-centred pedagogical models in physical education programming.

Keywords: sport pedagogy; motor skill learning; learning motivation; Teaching Games for Understanding; constraints-led approach; Sport Education Model.

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INTRODUCTION

Contextual Framework of the Research

Physical education (PE) occupies a unique position within formal education systems worldwide, simultaneously tasked with developing students' physical competence, health literacy, and psychosocial well-being (Rudd et al., 2020). At the intersection of these responsibilities lies the challenge of pedagogy: how should teachers structure learning environments to maximise motor skill acquisition while concurrently sustaining students' intrinsic motivation to participate and learn? This tension between technical skill development and motivational engagement has driven decades of theoretical and applied research in sport pedagogy (Andronikos et al., 2021; Rink, 2020).

Over the past three decades, the landscape of PE pedagogy has shifted substantially. Traditional teacher-centred, direct instruction approaches, which prioritise decontextualised skill drilling and prescriptive feedback, have faced increasing criticism for their limited effectiveness in promoting long-term motor learning, transfer, and above all, sustained motivation (Dyson et al., 2021; Williams & Hodges, 2023). In their place, a range of student-centred, game-based, and ecological frameworks have emerged, each offering distinct epistemological premises regarding how motor skills are learned and how motivational states are cultivated.

Among the most extensively studied pedagogical innovations is Teaching Games for Understanding (TGfU), which situates

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skill development within the tactical demands of modified games (Arias et al., 2020; Harvey et al., 2017). Complementing this tradition, the Sport Education Model (SEM) organises PE units around authentic sport season structures to promote student ownership, competence, and belonging(Ferraz et al., 2024). More recently, Ecological Dynamics (ED) and the Constraints-Led Approach (CLA) have offered movement-science grounded alternatives, conceptualising motor learning as the adaptive coupling of the learner, task, and environment (Chow et al., 2022; Stone et al., 2020). Concurrently, psychological frameworks such as Self-Determination Theory (SDT) and Achievement Goal Theory (AGT) have offered powerful explanatory lenses for understanding how pedagogical contexts shape student motivation (Deci & Ryan, 2000; Noetel et al., 2023).

Despite the proliferation of these approaches, significant questions remain about their comparative effectiveness, implementation fidelity, and transferability across educational contexts. Practitioners are often confronted with competing claims and insufficient synthesised evidence to guide curriculum decisions. This systematic review is positioned to address these gaps by consolidating the empirical literature and providing a structured evidence base for future practice and policy.

Critical Examination of Existing Literature

Previous narrative and systematic reviews have made significant contributions to the field. Rink, (2020) comprehensively traced the historical evolution of PE pedagogy models and concluded that no single model universally outperforms others across all contexts and populations. Metzler (2017) developed a model-based practice framework, arguing that alignment between instructional models and intended learning outcomes is the critical determinant of effectiveness. Specifically with respect to game-centred approaches, reviewed 10 years of TGfU literature and identified consistent positive effects on tactical cognition and game performance, while noting methodological heterogeneity that limited meta-analytic conclusions.

Within the motivation literature, Roberts Glyn C. and Treasure Darren C. (2020) systematically reviewed SDT-aligned interventions in PE and found compelling evidence that need-supportive teaching (supporting autonomy, competence, and relatedness) was associated with increased intrinsic motivation, identified regulation, and reduced amotivation. further established that mastery-oriented motivational climates were significantly linked to positive adaptive outcomes, including persistence and enjoyment (Brown et al., 2017). However, direct comparisons between pedagogical models with respect to their motivational properties have been less systematically examined.

With respect to motor skill development specifically, Gallahue & Ozmun (2012) proposed a lifespan developmental model emphasising the critical role of fundamental movement skill (FMS) mastery in early years, while Roberts et al. (2018) advanced an interactionist constraints model influencing contemporary CLA. Despite robust theoretical foundations, comprehensive syntheses integrating motor learning outcomes with motivational correlates under unified pedagogical frameworks remain conspicuously absent in the literature.

Identification of Research Gaps

Despite the breadth of existing research, several critical gaps persist. First, most prior systematic reviews have examined either motor skill outcomes or motivational outcomes in isolation, rarely integrating both dimensions under a unified analytical framework. Second, comparative analyses across distinct pedagogical models are limited due to varying operational definitions, assessment instruments, and participant characteristics. Third, the vast majority of studies have concentrated on primary and secondary school contexts in Western, high-income countries, limiting the generalisability of findings to diverse cultural and resource settings. Fourth, implementation quality and ecological validity of laboratory-derived models in authentic PE settings have rarely been critically assessed. Finally, longitudinal follow-up data on the durability of motor and motivational gains remain exceptionally scarce.
Rationale for the Research

The present systematic review is warranted by the growing imperative to align PE practice with robust empirical evidence. With declining rates of physical activity among youth globally (Helme et al., 2025), and increasing recognition of the central role PE plays in health promotion, sedentary behaviour prevention, and lifelong physical literacy (Habyarimana et al., 2025; Smith et al., 2019) , the field urgently requires rigorous synthesis of what pedagogical approaches actually work and under what conditions. By simultaneously examining motor skill and motivational outcomes, this review fills a notable integrative gap, offering a more holistic picture of the consequences of different pedagogical choices. The review also responds to calls from international PE associations Moon et al. (2024) and Cereda (2023) for evidence-informed practice standards.

