Sport education model versus traditional teaching in secondary-school Physical Education: a systematic review and meta-analysis

Modelo de educación deportiva frente a la enseñanza tradicional en Educación Física de secundaria: una revisión sistemática y metaanálisis

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Abstract

Introduction: Secondary-school physical education needs teaching models that can support students' motivation, psychological need satisfaction and engagement.
Objective: This review examined whether the sport education model produced more favourable outcomes than traditional teaching in secondary-school physical education.
Methodology: Searches were conducted in Scopus, PubMed, Google Scholar and SPORTDiscus for peer-reviewed studies published from 2016 to 2026. Eligible studies compared the sport education model with traditional teaching, direct instruction or similar teacher-centred approaches. Risk of bias was assessed with design-specific tools. Random-effects meta-analyses were conducted using Hedges' g.
Results: Eleven studies met the inclusion criteria. Six studies were included in the motivation-related meta-analysis. The pooled result favoured the Sport Education Model after the intervention (Hedges' g = 0.95, 95% confidence interval 0.59 to 1.31), although heterogeneity was high. After excluding Baş and Cuevas et al., the effect remained significant and heterogeneity decreased. The primary analysis of basic psychological need satisfaction included two studies. It favoured the sport education model under DerSimonian–Laird estimation, but was not significant under Paule–Mandel estimation with Hartung–Knapp adjustment.
Discussion: Engagement evidence was limited. Two studies reported positive within-group changes, but no clear post-test advantage over traditional teaching.
Conclusions: The sport education model appears promising for motivation-related outcomes, while evidence for basic psychological need satisfaction and engagement remains preliminary.

Keywords

Basic psychological need satisfaction; motivation; secondary school; sport education model; traditional teaching.

Resumen

Introducción: La Educación Física de secundaria necesita modelos que apoyen la motivación, la satisfacción de las necesidades psicológicas básicas y la implicación.
Objetivo: Esta revisión examinó si el Modelo de Educación Deportiva produjo resultados más favorables que la enseñanza tradicional en secundaria.
Metodología: Se buscaron estudios revisados por pares publicados entre 2016 y 2026 en Scopus, PubMed, Google Scholar y SPORTDiscus. Los estudios elegibles compararon el Modelo de Educación Deportiva con la enseñanza tradicional, la instrucción directa u otros enfoques centrados en el profesorado. El riesgo de sesgo se evaluó con herramientas específicas. Se realizaron metaanálisis de efectos aleatorios con la g de Hedges.
Resultados: Once estudios cumplieron los criterios de inclusión. Seis se incluyeron en el metaanálisis de motivación. El efecto combinado favoreció al Modelo de Educación Deportiva tras la intervención (g = 0,95; IC 95%: 0,59 a 1,31), aunque la heterogeneidad fue alta. Tras excluir a Baş y Cuevas et al., el efecto siguió siendo significativo y la heterogeneidad disminuyó. El análisis principal de la satisfacción de las necesidades psicológicas básicas incluyó dos estudios. Favoreció al Modelo de Educación Deportiva con DerSimonian–Laird, pero no fue significativo con Paule–Mandel y Hartung–Knapp.
Discusión: La evidencia sobre la implicación fue limitada. Dos estudios informaron cambios positivos dentro del grupo, pero no una ventaja clara frente a la enseñanza tradicional.
Conclusiones: El Modelo de Educación Deportiva parece prometedor para los resultados de motivación, mientras que la evidencia sobre la satisfacción de las necesidades psicológicas básicas y la implicación sigue siendo preliminar.

Palabras clave

Satisfacción de las necesidades psicológicas básicas; motivación; educación física de secundaria; modelo de educación deportiva; enseñanza tradicional.

Introduction

Researchers have increasingly examined the quality and educational value of school physical education (PE). This issue is especially relevant in secondary-school PE, where students' motivation, engagement and sustained participation in physical activity often decline during adolescence (Estevan et al., 2021). In this review, traditional teaching (TT) was used as an umbrella term for teacher-centred comparison conditions, including traditional teaching, conventional teaching, direct instruction, and similar teacher-led approaches. These approaches shared common features such as teacher control of lesson organisation, demonstration, technical practice, feedback, and assessment. However, TT was not treated as a single uniform method. Differences in how comparison lessons were described and implemented may have influenced the comparability of studies and were therefore considered when interpreting the findings. Although TT may support classroom organisation, technical correction, and short-term skill acquisition, it has been criticised for offering fewer opportunities for autonomy, peer interaction, shared responsibility, and meaningful participation (Bessa et al., 2021).

In this context, the Sport Education Model (SEM) has been discussed as a pedagogical model that can offer students more meaningful sport experiences. Originally developed by Siedentop (1994), SEM is structured around key features of institutionalised sport, including seasons, team affiliation, formal competition, record keeping, festivity, and a culminating event. SEM is not a single teaching technique. It is a curriculum and instructional model that can combine direct instruction, cooperative small-group learning, peer teaching and team-based responsibility within a sport-based context (Siedentop, 1998). In this respect, SEM differs from TT not only in lesson organisation, but also in the way students take active roles in learning, performance, team work and classroom social interaction.

