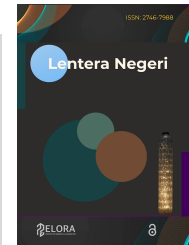




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Flipped classroom in physical education: a systematic review of implementation and student outcomes

Aidil Syaputra¹, Jeki Haryanto², Eval Edmizal²

¹ Universitas Riau

² Universitas Negeri Padang

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ABSTRACT

The flipped classroom has emerged as a prominent pedagogical innovation, yet its application within physical education—a domain defined by embodied, psychomotor learning—remains comparatively underexamined and empirically fragmented. This systematic literature review synthesises evidence on how the flipped classroom has been implemented in physical education and what effects it produces on student outcomes. The review followed the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA 2020) framework, drawing records from the Scopus database through a structured Boolean search of title, abstract, and keyword fields. The initial search returned 161 records; after removing 14 duplicates, screening 147 titles and abstracts, and assessing 60 full texts against predefined eligibility criteria, 23 studies were included. Study quality was appraised with the FICO framework (Focus, Information, Context, Outcome), retaining only studies that satisfied all four dimensions; because the included studies were highly heterogeneous in design and outcome measurement, their findings were combined through thematic synthesis rather than meta-analytic pooling. Thematic synthesis identified five recurrent outcome domains: motor-skill learning, motivation, physical activity and engagement, cognitive knowledge, and student satisfaction. Across designs, flipped approaches generally improved psychomotor performance, autonomous motivation, in-class activity time, and conceptual understanding, although effects on physical fitness were inconsistent. The review advances theoretical understanding of pre-class digital preparation in movement contexts and offers practical guidance for teachers, while underscoring the need for larger, longer, and methodologically rigorous trials across diverse educational settings.



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Corresponding Author:

Jeki Haryanto,

jekiharyanto@fik.unp.ac.id

Introduction

The flipped classroom—also termed flipped or inverted learning—reorganises the conventional sequence of instruction by relocating the initial transmission of content to a pre-class phase, typically through short videos or digital resources, so that face-to-face time can be devoted to active, higher-order application (Lage et al., 2000; Bergmann & Sams, 2012). Since its articulation in higher and secondary education, the model has spread rapidly across disciplines as institutions seek learner-centred alternatives to didactic lecturing (Bishop & Verleger, 2013). Proponents argue that shifting passive reception out of the classroom frees teachers to

facilitate problem-solving, feedback, and collaboration, thereby aligning instruction with constructivist principles of active engagement (O’Flaherty & Phillips, 2015). The proliferation of affordable mobile devices, learning-management systems, and video platforms has further accelerated adoption, embedding the approach within broader debates about digital transformation in education. As a result, the flipped classroom now occupies a central position in contemporary pedagogical research, prompting sustained inquiry into whether its documented benefits in lecture-based subjects extend to fields organised around practical, embodied performance.

Physical education presents a distinctive and demanding test case for the flipped classroom because its core learning objectives are enacted through the body rather than through verbal or symbolic reasoning alone. Lesson time in physical education is uniquely valuable: it is the principal opportunity for supervised movement, skill rehearsal, and physical activity, and it is frequently constrained by short timetabled slots, large classes, and limited facilities (Sargent & Casey, 2020). Advocates contend that delivering rules, tactical concepts, and technical demonstrations before the lesson can protect and even expand the time available for active practice, allowing teachers to concentrate on individualised feedback and guided rehearsal during contact time (Østerlie & Mehus, 2020). Yet the same embodied character that makes the subject distinctive also complicates the transfer of a video-centred model conceived for cognitive content. Questions arise about whether pre-class viewing meaningfully prepares learners for psychomotor tasks, how younger pupils self-regulate digital preparation, and whether enriched in-class activity translates into measurable gains in skill, fitness, or motivation-issues that motivate close scrutiny of the accumulating evidence base.

A substantial body of cross-disciplinary research has examined the flipped classroom’s effectiveness, and the broad pattern of findings is cautiously favourable. Meta-analytic syntheses spanning multiple subjects and education levels report small-to-moderate advantages for flipped instruction over traditional lecturing on academic performance (Strelan et al., 2020; van Alten et al., 2019). In health-professions education, comparable benefits have been documented for knowledge acquisition relative to conventional teaching (Hew & Lo, 2018). Reviews nonetheless temper this optimism by drawing attention to recurring challenges, including uneven student preparation, increased teacher workload, heterogeneous implementation fidelity, and the difficulty of isolating the model’s active ingredients (Akçayır & Akçayır, 2018). These syntheses also note that satisfaction outcomes are frequently more variable than achievement outcomes, and that effect sizes depend heavily on how the in-class phase is designed. Collectively, this literature establishes a plausible but conditional case for the approach while underscoring that aggregate findings derived predominantly from lecture-based disciplines cannot be assumed to generalise to the practical, movement-oriented context of physical education.