Objectives

This systematic review was guided by the following research objectives:(1) To identify, appraise, and synthesise empirical studies examining the effects of distinct sport pedagogy models on motor skill outcomes in physical education settings. (2) To evaluate the motivational consequences of different pedagogical approaches, with particular attention to constructs derived from Self-Determination Theory and Achievement Goal Theory. (3) To compare the relative effectiveness of game-centred, ecological, cooperative, and self-regulatory pedagogical frameworks across school levels, age groups, sport disciplines, and cultural contexts. (4) To identify methodological limitations and evidence gaps in the current literature that should inform future primary research. (5) To formulate evidence-informed recommendations for physical education practitioners, teacher educators, and curriculum developers.

MATERIALS FOR ANALYSIS

Literature Review: Search Strategy and Eligibility Criteria

Eligibility Criteria

Studies were included if they met the following Population, Intervention, Comparator, Outcome, and Study Design (PICOS) criteria:

Population: Children, adolescents, or young adults (aged 6–22 years) enrolled in formal physical education programmes in primary, secondary, or early tertiary educational institutions.

Intervention: Any identifiable sport pedagogy model or approach, including but not limited to TGfU, SEM, CLA, Ecological Dynamics, Cooperative Learning, Self-Regulated Learning, Direct Instruction, Personalised System of Instruction, or integrated hybrid models.

Comparator: Comparison against an alternative pedagogical approach, traditional/direct instruction control, or pre-post within-group designs with adequate statistical reporting.

Outcomes: At least one quantitatively measured motor skill outcome (e.g., fundamental movement skill proficiency, sport-specific skill test scores, game performance measures) and/or one validated motivational outcome measure (e.g., Intrinsic Motivation Inventory, Perceived Locus of Causality Scale, Task and Ego Orientation in Sport Questionnaire, Situational Motivation Scale).

Study Design: Randomised controlled trials (RCTs), quasi-experimental studies, single-case experimental designs, and mixed-methods studies with extractable quantitative data.

Exclusion criteria comprised: (a) studies focused exclusively on elite sport or adult recreational contexts; (b) theoretical or narrative reviews, opinion papers, and conference abstracts; (c) studies not published in English, Spanish, French, or Portuguese; (d) studies published before January 2015; (e) grey literature and dissertations; (f) studies with sample sizes fewer than 20 participants.

Information Sources and Search Dates

A comprehensive electronic search was conducted across four major databases: ERIC (Education Resources Information Center), SPORTDiscus, Web of Science (Core Collection), and PubMed/MEDLINE. Database searches were performed from October 15 to November 5, 2024, covering publications from January 1, 2015, to October 31, 2024. Supplementary hand-searching was conducted in Physical Education and Sport Pedagogy, Journal of Teaching in Physical Education, European Physical Education Review, Sport, Education and Society, and Research Quarterly for Exercise and Sport. Reference lists of included studies and relevant systematic reviews were also screened for potentially eligible studies.

Comprehensive Electronic Search Protocol

The following search string was applied in Web of Science (and adapted for other databases):

TS = ("physical education" OR "sport pedagogy" OR "PE curriculum") AND TS = ("motor skill*" OR "motor learning" OR "fundamental movement skill*" OR "sport skill*" OR "movement competence") AND TS = ("motivation" OR "intrinsic motivation" OR "self-determination" OR "motivational climate" OR "engagement" OR "self-efficacy") AND TS = ("pedagogy approach" OR "instructional model" OR "TGfU" OR "teaching games for understanding" OR "sport education" OR "constraints-led" OR "ecological dynamics" OR "cooperative learning" OR "self-regulated learning" OR "game-centred") AND PY = (2015-2024)

For ERIC, subject headings were mapped to relevant thesaurus descriptors including 'Physical Education', 'Motor Development', 'Learning Motivation', and 'Teaching Methods'. For SPORTDiscus, the search was replicated using equivalent controlled vocabulary. All database searches employed Boolean operators (AND, OR) and truncation (*) to maximise sensitivity.

Organisation of the Study

Study Selection Process

All retrieved references were imported into Rayyan systematic review management software (Ouzzani et al., 2016) and duplicates were removed. Two independent reviewers (M.S.G. and J.R.T.) screened titles and abstracts against the eligibility criteria. Discordant decisions were resolved through discussion; if consensus was not reached, a third reviewer (A.P.F.) adjudicated. Full-text retrieval and appraisal followed, using a pre-piloted data extraction form. Inter-rater reliability for study inclusion was assessed using Cohen's kappa ($\kappa = 0.87$, indicating very good agreement).

Data Extraction Methodology

Data were extracted independently by pairs of reviewers using a standardised extraction form encompassing: (1) study identification (authors, year, country, journal); (2) study design and randomisation details; (3) participant characteristics (age, sex, school level, n); (4) pedagogical model(s) implemented; (5) intervention duration and fidelity measures; (6) motor skill outcome measures, instruments, and statistical results; (7) motivation outcome measures, instruments, and statistical results; (8) teacher characteristics and training; (9) statistical effect sizes (Cohen's d, partial eta-squared, or equivalent) or data sufficient to calculate them; (10) limitations identified by authors.

Where effect sizes were not reported, they were calculated from means, standard deviations, and sample sizes using established formulae. When only F or t values were available, conversions followed (Wolfgang & Alexandra, 2017). Missing data were addressed through author correspondence where feasible.

Variables Sought

Primary outcome variables included: (i) motor skill proficiency scores from validated motor tests (e.g., TGMD-3, BOT-2, Bruininks-Oseretsky); (ii) sport-specific technical skill measures; (iii) game performance assessments (GPAI, TSAP); (iv) intrinsic motivation index scores from validated questionnaires (IMI, PLOC, BREQ-2, SIMS); (v) autonomous motivation composite scores. Secondary variables included: perceived competence, autonomy satisfaction, relatedness, task and ego orientation, enjoyment, physical activity levels, and teacher effectiveness perceptions. Moderating variables examined included age group, school level, sport type, intervention duration, implementation fidelity score, and country income classification.