This distinction is important during adolescence, when motivation and engagement in PE may become more fragile. SEM may address some of these concerns by offering sustained roles, team affiliation, shared goals, and opportunities to experience autonomy, competence, and relatedness across a longer season. Existing evidence suggests that SEM can support learning across cognitive and non-cognitive domains, although its effects may vary according to participant characteristics, intervention duration, sport content, teacher expertise, and implementation fidelity (Chu & Zhang, 2018; Wallhead & Ntoumanis, 2004; Yao et al., 2025). Previous reviews have also reported positive effects of SEM on motivational responses in PE (Tendinha et al., 2021), while Bessa et al. (2021) argued that SEM and TT may contribute to different types of learning outcomes, with SEM showing particular promise for social, motivational, and affective development.

The theoretical basis for these effects is commonly linked to Self-Determination Theory (SDT), which identifies autonomy, competence, and relatedness as key psychological needs for more self-determined forms of motivation (Ryan & Deci, 2000, 2020). Within SEM, stable teams and long-term affiliation may foster relatedness; progressive competition, role responsibility, and record keeping may support competence; and opportunities for team decision-making may enhance autonomy (Siedentop, 1994, 1998; Wallhead & Ntoumanis, 2004). These mechanisms are especially relevant in secondary-school PE, where overly controlled, narrowly skill-focused, or fragmented lessons may contribute to disengagement rather than sustained participation (Chu & Zhang, 2018; Cuevas et al., 2016). From this perspective, SEM should not be seen as universally superior to TT. Its benefits are more likely to emerge when the model is implemented with sufficient duration, clear student roles, meaningful competition, supportive teacher facilitation, and fidelity to its core pedagogical features (Hastie et al., 2011; Manninen & Campbell, 2022).

Although reviews on SEM and motivation in PE have increased, the comparison between SEM and teacher-centred teaching is still not fully clear. Previous reviews have examined motivational processes in SEM, wider learning outcomes, and implementation features across different educational stages and PE contexts (Bessa et al., 2021; Chu & Zhang, 2018; Manninen & Campbell, 2022; Yao et al., 2025). However, they have not closely examined direct comparisons between SEM and TT, direct instruction, or conventional teaching in secondary-school PE. Evidence from mixed age groups, mixed comparators, or non-comparative SEM studies cannot clearly show whether SEM provides a more supportive psychological learning context than teacher-centred approaches in adolescent PE. This matters because motivation, basic psychological need satisfaction (BPNS), and engagement are closely linked to students' continued participation in PE and physical activity.

This review addresses this gap in three ways. First, it focuses on secondary-school PE, including lower secondary, upper secondary, and high-school contexts. Second, it includes only studies that directly compare SEM with TT, direct instruction, conventional teaching, or similar teacher-centred approaches. Third, it brings together motivation, BPNS, and engagement through an SDT-informed perspective, while separating outcomes suitable for meta-analysis from those requiring narrative synthesis. The review was limited to studies published from 2016 to 2026 to focus on recent comparative intervention evidence in contemporary PE curricula and teaching contexts. Earlier SEM studies were used to inform the theoretical background, but they were not included in the quantitative synthesis because the review aimed to synthesise recent studies with more comparable curriculum settings, intervention designs, and outcome measures. Rather than repeating earlier SEM reviews, this review clarifies how SEM and teacher-centred teaching compare as instructional contexts for students' motivation, need satisfaction, and engagement in adolescent PE.

Method

Registration

The review protocol was registered in PROSPERO before the review was conducted. The registration number was CRD420261370492. The review followed the registered protocol. One later change was made to the search process, and this is reported below.

Search strategy

The search aimed to identify studies that compared the SEM with TT in school PE. In this review, TT was used as a broad term. It included traditional teaching, conventional teaching, direct instruction, and similar teacher-centred approaches.

The first search was conducted in Scopus, PubMed, and Google Scholar. The search covered peer-reviewed articles published from 1 January 2016 to 14 April 2026. This period was chosen to focus on recent comparative intervention evidence in contemporary school PE contexts. Earlier SEM studies were used for theoretical background but were not included in the quantitative synthesis. After the initial PROSPERO registration, SPORTDiscus was added to improve coverage of sport pedagogy and PE research. This change was submitted through the PROSPERO update system and reflected in the updated record. SPORTDiscus was searched on 30 April 2026 using the same publication-year limits.

The search terms covered four areas: SEM, PE, secondary-school education, and the target outcomes. Search strings were adapted for each database because the search functions were not the same. Secondary-school eligibility was checked during screening. Comparator terms were not used as strict database limits because studies used different names for teacher-centred teaching.

For Google Scholar, four search strings were used. Results were sorted by relevance. The first 100 records from each search string were recorded manually and exported before being imported into Mendeley. Google Scholar hit counts were not used as formal screening totals because they can change between searches. We acknowledge that limiting Google Scholar screening to the first 100 records per search string may have introduced coverage bias. To reduce this risk, the database search was supplemented by checking the reference lists of the included studies and relevant reviews. This reference chasing procedure was used as a compensatory strategy to improve the completeness of the search. Full search strategies are shown in Supplementary File 1.

Eligibility criteria

Eligibility was based on the PICOS framework. Studies were included if they met the following criteria: peer-reviewed full-text journal articles; written in English; participants were secondary-school, high-school, senior high-school, or equivalent vocational secondary-school students; the setting was formal PE; SEM was the main intervention; the comparison group used TT, direct instruction, conventional teaching, or a similar teacher-centred approach; at least one eligible outcome was reported; and the design allowed quantitative between-group comparison.

The primary outcomes were motivation-related outcomes and BPNS. BPNS included autonomy, competence, and relatedness. Engagement in PE was included as a secondary outcome because it was part of the registered review scope.