Within physical education specifically, interest in the flipped classroom has grown markedly over the past decade, accompanied by experimentation with an expanding repertoire of digital tools. Early curriculum-design work proposed reorganising physical-education content around pre-class digital preparation (Bai, 2018), and subsequent university-based studies reported positive effects on academic performance when flipped designs were introduced into teacher-education and activity courses (Hinojo-Lucena et al., 2018; Hinojo Lucena et al., 2019). Investigations of physical-activity courses found that flipping could enhance knowledge and skills while preserving or increasing in-class movement (Vaughn et al., 2019). More recent implementations have incorporated video-annotation platforms, gamification, augmented and virtual reality, and mobile messaging applications to deliver pre-class material and structure feedback. This methodological diversification reflects both the affordances of emerging technologies and a search for designs suited to the sensorimotor demands of sport content. However, the rapid expansion of tools has produced a fragmented evidence base in which interventions differ substantially in platform, dosage, content, and population, complicating efforts to draw cumulative conclusions about what works, for whom, and under what conditions.

Despite this growth, the physical-education evidence base remains comparatively thin and unevenly consolidated. A recent scoping review of flipped learning in physical education concluded that the field, although expanding, is still characterised by small samples, short interventions, and a concentration of studies in a limited number of countries and educational stages (Østerlie et al., 2023). Qualitative inquiry has further shown that pupils’ encounters with flipped preparation are not uniformly positive: engagement with pre-class material varies, and some learners perceive the additional out-of-class demand as burdensome (Østerlie & Kjelaas, 2019). The cumulative picture is therefore one of promising but inconsistent findings, in which favourable results for motivation or skill in one setting are not always replicated in another. Few syntheses have systematically organised the physical-education-specific literature by the type of student outcome examined, leaving practitioners without a clear map of where evidence is robust and where it is

sparse. This first gap—an incomplete and fragmented consolidation of outcome-specific evidence—motivates a focused systematic review centred on the physical-education domain.

A second gap concerns the theoretical and methodological underpinning of the field. Although many physical-education studies invoke motivational constructs, comparatively few are explicitly anchored in a coherent framework that would explain why pre-class preparation should alter learning. Self-determination theory, which distinguishes autonomous from controlled motivation and emphasises the satisfaction of needs for autonomy, competence, and relatedness, offers a particularly relevant lens for interpreting flipped designs that grant learners greater control over the pace and place of study (Ryan & Deci, 2000). When such frameworks are applied, flipped and allied active methodologies have been associated with gains in personal and motivational factors (Segura-Robles et al., 2020), yet comparisons with traditional instruction sometimes yield equivocal or context-dependent results (Espada et al., 2020). Methodologically, the literature is dominated by short quasi-experiments with modest samples, infrequent randomisation, and limited follow-up, which constrains causal inference and the assessment of durability. These theoretical and design limitations make it difficult to determine whether observed benefits reflect the flipped model itself or the enriched active practice it enables.

The case for a timely synthesis has strengthened as the volume of physical-education flipped-classroom research has accelerated and as findings have begun to diverge. A recent meta-analysis focused on physical education reported favourable pooled effects on intrinsic motivation, self-efficacy, and learning satisfaction, signalling that the subfield has reached sufficient maturity for quantitative aggregation while also exposing residual heterogeneity (Wu et al., 2025). Parallel work demonstrates that selected practical competencies can be partially self-trained through pre-class preparation (Van Raemdonck et al., 2017), and that inverted designs can enhance motivation and motor performance in specific skill domains (Khudair et al., 2020). At the same time, the diffusion of the approach into varied national systems, age groups, and sporting activities has produced a more heterogeneous corpus whose implications for practice are not yet fully articulated. Consolidating this rapidly growing and increasingly varied literature is therefore both timely and necessary, so that educators and researchers can distinguish reliably supported outcomes from those that remain uncertain and identify the conditions under which flipped physical education is most likely to succeed.