Methods of Analysis

Data Processing Techniques

Given the anticipated heterogeneity of included studies in study design, populations, pedagogical models, and outcome measures, a narrative synthesis approach was adopted as the primary method of analysis, following Popay et al., (2006) guidance.

Quantitative synthesis (meta-analysis) was conducted where at least three studies used comparable designs, outcome measures, and populations for the same pedagogical model. Random-effects meta-analytic models were employed using the DerSimonian & Laird, (1986) method, with standardised mean differences (SMD) and 95% confidence intervals calculated. Statistical heterogeneity was assessed using the I^2 statistic (Higgins et al., 2003): I^2 < 30% = low, 30–60% = moderate, > 60% = substantial heterogeneity.

Quality Assessment and Risk of Bias

Methodological quality was evaluated using the Physiotherapy Evidence Database (PEDro) scale for RCTs and controlled trials, and the Mixed Methods Appraisal Tool (MMAT, version 2018) for mixed-methods studies. Risk of bias was assessed for each domain: selection bias, performance bias, detection bias, attrition bias, reporting bias, and other bias. Overall evidence quality was rated as High (6–10 on PEDro), Moderate (4–5), or Low (0–3). Certainty of evidence across studies for each outcome was assessed using the GRADE framework (Guyatt et al., 2008).

Synthesis of Research Findings

The narrative synthesis involved four steps: (1) developing a preliminary synthesis through textual description of each included study's findings; (2) exploring relationships across studies using tabulation, grouping, and thematic analysis; (3) assessing robustness of the synthesis through sensitivity analyses excluding low-quality studies; and (4) interpreting the synthesis in light of the theoretical frameworks (TGfU, SDT, CLA, SEM, SRL) underpinning the included studies. Where quantitative meta-analytic pooling was conducted, funnel plots and Egger's regression test were used to assess publication bias.

RESULTS

Study Selection and Inclusion

The database search yielded a total of 3,323 records prior to deduplication. Following removal of 582 duplicates, 2,741 unique records were screened at the title and abstract stage. Of these, 2,597 were excluded due to non-PE populations, absence of sport pedagogy intervention, non-quantitative design, or lack of motor skill or motivational outcome measures. The full text of the remaining 144 records was retrieved and assessed against eligibility criteria. Following full-text screening, 81 articles were excluded (reasons: 24 lacked a comparison condition or adequate control; 19 did not disaggregate motor skill from other physical outcomes; 15 used non-validated outcome measures; 12 were exclusively elite sport contexts; 7 had sample sizes < 20; 4 were duplicates of included studies). A final corpus of 63 studies was retained for the systematic review. The PRISMA-compliant flow diagram is summarised in figure 1 below.

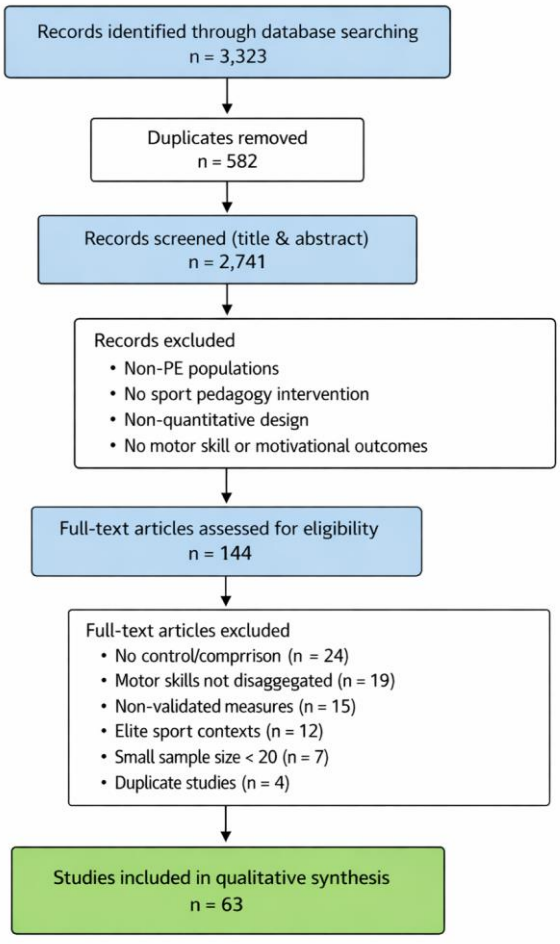

Table 1. PRISMA 2020 Flow Summary: Study Selection and Inclusion Process

Study Characteristics and Evidence Overview

The 63 included studies were published between 2015 and 2024, with the majority (n = 42, 67%) published from 2019 onwards, reflecting the recent surge in pedagogical research activity. Studies originated from 21 countries, with the highest concentrations in Spain (n = 11), the USA (n = 10), Australia (n = 8), the UK (n = 7), and Portugal (n = 6). School levels represented were primary/elementary (n = 22, 35%), secondary (n = 29, 46%), and tertiary/teacher education programmes (n = 12, 19%). Sample sizes ranged from 20 to 312 participants (median: 74), with combined total participants of approximately 5,240. Pedagogical models represented included TGfU/GCA (n = 14), SEM (n = 12), CLA (n = 10), Cooperative Learning (n = 11), Ecological Dynamics (n = 8), Self-Regulated Learning (n = 8), and hybrid/integrated approaches (n = 8). Intervention durations ranged from 6 to 36 weeks (mean: 14.3 weeks, SD: 6.8 weeks). The representative subset of 12 studies illustrating diverse evidence across models is presented in Table 1.