Studies were excluded if they were not conducted in formal PE settings. Studies were also excluded if they did not compare SEM with a teacher-centred approach, used SEM only as one part of a combined intervention, did not use a quantitative comparative design, or did not report any eligible outcome.

In this review, secondary-school PE referred to curriculum-based PE in lower secondary, upper secondary, high-school, senior high-school, or equivalent vocational secondary-school settings.

Table 1. Inclusion criteria according to the PICOS framework

Items	Detailed inclusion criteria
Population	Secondary school students, including high school students, in formal PE settings
Intervention	Sport Education Model
Comparison	Traditional teaching, including conventional teaching, direct instruction, and comparable teacher-centred instructional approaches
Outcome	Primary outcomes: motivation and BPNS, including autonomy, competence, and relatedness; secondary outcome: engagement in PE
Study design	Randomised controlled trials, cluster-randomised controlled trials, non-randomised controlled trials, and quasi-experimental studies

Note. PE = physical education; BPNS = basic psychological need satisfaction.

Study selection

All records were imported into Mendeley, and duplicates were removed. The screening was completed in two stages.

First, two reviewers independently screened the titles and abstracts according to the eligibility criteria. Inter-rater agreement at this stage was substantial, with a Cohen's kappa value of 0.80. Disagreements were discussed and resolved by checking the PICOS criteria.

Second, the same reviewers independently assessed the full texts of potentially eligible studies. A separate kappa statistic was not calculated for the full-text screening stage. This was because all full-text decisions were checked by both reviewers, and any disagreement was discussed until consensus was reached. During this stage, studies based on the same sample, dataset, or intervention were checked carefully to avoid double counting. Reasons for full-text exclusion were recorded. The selection process is presented in the PRISMA flow diagram (Page et al., 2021; Figure 1).

Data extraction

Two reviewers extracted the data using a standardised form. Extracted information included author details, publication year, country, sample size, participant characteristics, study design, intervention content, comparison condition, intervention duration, outcome measures, assessment time points, baseline comparability, and main findings. A separate inter-rater agreement statistic was not calculated for data extraction. Instead, the extracted data were checked by both reviewers against the full texts, and any disagreement or uncertainty was resolved through discussion.

For the meta-analysis, the main extracted data were group sample sizes, post-intervention means, and standard deviations for the SEM and comparison groups. Baseline data were also recorded to help judge group comparability before the intervention. Post-intervention data were used in the main analyses because change-score standard deviations and adjusted estimates were not reported consistently.

When means and standard deviations were not available, other statistics were checked. These included t values, F values, p values, and confidence intervals. If an effect size still could not be calculated, the study was included in the narrative synthesis.

When several eligible outcomes were reported within the same domain, one study-level effect size was selected using a predefined outcome hierarchy. This reduced selective outcome use and avoided double counting. A summary of the outcome-selection decisions for the quantitative synthesis is provided in Table 2, and full details are reported in Supplementary File 2. Extracted data, effect-size calculations, composite checks, and forest-plot weights are reported in Supplementary File 3.

When inter-subscale correlations were unavailable, the main composite estimates used a conservative average-SD approach rather than an assumed correlation coefficient. Sensitivity checks using assumed inter-subscale correlations of r = 0.25, r = 0.50, and r = 0.75 are reported in Supplementary File 3. Across all composite outcomes, the effects remained positive under the three assumptions, and the interpretation was unchanged.

Table 2. Summary of outcome-selection decisions for the quantitative synthesis

Study	Domain	Outcome selected	Reason for selection
Baş (2016)	Motivation	Intrinsic motivation	No autonomous motivation composite or self-determination index was reported.
Burgueño et al. (2018)	BPNS	Composite BPNS satisfaction	Autonomy, competence, and relatedness satisfaction were combined to represent BPNS.
Cuevas et al. (2016)	Motivation; BPNS-related sensitivity	Self-determination index; reverse-coded need-thwarting composite	The self-determination index matched the motivation hierarchy. Need-thwarting indicators were used only for sensitivity analysis.
Franco et al. (2021)	Motivation; BPNS	Intrinsic motivation; composite BPNS satisfaction	Intrinsic motivation was the available motivation indicator. Three need-satisfaction subscales were combined to represent BPNS.
Hernández-Andreo et al. (2020)	Motivation	Autonomous motivation composite	Intrinsic motivation and identified regulation were combined because both reflected autonomous motivation.
Tang et al. (2026)	Motivation	Intrinsic motivation composite	Interest in learning, achievement, and excitement/enjoyment were combined as intrinsic motivation-related indicators.
Viciana et al. (2020)	Motivation; BPNS-related sensitivity	Autonomous motivation composite; relatedness indicator for sensitivity analysis	Autonomous motivation matched the predefined hierarchy. Relatedness was used only as a BPNS-related sensitivity indicator.

Note. BPNS = basic psychological need satisfaction. Composite effects were calculated when multiple eligible subscales represented the same construct. Positive Hedges' g values indicate effects favouring SEM over TT. Full outcome-selection rules, narrative-synthesis decisions, composite calculations, and sensitivity checks are reported in Supplementary Files 2 and 3.

Risk of bias assessment

Risk of bias was assessed by two reviewers. The assessment tool depended on the study design. Study design was judged from the reported allocation method, not only from the label used by the authors.

Studies with clear allocation of intact classes or groups were treated as cluster-randomised trials. Studies using existing classes, existing groups, or unclear allocation methods were treated as non-randomised or quasi-experimental studies.

The revised Cochrane risk-of-bias tool for randomised trials (RoB 2) was used for randomised and cluster-randomised trials, whereas ROBINS-I was used for non-randomised and quasi-experimental comparative studies (Sterne et al., 2016, 2019). For non-randomised studies, baseline equivalence was considered when judging bias due to confounding and participant selection. A separate inter-rater agreement statistic was not calculated for the risk-of-bias assessment. Instead, both reviewers checked the judgements against the full texts, and any disagreement was resolved through discussion and re-checking of the original reports.

Risk-of-bias judgements were not changed into numerical scores. They were used to support interpretation of the findings. No study was excluded only because of risk of bias, as the number of eligible studies was small.

Data synthesis

The quantitative synthesis was guided by the Cochrane Handbook (Deeks et al., 2024; Higgins et al., 2024). Meta-analyses and forest plots were prepared in R version 4.5.3, using the metafor package version 5.0-1. The readxl and dplyr packages were used to import and organise the data.

The primary analyses used random-effects models with DerSimonian–Laird estimation. Sensitivity analyses used Paule–Mandel estimation with Hartung–Knapp adjustment, as the number of studies was small. Studies were pooled only when they were sufficiently similar in participants, intervention and comparator conditions, outcome constructs, and assessment timing. Motivation-related outcomes and BPNS were analysed quantitatively. Engagement was synthesised narratively because only two studies reported this outcome, and their measures were not sufficiently comparable.

Random-effects models were chosen because the included studies differed in sport content, intervention length, implementation features, and study design. Continuous outcomes were analysed using Hedges' g with 95% confidence intervals. Positive values indicated results favouring SEM over TT. The pooled estimates were interpreted as post-intervention between-group differences. They were not treated as fully adjusted causal effects because adjusted estimates and change-score data were not consistently available.

To avoid double counting, each study contributed only one study-level effect size to each meta-analysis. When a total score or eligible composite score was available, it was used directly. When only subscale scores were reported, subscales measuring the same construct were combined. Composite means were calculated using the arithmetic mean of the selected subscale means. When correlations between subscales were not reported, the main estimates used an average-SD approach. Sensitivity checks were then conducted using assumed correlations of r = 0.25, r = 0.50, and r = 0.75. The selected subscales, assumptions, and calculations are reported in Supplementary Files 2 and 3.

For motivation-related outcomes, autonomous motivation composites and self-determination indices were prioritised. If these were not available, adaptive motivational indicators, such as intrinsic motivation or identified regulation, were used. For BPNS, total need-satisfaction scores were prioritised. If total scores were unavailable, autonomy, competence, and relatedness satisfaction were combined. Single-need indicators and need frustration or need thwarting outcomes were not included in the primary BPNS analysis. They were used only in sensitivity analyses where appropriate.

Heterogeneity was assessed using Cochran's Q and I^2. Publication bias was not formally tested because fewer than ten studies were included in each meta-analysis.

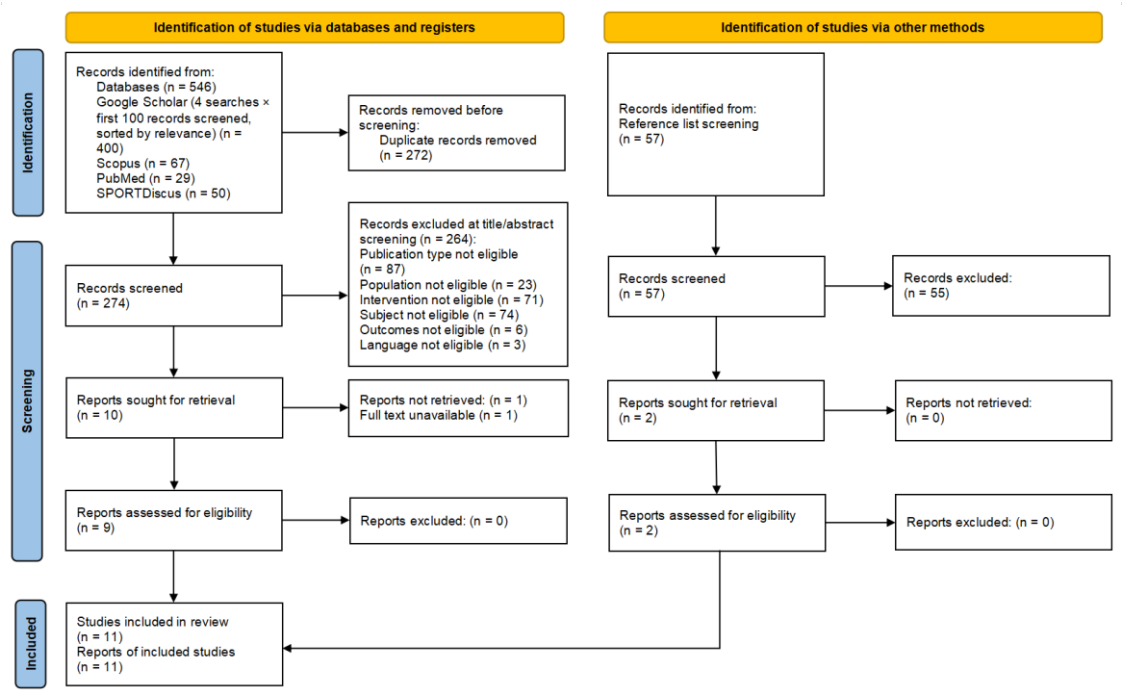
Results

Study selection

The database searches identified 546 records: 400 from Google Scholar, 67 from Scopus, 29 from PubMed, and 50 from SPORTDiscus. After 272 duplicate records were removed in Mendeley, 274 records remained for title and abstract screening. Of these, 264 were excluded because of ineligible publication type (n = 87), population (n = 23), intervention (n = 71), subject focus (n = 74), outcomes (n = 6), or language (n = 3). Ten reports were sought for retrieval, of which one could not be obtained because the full text was unavailable. The remaining nine reports were assessed for eligibility and all were included.