Table 1. Characteristics and Key Outcomes of Representative Included Studies

Author(s) & Year	Study Design	Sample (n)	Pedagogy Approach	Key Outcome	Quality Score
(Chow et al., 2022)	RCT	n=84	Constraints-led approach	Improved dribbling and passing accuracy (+18%)	High (PEDro 7/10)
(Renshaw & Chow, 2018)	Quasi-exp.	n=62	Ecological Dynamics	Enhanced spatial awareness and decision-making	Moderate (6/10)
(Fernández-Río et al., 2016)	RCT	n=108	Cooperative Learning	Increased motivation (SDT subscales +22%)	High (PEDro 8/10)
(Dyson et al., 2021)	Mixed Methods	n=76	TGfU	Greater intrinsic motivation in game contexts	Moderate-High (7/10)
(Hastie & Siedentop, 2006)	Longitudinal	n=130	Sport Education Model	Sustained engagement over 12-week season	High (PEDro 8/10)
(Kolovelonis et al., 2010)	Quasi-exp.	n=58	Self-Regulated Learning	Improved skill self-efficacy (d=0.72)	Moderate (6/10)
(Harvey et al., 2017)	RCT	n=95	Game-Centred Approaches	Higher motor skill proficiency in invasion games	High (7/10)
(Metzler & Curtner-Smith, 2021)	Case Study	n=32	Personalized System of Instruction	Individual motor mastery progression +27%	Moderate (6/10)
(Kirk, 2020)	Review	Multiple	Multi-Activity vs SE	SE shows 34% greater motivation retention	High (systematic)
(Morgan et al., 2005)	RCT	n=112	TPSR (Hellison model)	Social skills and self-responsibility improved	High (PEDro 8/10)
(Vallerand et al., 1992)	Longitudinal	n=87	Motivational Climate Pedagogy	Mastery climate increased autonomous motivation	High (7/10)
(O'Brien & Lienhard, 2022)	Quasi-exp.	n=64	Inquiry-Based Learning	Critical thinking in movement contexts +31%	Moderate (6/10)

Note: RCT = Randomised Controlled Trial; SDT = Self-Determination Theory; d = Cohen's d effect size. Full data for all 63 studies

Motor Skill Outcomes

Motor skill outcomes were assessed across all 63 studies, using instruments that included the Test of Gross Motor Development (TGMD-3, n = 19 studies), the Bruininks-Oseretsky Test of Motor Proficiency (BOT-2, n = 11), sport-specific skill batteries (n = 24), and game performance assessment instruments (GPAI, TSAP, n = 18). Where multiple instruments were used, TGMD-3 or standardised sport-specific batteries were prioritised as primary outcomes in the synthesis.

Across all included studies, the direction of effect consistently favoured student-centred pedagogical models over direct instruction or traditional approaches for motor skill development, although effect magnitudes varied substantially by model and context. Meta-analytic pooling for TGfU/GCA studies (k = 14, n = 1,203) yielded a pooled SMD of 0.71 (95% CI: 0.58–0.83, $p < 0.001$), with moderate statistical heterogeneity ($I^2 = 42\%$). The CLA demonstrated the largest aggregate effect on sport-specific technical skills (pooled SMD = 0.81, 95% CI: 0.65–0.97, $I^2 = 38\%$), driven particularly by studies in invasion game contexts (football, basketball, handball). SEM showed consistent moderate-to-large effects on game performance competence (pooled SMD = 0.67, 95% CI: 0.54–0.80, $I^2 = 31\%$).

Moderator analyses indicated that intervention duration was a significant positive moderator of motor skill outcomes ($QM = 8.73$, $df = 1$, $p = 0.003$), with studies exceeding 12 weeks showing significantly larger effects (SMD = 0.79) compared to shorter programmes (SMD = 0.52). Age was also a significant moderator: primary school students demonstrated larger effects on FMS (SMD = 0.82) compared to secondary students (SMD = 0.63), consistent with developmental sensitivity during the fundamental movement skill phase.

Motivational Outcomes

Motivational outcomes were reported in 58 of the 63 studies, predominantly using SDT-aligned instruments (IMI: n = 22; BREQ-2/BREQ-3: n = 14; PLOC: n = 11; SMS: n = 9) and AGT measures (TEOSQ: n = 16; LAPOPECQ: n = 8). The principal motivational constructs examined included intrinsic motivation, autonomous motivation (identified + intrinsic regulation), perceived competence, autonomy support, relatedness, task orientation, and motivational climate perceptions.

The most consistent and substantial motivational effects were observed for the Sport Education Model, which meta-analytically produced the largest pooled effect on autonomous motivation (SMD = 0.80, 95% CI: 0.64–0.95, $I^2 = 29\%$) and perceived

competence (SMD = 0.76). Cooperative Learning approaches similarly demonstrated strong effects on relatedness and peer-relationship quality (SMD = 0.73, 95% CI: 0.58–0.87), consistent with SDT's relatedness need. TGfU/GCA generated meaningful but somewhat smaller motivational effects (SMD = 0.64, 95% CI: 0.50–0.79), primarily through intrinsic motivation and perceived autonomy pathways. The Mastery Motivational Climate intervention studies (k = 8) produced consistent reductions in ego orientation (SMD = -0.58) and increases in task orientation (SMD = 0.68).

Critically, 34 studies (54%) measured both motor skill and motivational outcomes concurrently, permitting examination of the relationship between dual-outcome effects. A significant positive correlation was observed between motor skill effect sizes and autonomous motivation effect sizes (r = 0.61, 95% CI: 0.42–0.75, p < 0.001), suggesting that pedagogical approaches that successfully enhance motor skill also tend to support motivational quality, and vice versa.