Reference list screening identified a further 57 records. After screening these records, 55 were excluded because they did not meet the eligibility criteria. Two reports were sought for retrieval, both were retrieved and assessed for eligibility, and both were included. In total, 11 studies from 11 reports were included in the review (Figure 1).

Figure 1. PRISMA 2020 flow diagram of the study selection process



Study characteristics

An overview of the 11 included studies and their contribution to the synthesis is provided in Table 3. Full study characteristics, including detailed outcome measures and main findings, are provided in Supplementary File 4. Most studies were quasi-experimental comparisons conducted in authentic school PE settings with pre-existing classes; one study was treated as a cluster-randomised trial for risk-of-bias assessment. All studies were conducted in secondary or high-school contexts, with sample sizes ranging from 44 to 430 participants.

All studies compared SEM with a teacher-centred comparator, described variously as traditional teaching, direct instruction, conventional learning, or traditional PE. Interventions covered basketball, volleyball, table tennis, futsal, Ultimate Frisbee, alternative sports, and multi-activity programmes. Most studies used self-report measures of motivation, BPNS, engagement, or related psychosocial outcomes. Intervention duration varied from short units of eight or 12 lessons to longer programmes of 19, 20, or 24 lessons; two studies did not report session number clearly.

Table 3. Characteristics of the included studies

Study ID	Country/design	Participants	SEM content/duration	Contribution to synthesis
Baş (2016)	Turkey; quasi-experimental	Secondary school (n = 120)	Sport-based SEM; 10 weeks	Motivation meta-analysis
Bessa et al. (2020)	Portugal; quasi-experimental	High school (n = 430)	Multi-unit SE; 24 lessons	Engagement narrative synthesis
Burgueño et al. (2018)	Spain; quasi-experimental	High school (n = 44)	Basketball SEM; 12 lessons	BPNS meta-analysis
Cuevas et al. (2016)	Spain; quasi-experimental	Secondary school (n = 86)	Volleyball SEM; 19 lessons	Motivation meta-analysis; BPNS-related sensitivity analysis
Fernández-Río et al. (2017)	Spain; quasi-experimental	Secondary school (n = 217)	Ultimate Frisbee SEM; 12 lessons	Narrative synthesis
Franco et al. (2021)	Spain; quasi-experimental	Secondary school (n = 50)	Basketball SEM; 8 lessons	Motivation and BPNS meta-analysis; engagement narrative synthesis
Hasyim et al. (2020)	Indonesia; quasi-experimental	High school (n = 50)	Futsal SEM; duration unclear	Narrative synthesis
Hernández-Andreo et al. (2020)	Spain; quasi-experimental	Secondary school (n = 93)	Alternative-sports SEM; 12 lessons	Motivation meta-analysis
Jamalludin et al. (2026)	Indonesia; quasi-experimental	High school (n = 60)	Basketball SEM; several sessions	Narrative synthesis
Tang et al. (2026)	China; quasi-experimental	High school (n = 116)	Table-tennis SEM; 20 lessons	Motivation meta-analysis

Viciana et al. (2020)	Spain; cluster-randomised trial	High school (n = 109)	Volleyball SEM; 12 lessons	Motivation meta-analysis; BPNS-related sensitivity analysis

Note. SEM = Sport Education Model; SE = Sport Education; BPNS = basic psychological need satisfaction. Detailed outcome measures and main study findings are provided in Supplementary File 4.

Risk of bias

Risk of bias was assessed using ROBINS-I for non-randomised and quasi-experimental studies, and RoB 2 for the cluster-randomised trial. Domain-level judgements are reported in Supplementary File 5.

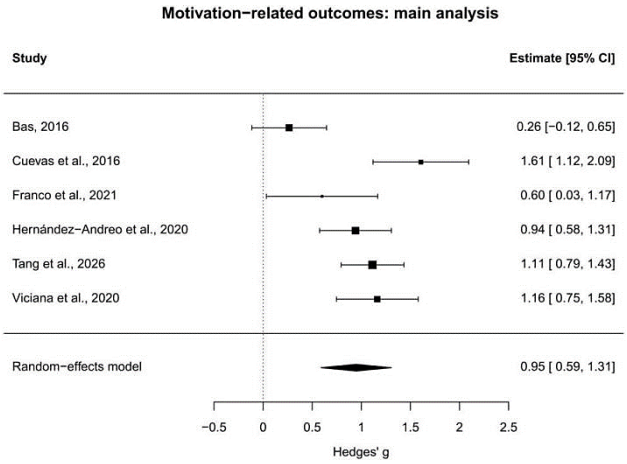
Overall, the evidence base had notable methodological limitations. All ten non-randomised studies were judged to be at serious risk of bias, mainly because they used pre-existing groups without individual randomisation and provided limited control for potential confounders, baseline differences, or selection effects.

Intervention classification was generally rated as low risk because SEM and TT conditions were usually described clearly. However, other domains were more variable, with common concerns including teacher effects, limited fidelity reporting, missing data, self-report outcome measures, and the absence of pre-registered analysis plans. The single cluster-randomised trial was judged as having some concerns overall. Taken together, these findings indicate that the review evidence should be interpreted cautiously, particularly because most studies were non-randomised and vulnerable to confounding and selection bias.

Meta-analysis of motivation-related outcomes

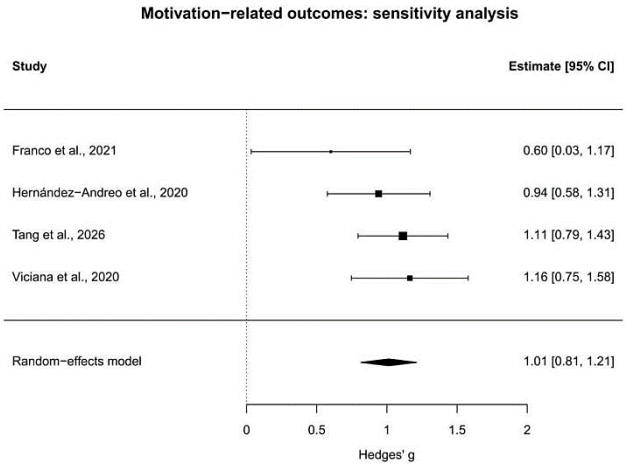
The motivation-related meta-analysis included six studies. The pooled post-intervention effect was in favour of SEM when compared with TT (Hedges' g = 0.95, 95% CI 0.59 to 1.31). This result was statistically significant. However, heterogeneity was high (Q = 22.87, df = 5, I^2 = 78.1%, τ^2 = 0.154), showing clear variation in effect sizes across studies (Figure 2).

Figure 2. Forest plot of motivation-related outcomes: main analysis. Positive Hedges' g values favour Sport Education Model over traditional teaching.



Sensitivity analyses were used to check whether the result was influenced by individual studies. The analyses excluding Baş (2016) and Cuevas et al. (2016) separately are presented in Supplementary File 6. In the combined sensitivity analysis, both studies were removed. Baş (2016) was excluded because the SEM and TT groups had unequal intervention duration (10 vs 5 weeks). Cuevas et al. (2016) was excluded because it had a relatively large individual effect. After removing these two studies, the pooled effect still favoured SEM and remained significant (Hedges' g = 1.01, 95% CI 0.81 to 1.21). Heterogeneity was much lower (Q = 3.07, df = 3, I^2 = 2.3%, τ^2 = 0.001), suggesting that these two studies explained a large part of the between-study variation (Figure 3).

Figure 3. Forest plot of motivation-related outcomes: sensitivity analysis excluding Baş (2016) and Cuevas et al. (2016). Positive Hedges' g values favour Sport Education Model over traditional teaching.

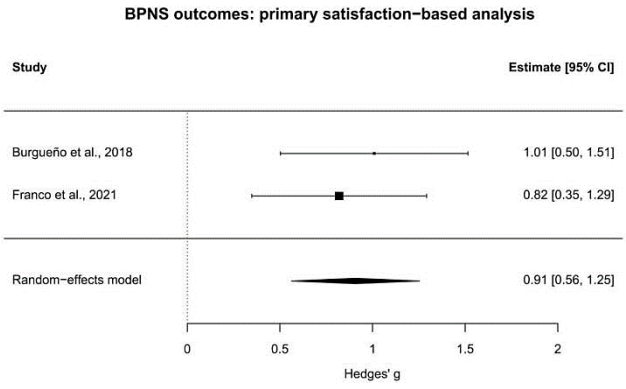


Overall, the motivation-related results consistently favoured SEM over TT. Even so, the size of the effect should be read with caution, mainly because the main analysis showed high heterogeneity and was influenced by specific studies.

Meta-analysis of BPNS outcomes

The primary BPNS meta-analysis was based on two satisfaction-based studies. These studies either reported indicators across the three basic psychological needs or provided data from which a three-need BPNS satisfaction composite could be calculated. Using the DerSimonian–Laird random-effects model, the pooled post-intervention effect favoured SEM over TT (Hedges' g = 0.91, 95% CI 0.56 to 1.25). Statistical heterogeneity was low (Q = 0.29, df = 1, I^2 = 0.0%, τ^2 = 0.000; Figure 4). This estimate should still be treated carefully because it was based on only two studies, which limited precision.

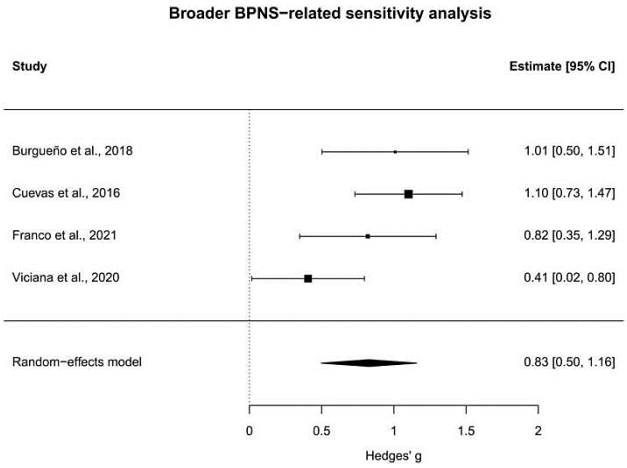
Figure 4. Forest plot of basic psychological need satisfaction outcomes: primary satisfaction-based analysis. Positive Hedges' g values favour Sport Education Model over traditional teaching.