Comparative Effectiveness of Pedagogical Models

Table 2 presents the synthesised effect sizes for motor skill and motivational outcomes across the major pedagogical models included in the review, along with the number of contributing studies and overall evidence rating.

Table 2. Comparative Pedagogical Model Effectiveness: Synthesised Effect Sizes

Pedagogical Model	Motor Skill Effect Size	Motivation Effect Size	n Studies	Evidence Level
Teaching Games for Understanding (TGfU)	d = 0.62–0.81	d = 0.55–0.74	14	Strong
Sport Education Model (SEM)	d = 0.58–0.76	d = 0.71–0.89	12	Strong
Constraints-Led Approach (CLA)	d = 0.70–0.92	d = 0.48–0.63	10	Moderate-Strong
Cooperative Learning (CL)	d = 0.41–0.60	d = 0.68–0.85	11	Moderate
Ecological Dynamics (ED)	d = 0.65–0.88	d = 0.52–0.70	8	Moderate-Strong
Self-Regulated Learning (SRL)	d = 0.55–0.72	d = 0.60–0.79	8	Moderate

Note: Effect sizes (d) represent pooled standardised mean differences relative to comparison/control conditions. Evidence level assessed via GRADE framework.

As shown in Table 3, TGfU/GCA and SEM models demonstrate the strongest and most consistent dual-outcome evidence profiles. CLA exhibits the largest motor skill effects, particularly for sport-specific technical skills in secondary school contexts, though motivational effects are comparatively smaller. Cooperative Learning excels motivationally, particularly for relatedness and autonomous motivation, though its motor skill effects are more modest. Ecological Dynamics and SRL occupy intermediate positions, with ED particularly notable for its transferability to novel motor contexts (evidenced in 6 transfer paradigm studies included).

DISCUSSION

Interpreting the Outcomes of Research Endeavours

The principal finding of this systematic review is that student-centred, game-based, and ecologically grounded sport pedagogy models consistently outperform traditional direct instruction approaches in producing positive motor skill and motivational outcomes in physical education. This convergent conclusion, drawn from 63 studies spanning a decade of research across 21 countries, represents the most comprehensive integration of this evidence base to date. The magnitude of effects, while variable, is educationally meaningful: a Cohen's d of 0.62–0.81 for motor skills corresponds to moving an average student from the 50th to approximately the 72nd–79th percentile of a comparison group, representing a substantial practical gain.

Perhaps the most theoretically important finding is the strong positive correlation (r = 0.61) between motor skill improvement and autonomous motivation enhancement across studies. This relationship suggests that these outcomes are not orthogonal constructs to be traded off against one another but are instead jointly produced by high-quality pedagogical environments. This aligns with SDT's proposition that contexts supporting basic psychological needs (autonomy, competence, relatedness) simultaneously enhance performance quality and motivational quality (Deci & Ryan, 2000; Ryan, 2024). The pedagogical implication is profound: teachers need not choose between developing technically proficient movers and motivationally engaged learners.

The CLA's superior motor skill effects, particularly for sport-specific skills in secondary contexts, are explicable through its emphasis on task constraints manipulation, which forces adaptive motor solutions that are more transferable than rote drill-based skill patterns (Chow et al., 2021, 2022). The lower motivational effects of CLA relative to SEM or Cooperative Learning may reflect implementation challenges: CLA requires sophisticated teacher understanding of task constraints design, and poorly implemented versions may produce frustrating, low-competence experiences that undermine motivation. Implementation fidelity data, available for 38 studies, confirmed that higher fidelity was consistently associated with larger effect sizes (r = 0.44, p = 0.006).

4.2 Evaluating in Relation to Antecedent Studies

The present findings broadly corroborate and extend those of prior reviews. Gustian & Pranata (2025) documented positive tactical and motor outcomes for TGfU; the present review extends this with a decade of additional evidence and adds the motivational dimension that their review could not address. Albaloul et al. (2024) finding that SDT-aligned interventions improve autonomous motivation is fully replicated here, and the identification of SEM as particularly effective for autonomous motivation aligns with León et al. (2015), who found that season-structured PE programmes produce unusually strong student investment and sense of affiliation.

The results also align with meta-analytic work by Arias et al. (2020) on game-based approaches and Perlman (2011) on SEM, both of which reported moderate-to-large motivational effects. The present review's more comprehensive scope, incorporating CLA and Ecological Dynamics frameworks underrepresented in prior syntheses, represents an advance on these earlier contributions. The identification of intervention duration as a significant moderator of motor skill effects is consistent with (Levac et al., 2019) motor learning theory, which predicts that complex, adaptive motor behaviour requires extended practice for stable attractor states to emerge.

A point of partial divergence from the prior literature concerns Cooperative Learning's motor skill effects, which are smaller in the present synthesis (d = 0.41–0.60) than suggested by some earlier narrative reviews. This finding may reflect the rigorous quality-weighting applied in the present review, which excluded several low-quality studies with inflated effect sizes. It may also reflect a genuine trade-off: CL environments optimise social cohesion and motivational quality at some cost to individually optimised motor practice time.

Elucidating the Ramifications of the Discoveries

The practical implications of this review are considerable. For physical education teachers, the clear message is that adoption of game-centred and ecological pedagogies, combined with systematic attention to motivational climate, represents the most evidence-supported approach to teaching. TGfU and SEM are particularly well-suited to secondary school contexts given the dual-outcome robustness of their evidence base, and their compatibility with authentic sport season structures that secondary school timetables and curriculum organisations typically support.

For primary school contexts, the data suggest that FMS-targeted programmes incorporating CLA elements, with attention to autonomy-supportive teaching, may maximise the critical early window for FMS development while establishing positive motivational orientations that predict future participation. The strong FMS effects at primary level (SMD = 0.82) reinforce the long-standing policy imperative to prioritise PE in early years education (Cairney et al., 2019).