Note. BPNS = basic psychological need satisfaction.

Further sensitivity analyses tested whether the direction of the result changed when broader BPNS-related indicators were included. These indicators came from Viciana et al. (2020), which reported relatedness with others as a single need-related outcome, and Cuevas et al. (2016), which measured need thwarting rather than need satisfaction (Supplementary File 6). In this broader analysis, the pooled effect still favoured SEM (Hedges' g = 0.83, 95% CI 0.50 to 1.16). Heterogeneity increased to a moderate level (Q = 7.08, df = 3, I^2 = 57.6%, τ^2 = 0.065; Figure 5). Because these added indicators were not the same as overall BPNS satisfaction, this analysis was treated as exploratory.

Figure 5. Forest plot of broader basic psychological need satisfaction related sensitivity analysis including Cuevas et al. (2016) and Viciana et al. (2020). Positive Hedges' g values favour Sport Education Model over traditional teaching.



Note. BPNS = basic psychological need satisfaction.

The BPNS findings were further checked using Paule–Mandel estimation with Hartung–Knapp adjustment (Supplementary File 7). Under this more conservative approach, the primary satisfaction-based BPNS effect remained positive but was no longer statistically significant (Hedges' g = 0.91, 95% CI −0.29 to 2.11). When the broader BPNS-related indicators from Viciana et al. (2020) and Cuevas et al. (2016) were included, the pooled effect remained significant (Hedges' g = 0.83, 95% CI 0.32 to 1.34). Taken together, the BPNS results point towards a possible advantage of SEM over TT. However, the evidence is still preliminary and depends partly on the analytical approach used. The finding should therefore be viewed as suggestive rather than definitive.

Narrative synthesis

Engagement outcomes

Two studies reported engagement outcomes and were synthesised narratively because their measures were not sufficiently comparable for meta-analysis. Franco et al. (2021) reported behavioural engagement, whereas Bessa et al. (2020) assessed broader engagement using the Athlete Engagement Questionnaire. Both studies found significant within-group improvements under SEM, but neither showed a significant post-test advantage over TT. Therefore, the engagement evidence suggests possible positive within-group change rather than a clear comparative effect (Supplementary File 2).

Additional studies with insufficient data for meta-analysis

Three eligible studies could not be included in the meta-analysis because they did not report sufficient between-group data to calculate standardised effect sizes. The corresponding authors were contacted for missing data, but no responses were received. These studies were therefore retained in the review and synthesised narratively (Supplementary File 2).

Jamalludin et al. (2026) reported greater improvements in learning motivation under SEM than under conventional teaching. Fernández-Río et al. (2017) found broader improvements in adaptive psychological outcomes in the SEM group, including intrinsic motivation, competence, interest, social relationships, and cooperative learning. Hasyim et al. (2020) also reported more favourable pre–post changes in motivation-related outcomes under SEM than under TT.

Although these studies could not contribute to the pooled estimates, their findings were broadly consistent with the meta-analysis. They provide additional narrative support for the view that SEM may be associated with more favourable motivational and related psychosocial outcomes than TT, while also highlighting the need for more complete statistical reporting in future studies.

Discussion

This review compared SEM and TT in secondary-school PE, focusing on post-intervention differences in motivation-related outcomes, BPNS, and engagement. The results were clearest for motivation. SEM showed more favourable motivation-related outcomes than TT. The evidence for BPNS was also positive in direction, but less stable. Evidence for engagement was still limited. These findings need careful interpretation. Most included studies used intact classes and non-randomised or quasi-experimental designs. Baseline equivalence, implementation fidelity, teacher effects, and possible bias from self-report measures were not reported consistently. For this reason, the pooled results should be understood as post-intervention differences linked with SEM, rather than firm causal evidence that SEM is better than TT.

For motivation-related outcomes, the main meta-analysis showed a significant pooled effect in favour of SEM, although heterogeneity was high. The sensitivity analysis removed Baş (2016), because of unequal intervention exposure, and Cuevas et al. (2016), because of its large individual effect. After these two studies were removed, the effect remained significant and heterogeneity decreased. This suggests that the overall result was not driven by either study alone. Even so, the size of the pooled effect should be treated cautiously. Franco et al. (2021) was conducted during the COVID-19 scenario, which may have affected peer interaction, team roles, competition formats, and SEM implementation. This context may have influenced motivation and engagement outcomes and contributed to heterogeneity across studies. The included studies measured motivation in different ways, and most used post-intervention self-report data within non-randomised designs.

The BPNS results were encouraging, but still preliminary. The primary analysis included only two satisfaction-based studies. Under the DerSimonian–Laird model, the result favoured SEM. However, this effect was no longer significant when Paule–Mandel estimation with Hartung–Knapp adjustment was applied. The broader BPNS-related sensitivity analyses showed the same direction of effect, but they included indicators that were not fully equivalent to overall BPNS satisfaction. The evidence for engagement was also weak. Only two studies measured this outcome. Both reported within-group improvements under SEM, but neither showed a clear post-test advantage over TT.

The findings are plausible from an SDT perspective. SEM may offer students more opportunities to experience autonomy, competence, and relatedness. Stable teams may support a sense of belonging. Student roles and shared decision-making may strengthen autonomy. Formal competition, record keeping, and progressive team tasks may also help students feel more competent. These features may partly explain the stronger motivation-related outcomes under SEM. However, most studies did not directly test BPNS as a mediating mechanism. Therefore, this explanation remains theory-based rather than empirically confirmed.