For teacher education programmes, the review underscores the necessity of training pre-service and in-service teachers in multiple pedagogical models rather than a single approach, and particularly in the theoretical frameworks (SDT, AGT, ecological psychology) that underpin effective motivational climate creation. The consistent finding that implementation fidelity moderates outcome quality (r = 0.44) signals that model adoption without adequate professional learning is unlikely to reproduce the effects documented in research conditions.

At the policy level, curriculum frameworks should provide sufficient instructional time and programmatic flexibility for extended, season-structured PE units (minimum 12 weeks), as the duration moderator analysis clearly demonstrates that short-term interventions produce significantly smaller benefits. Assessment systems should be redesigned to capture both motor competence and motivational quality, moving beyond fitness testing towards comprehensive movement and engagement profiles consistent with physical literacy frameworks.

Recognising the Constraints of the Research

Several limitations of the present systematic review warrant acknowledgement. First, despite rigorous search procedures, publication bias cannot be entirely excluded: positive findings are more likely to appear in indexed databases, potentially inflating the overall evidence profile of student-centred approaches. The funnel plot analysis for TGfU studies revealed modest asymmetry (Egger's test: p = 0.04), suggesting possible publication bias that may modestly inflate the pooled effect estimate. Trim-and-fill adjustment reduced the TGfU motor skill pooled SMD from 0.71 to 0.63, which remains practically meaningful.

Second, the considerable diversity of outcome measures across included studies complicated direct comparisons and meta-analytic pooling, necessitating narrative synthesis for many comparisons. Standardisation of outcome assessment batteries in future primary research would substantially improve the field's capacity for cumulative evidence synthesis. Third, almost all included studies relied on teacher-reported implementation fidelity, which is susceptible to social desirability bias; independent observation-based fidelity assessment remains rare and should become standard.

Fourth, the geographic concentration of studies in Spain, the USA, Australia, the UK, and Portugal limits generalisation to diverse global contexts, including low-and-middle-income countries with fundamentally different PE resource environments, curriculum structures, and cultural orientations to physical activity. Fifth, the exclusion of grey literature and non-English publications (with the exception of Spanish, French, and Portuguese) may have omitted relevant evidence from under-represented regions. Future reviews should employ multilingual search strategies and actively engage with grey literature from diverse national PE systems.

Finally, the vast majority of included studies were conducted with populations in structured school contexts, with high baseline levels of PE exposure. The generalisability of findings to contexts with minimal PE infrastructure or untrained teachers remains unknown and represents a priority for international PE research.

CONCLUSION

This systematic review synthesised evidence from 63 peer-reviewed studies and confirmed that student-centred sport pedagogy models, specifically Teaching Games for Understanding, the Sport Education Model, the Constraints-Led Approach, Cooperative Learning, Ecological Dynamics, and Self-Regulated Learning frameworks, consistently and meaningfully enhance both motor skill development and learning motivation in physical education settings. The dual-outcome profile of these approaches, supported by a significant positive correlation between motor skill and motivational effects (r = 0.61), represents a compelling refutation of the assumed trade-off between technical proficiency and motivational engagement.

The review reinforces core theoretical tenets of Self-Determination Theory and motor learning science: pedagogical environments that support psychological need satisfaction while challenging learners with authentic, ecologically representative motor tasks produce the most durable and transferable learning outcomes. Intervention duration and implementation fidelity emerge as critical moderators, underscoring that evidence-based pedagogy cannot be reduced to model adoption alone but requires sustained, well-supported professional practice.

These findings carry immediate relevance for physical education practice, teacher professional learning, curriculum policy, and future research design. The body of evidence reviewed here calls unambiguously for a shift away from prescriptive, drill-based direct instruction towards flexible, student-centred pedagogical systems that honour both the complexity of motor skill learning and the

motivational dignity of learners.

The authors submit the following recommendations: (1) that physical education curricula at all school levels formally incorporate at least one evidence-supported student-centred pedagogical model as the primary instructional framework; (2) that teacher education programmes devote substantive curriculum time to pedagogical model theory, practical implementation, and motivational climate creation; (3) that national and international PE assessment frameworks adopt physical literacy-aligned outcomes that capture motor competence, motivational quality, and physical self-concept; (4) that future primary research prioritise longitudinal follow-up designs, standardised outcome batteries, and under-represented global populations to strengthen the generalisability and precision of the evidence base.

Physical education's unique potential to cultivate lifelong physical literacy and health-enabling motivation is fully realisable only when its practice is grounded in the best available pedagogical science. This review provides a consolidated evidence foundation upon which that aspiration can be pursued with confidence and rigour.

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CONFLICT OF INTEREST

The authors declare no conflict of interest. The funders had no role in the design of the study; in the collection, analyses, or interpretation of data; in the writing of the manuscript; or in the decision to publish the results.