These findings partly confirm and partly qualify previous SEM reviews. They support Tendinha et al. (2021) by showing a favourable motivation-related effect for SEM in PE. However, the effect was large (Hedges' g = 0.95) and should be interpreted cautiously because it was based on few studies and showed high heterogeneity. The findings also partly support Manninen and Campbell (2022), but the BPNS evidence was less stable, as the primary BPNS effect became non-significant under the more conservative Paule–Mandel and Hartung–Knapp approach. Thus, this review supports the motivational promise of SEM, but qualifies stronger claims about BPNS and engagement.

SEM appears more likely to be effective when delivered as a complete instructional model rather than as a brief change in lesson format. The current evidence does not identify a precise minimum duration, but SEM seems more suitable when implemented across a sustained unit or season, allowing stable teams, student roles, competition, record keeping, and a culminating event to become established. A recent study also suggested that a shortened SEM unit may limit effects on motivational climate (Izquierdo-Núñez et al., 2025). Teacher characteristics, sport type, and implementation quality may also influence effectiveness. SEM is more likely to support motivation, cooperation, responsibility, and meaningful participation when teachers prepare students for their roles, adapt the model to the sport content, and implement its core features with fidelity.

Possible publication bias should also be considered. Formal tests were not conducted because fewer than ten studies were included in each meta-analysis. However, the field is small, and the available

evidence was dominated by positive or favourable findings for SEM. Studies with null, negative, or less favourable findings may have been less likely to be published, indexed, or reported with sufficient data for meta-analysis. These issues may have contributed to an overestimation of the pooled effects, especially for motivation-related outcomes.

Practical implications

In practical terms, SEM should be implemented as a structured season rather than as a short activity block. Teachers should provide stable teams, clear student roles, record keeping, formal competition, and a culminating event, while also preparing students for roles such as captain, coach, referee, recorder, or equipment manager. SEM may support motivation, cooperation, responsibility, and sustained engagement, but TT remains useful for demonstration, safety, technical correction, and early skill learning. A practical approach is to combine clear instruction with SEM features and to monitor whether the core features of SEM are implemented with fidelity. This aligns with recent evidence that student-centred approaches require careful planning, teacher preparation, student participation, and formative assessment (León Díaz et al., 2023).

Certainty of evidence

The certainty of evidence was considered using GRADE-informed domains: risk of bias, inconsistency, indirectness, imprecision, and publication bias. Overall, the certainty of evidence was judged to be low for motivation-related outcomes and very low for BPNS and engagement. These judgements reflected serious risk of bias, the small number of included studies, substantial heterogeneity in the motivation analysis, and the narrative synthesis of engagement outcomes. The full certainty assessment is provided in Supplementary File 8.

Limitations

This review has several limitations. First, most included studies used intact classes and non-randomised or quasi-experimental designs. This limited control over selection bias, baseline imbalance, and residual confounding. Baseline equivalence was extracted and considered, but it was not reported consistently across studies. Most studies also did not provide cluster-adjusted estimates or intraclass correlation coefficients. As a result, class-level or school-level clustering could not be formally adjusted for, and some confidence intervals may have been too narrow.

Second, the meta-analysis mainly used post-intervention standardised mean differences. This was necessary because change-score standard deviations and adjusted between-group estimates were not reported consistently. Therefore, the pooled estimates should be read as post-intervention group differences, not as fully adjusted intervention effects.

Third, the evidence base was small, especially for BPNS. This reduced precision and made subgroup analyses unsuitable. Publication bias could not be formally tested. In addition, TT was used as an umbrella term for teacher-centred comparison conditions. These conditions differed in lesson organisation, practice structure, feedback and reporting detail, which may have affected comparability across studies.

Finally, most studies used self-report questionnaires, and implementation fidelity was reported unevenly. The review was limited to English-language peer-reviewed articles. In Google Scholar, only the first 100 records from each search string were screened. These issues mean that the findings should be seen as a cautious summary of the current evidence, rather than conclusive proof that SEM is superior to TT.

Conclusions

This review compared SEM and TT in secondary-school PE, with a focus on motivation, BPNS, and engagement. Overall, the findings suggest that SEM may be linked with more favourable motivation-related outcomes than TT. The evidence for BPNS was positive in direction but remains preliminary. The primary satisfaction-based BPNS analysis included only two studies and became non-significant when Paule–Mandel estimation with Hartung–Knapp adjustment was applied. Evidence for engagement was also limited and did not show a consistent post-test advantage for SEM over TT.

The findings are consistent with SDT. SEM may give students more opportunities to experience autonomy, competence, and relatedness through stable teams, student roles, formal competition, and sustained participation. Even so, this review does not show that SEM is always better than TT. SEM appears most useful when PE aims to support motivation, meaningful participation, cooperation, and wider psychosocial development. TT may still be useful for clear demonstration, technical correction, safety, class organisation, and short-term skill practice.

These conclusions should be read with caution. The evidence base was small and methodologically limited. Most studies were non-randomised or quasi-experimental, and almost all non-randomised studies were judged to be at serious risk of bias. The GRADE-informed certainty assessment indicated low certainty for motivation-related outcomes and very low certainty for BPNS and engagement. Therefore, the findings should be interpreted as tentative rather than definitive. Future studies should use stronger comparative designs, report implementation fidelity in more detail, adjust for clustering where needed, and examine when, for whom, and through which mechanisms SEM is most effective.

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