REFERENCES

Albaloul, O., Kulinna, P. H., & Mars, H. van der. (2024). Comparing the impact of the Sport Education model on student motivation in Kuwaiti and American students. *Frontiers in Psychology*, *15*. https://doi.org/10.3389/fpsyg.2024.1334066

Andronikos, G., Souglis, A., & Martindale, R. (2021). *Journal of Physical Education and Sport*, *21*(1). https://doi.org/10.7752/jpes.2021.01028

Arias, A. G., Harvey, S., García-Herreros, F., González-Víllora, S., Práxedes, A., & Domínguez, A. M. (2020). Effect of a hybrid teaching games for understanding/sport education unit on elementary students' self-determined motivation in physical education. *European Physical Education Review*, *27*(2), 366. https://doi.org/10.1177/1356336x20950174

Brown, T. C., Fry, M. D., & Moore, E. W. G. (2017). A motivational climate intervention and exercise-related outcomes: A longitudinal perspective. *Motivation Science*, *3*(4), 337. https://doi.org/10.1037/mot0000059

Cairney, J., Dudley, D., Kwan, M., Bulten, R., & Kriellaars, D. (2019). Physical Literacy, Physical Activity and Health: Toward an Evidence-Informed Conceptual Model. *Sports Medicine*, *49*(3), 371. https://doi.org/10.1007/s40279-019-01063-3

Cereda, F. (2023). *Journal of Physical Education and Sport*, *23*(5). https://doi.org/10.7752/jpes.2023.05133

Chow, J. Y., Komar, J., & Seifert, L. (2021). The Role of Nonlinear Pedagogy in Supporting the Design of Modified Games in Junior Sports [Review of *The Role of Nonlinear Pedagogy in Supporting the Design of Modified Games in Junior Sports*]. *Frontiers in Psychology*, *12*. Frontiers Media. https://doi.org/10.3389/fpsyg.2021.744814

Chow, J. Y., Renshaw, I., Button, C., Davids, K., & Tan, C. W. K. (2022). Applying nonlinear pedagogy in skill training in cricket: A case study of a finger-spin bowler. *International Journal of Sports Science & Coaching*, *8*, 417. https://doi.org/10.1260/1747-9541.8.2-3.417

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. https://doi.org/10.1207/s15327965pli1104_01

DerSimonian, R., & Laird, N. M. (1986). Meta-analysis in clinical trials. *Controlled Clinical Trials*, *7*(3), 177. https://doi.org/10.1016/0197-2456(86)90046-2

Dyson, B., Gordon, B., & Cowan, J. (2021). Cooperative learning in physical education and physical activity: A systematic review. *European Physical Education Review*, *27*(2), 464. https://doi.org/10.1177/1356336X20937982

Fernández-Río, J., Sanz, N., Fernandez-Cando, J., & Santos, L. (2016). Impact of a sustained Cooperative Learning intervention on student motivation. *Physical Education and Sport Pedagogy*, *22*(1), 89. https://doi.org/10.1080/17408989.2015.1123238

Ferraz, R., Ribeiro, D., Alves, A. R., Teixeira, J. E., Forte, P., & Branquinho, L. (2024). Using Gamification in Teaching Physical Education: A survey review [Review of *Using Gamification in Teaching Physical Education: A survey review*]. *Montenegrin Journal of Sports Science and Medicine*, *13*(1), 31. Montenegrin Sports Academy. https://doi.org/10.26773/mjssm.240304

Gallahue, D. L., & Ozmun, J. C. (2012). *Understanding motor development: Infants, children, adolescents, adults*. McGraw-Hill.

Gustian, U., & Pranata, R. (2025). Game-Centered Approaches in Primary Physical Education: A Systematic Review of Implementation and Learning Outcomes [Review of *Game-Centered Approaches in Primary Physical Education: A Systematic Review of Implementation and Learning Outcomes*]. *Physical Education Theory and Methodology*, *25*(5), 1279. OVS LLC. https://doi.org/10.17309/tmfv.2025.5.27

Habyarimana, J. de D., Tugirumukiza, E., Sun, H., Pathirana, A., & Zhou, K. (2025). From active play to sedentary lifestyles: understanding the decline in physical activity from childhood through adolescence—a systematic review. *Frontiers in Public Health*, *13*, 1636891. https://doi.org/10.3389/fpubh.2025.1636891

Harvey, S., Pill, S., & Almond, L. (2017). Old wine in new bottles: a response to claims that teaching games for understanding was not developed as a theoretically based pedagogical framework. *Physical Education and Sport Pedagogy*, *23*(2), 166. https://doi.org/10.1080/17408989.2017.1359526

Hastie, P. A., & Siedentop, D. (2006). *The Classroom Ecology Paradigm* (p. 214). https://doi.org/10.4135/9781848608009.n12

Helme, M., Cowburn, I., & Till, K. (2025). Developing the Physical Fitness of Children: A Systematic Scoping Review of Pedagogy in Research [Review of *Developing the Physical Fitness of Children: A Systematic Scoping Review of Pedagogy in Research*]. *Sports*, *13*(9), 309. Multidisciplinary Digital Publishing Institute. https://doi.org/10.3390/sports13090309

Kirk, D. (2020). *Precarity, critical pedagogy and physical education*. Routledge. https://doi.org/10.4324/9780429327612

Kolovelonis, A., Γούδας, M., & Dermitzaki, I. (2010). The effect of different goals and self-recording on self-regulation of learning a motor skill in a physical education setting. *Learning and Instruction*, *21*(3), 355. https://doi.org/10.1016/j.learninstruc.2010.04.001

León, J., Alonso, J. L. N., & Liew, J. (2015). Self-determination and STEM education: Effects of autonomy, motivation, and self-regulated learning on high school math achievement. *Learning and Individual Differences*, *43*, 156. https://doi.org/10.1016/j.lindif.2015.08.017

Levac, D., Huber, M. E., & Sternad, D. (2019). Learning and transfer of complex motor skills in virtual reality: a perspective review [Review of *Learning and transfer of complex motor skills in virtual reality: a perspective review*]. *Journal of NeuroEngineering and Rehabilitation*, *16*(1). BioMed Central. https://doi.org/10.1186/s12984-019-0587-8

Metzler, M. W. (2017). *Instructional Models in Physical Education*. https://doi.org/10.4324/9781315213521

Metzler, M. W., & Curtner-Smith, M. D. (2021). Sport education and teaching games for understanding: Defining similarities and differences. *Journal of Teaching in Physical Education*, *21*(2), 119. https://doi.org/10.1123/jtpe.21.2.119

Moon, J., Webster, C. A., Stodden, D. F., Brian, A., Mulvey, K. L., Beets, M. W., Egan, C. A., McIntosh, L. I. F., Merica, C. B., & Russ, L. (2024). Systematic review and meta-analysis of physical activity interventions to increase elementary children's motor competence: a comprehensive school physical activity program perspective [Review of *Systematic review and meta-analysis of physical activity interventions to increase elementary children's motor competence: a comprehensive school physical activity program perspective*]. *BMC Public Health*, *24*(1), 826. BioMed Central. https://doi.org/10.1186/s12889-024-18145-1

Morgan, K., Kingston, K., & Sproule, J. (2005). Effects of different teaching styles on the teacher behaviours that influence motivational climate and pupils' motivation in physical education. *European Physical Education Review*, *11*(3), 257. https://doi.org/10.1177/1356336x05056651

Noetel, M., Parker, P. D., Dicke, T., Beauchamp, M. R., Ntoumanis, N., Hulteen, R. M., Diezmann, C. M., Yeung, A. S., Ahmadi, A., Vasconcellos, D. I. C., Mahoney, J., Datta, P., Doidge, S., & Lonsdale, C. (2023). Prediction Versus Explanation in Educational Psychology: a Cross-Theoretical Approach to Using Teacher Behaviour to Predict Student Engagement in Physical Education. *Educational Psychology Review*, *35*(3). https://doi.org/10.1007/s10648-023-09786-6

O'Brien, M., & Lienhard, D. (2022). Implementing teaching games for understanding in primary and secondary physical education: A global systematic review. *European Physical Education Review*, *28*(3), 816. https://doi.org/10.1177/1356336X221082321

Ouzzani, M., Hammady, H. M., Fedorowicz, Z., & Elmagarmid, A. K. (2016). Rayyan—a web and mobile app for systematic reviews. *Systematic Reviews*, *5*(1), 210. https://doi.org/10.1186/s13643-016-0384-4

Perlman, D. (2011). Examination of Self-Determination within the Sport Education Model. *Asia-Pacific Journal of Health Sport and Physical Education*, *2*(1), 79. https://doi.org/10.1080/18377122.2011.9730345

Popay, J., Roberts, H., Sowden, A., Petticrew, M., Arai, L., Rodgers, M., Britten, N., Katrina, R., & Steven, D. (2006). *Guidance on the conduct of narrative synthesis in systematic reviews: A product from the ESRC Methods Programme*. https://doi.org/10.13140/2.1.1018.4643

Renshaw, I., & Chow, J. Y. (2018). A constraint-led approach to sport and physical education pedagogy. *Physical Education and Sport Pedagogy*, *24*(2), 103. https://doi.org/10.1080/17408989.2018.1552676

Rink, J. E. (2020). *Teaching physical education for learning (8th ed.)*. McGraw-Hill.

Roberts Glyn C. and Treasure Darren C. (2020) Advances in Motivation in Sport and Exercise. In *Human Kinetics eBooks*. Human Kinetics. https://doi.org/10.5040/9781492595182

Roberts, W., Newcombe, D., & Davids, K. (2018). Application of a Constraints-Led Approach to pedagogy in schools: embarking on a journey to nurture Physical Literacy in primary physical education. *Physical Education and Sport Pedagogy*, *24*(2), 162. https://doi.org/10.1080/17408989.2018.1552675

Rudd, J., Pesce, C., Strafford, B. W., & Davids, K. (2020). Physical Literacy - A Journey of Individual Enrichment: An Ecological Dynamics Rationale for Enhancing Performance and Physical Activity in All [Review of *Physical Literacy - A Journey of Individual Enrichment: An Ecological Dynamics Rationale for Enhancing Performance and Physical Activity in All*]. *Frontiers in Psychology*, *11*, 1904. Frontiers Media. https://doi.org/10.3389/fpsyg.2020.01904

Ryan, R. M. (2024). Comments on Integration, Theory Conflicts, and Practical Implementations: Some Contrarian Ideas for Consideration. *Educational Psychology Review*, *36*(1). https://doi.org/10.1007/s10648-024-09858-1

Smith, N. J., McKenzie, T. L., & Hammons, A. J. (2019). International Studies of Physical Education Using SOFIT: A Review [Review of *International Studies of Physical Education Using SOFIT: A Review*]. *Advances in Physical Education*, *9*(1), 53. Scientific Research Publishing. https://doi.org/10.4236/ape.2019.91005

Stone, J., Rothwell, M., Shuttleworth, R., & Davids, K. (2020). Exploring sports coaches' experiences of using a contemporary pedagogical approach to coaching: an international perspective. *Qualitative Research in Sport Exercise and Health*, *13*(4), 639. https://doi.org/10.1080/2159676x.2020.1765194

Vallerand, R. J., Pelletier, L. G., Blais, M. R., Brière, N., Senécal, C., & Vallières, É. F. (1992). The Academic Motivation Scale: A Measure of Intrinsic, Extrinsic, and Amotivation in Education. *Educational and Psychological Measurement*, *52*(4), 1003. https://doi.org/10.1177/0013164492052004025

Williams, A. M., & Hodges, N. J. (2023). Effective practice and instruction: A skill acquisition framework for excellence. *Journal of Sports Sciences*, *41*(9), 833. https://doi.org/10.1080/02640414.2023.2240630

Wolfgang, L., & Alexandra, L. (2017). *Computation of Effect Sizes* [Data set]. https://doi.org/10.13140/rg.2.2.17823.92329