Against this background, the present systematic review synthesises peer-reviewed evidence on the flipped classroom in physical education with two complementary aims: to characterise how the approach has been implemented and to evaluate its effects on student outcomes. The first research question addresses implementation, mapping the instructional designs, technologies, content areas, populations, and methodological approaches through which flipped physical education has been enacted. By organising this information systematically, the review contributes a structured account of the field's practical and methodological landscape that can orient both teachers' seeking design guidance and researchers seeking to position new studies. RQ1: How has the flipped classroom approach been implemented in physical education settings? The second research question turns to outcomes, synthesising findings across the principal domains in which the model has been evaluated—motor-skill learning, motivation, physical activity and engagement, cognitive knowledge, and satisfaction—and weighing areas of convergence against points of contradiction. The novelty of this review lies in its outcome-centred consolidation of the physical-education-specific literature within a transparent PRISMA 2020 process, integrating recent studies that postdate earlier reviews and explicitly distinguishing robust from tentative conclusions. In doing so, it advances theoretical understanding of how pre-class digital preparation operates in embodied learning and provides an evidence-informed foundation for practice and future inquiry. RQ2: What are the effects of the flipped classroom approach on students' learning outcomes in physical education?.

Method

Research Design and Framework

This study adopted a systematic literature review design to synthesise empirical evidence on the flipped classroom in physical education. The systematic review was selected because it provides a transparent, rigorous, and reproducible method for locating, appraising, and integrating the findings of multiple primary studies, thereby reducing the selection bias inherent in narrative overviews and supporting evidence-informed conclusions (Tranfield et al., 2003). The review process was structured in accordance with established guidance for the conduct and reporting of systematic reviews (Liberati et al., 2009) and was reported following the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA 2020) statement, which specifies the items required for transparent documentation of identification, screening,

eligibility, and inclusion (Page et al., 2021). Adoption of PRISMA 2020 ensured that each decision point in the selection process was explicit and auditable. The review was guided by the two predefined research questions stated above, and all subsequent methodological choices-search strategy, eligibility criteria, data extraction, and synthesis-were aligned with them.

Search Strategy

A structured search strategy was developed to capture the intersection of the flipped-classroom concept and the physical-education domain. Search terms were identified from key reviews and refined iteratively, combining synonyms for the instructional model with terms for the subject area. The Boolean search string applied to the title, abstract, and keyword fields was: (("flipped classroom" OR "flipped learning" OR "inverted classroom" OR "inverted learning" OR "flipped instruction" OR "flipped teaching" OR "classroom flip" OR "classroom flipping" OR "flipped pedagogy" OR "reverse classroom" OR "blended flipped learning") AND ("physical education" OR "sport education" OR "sports education" OR "sport pedagogy" OR "sports pedagogy" OR "physical activity" OR "exercise education" OR "movement education" OR "physical literacy" OR PE OR PETE OR Kinesiology)). Boolean operators and phrase searching were used to balance sensitivity and precision: the OR operator captured terminological variants of both the pedagogy and the discipline, while the AND operator restricted retrieval to records addressing their intersection. The TITLE-ABS-KEY field code limited matches to the most semantically informative metadata fields. Language, document-type, and publication-period limiters were applied at the eligibility stage rather than within the query itself, so that the full retrieved set could be documented before restriction.

Database and Information Sources

Scopus served as the primary and authoritative information source for this review. Scopus was selected because of its broad multidisciplinary coverage of peer-reviewed literature in education, sport science, and health, its rigorous indexing standards, and the structured bibliographic metadata it exports, which together make it well suited to systematic identification and PRISMA-compliant counting. The search was executed in a single session to ensure a stable record set, and the complete set of returned records was exported with full bibliographic fields-authors, title, year, source, abstract, keywords, and digital object identifier-for screening. The initial search returned 161 records. No supplementary databases or hand-searching were undertaken; restricting identification to a single high-quality index promoted consistency and reproducibility while clearly delimiting the evidentiary scope, a boundary that is acknowledged among the limitations of the review.

Eligibility Criteria

Eligibility was defined a priori using a PICOS frame (Population, Intervention, Comparison, Outcomes, Study design) to align the review boundaries with the research questions. Table 1 summarises the PICOS specification, and Table 2 presents the corresponding inclusion and exclusion criteria applied during screening.

Table 1. PICOS framework guiding eligibility

Element	Specification
Population	Students enrolled in physical education or sport-activity courses across primary, secondary, and higher education
Intervention	Flipped classroom / flipped learning (pre-class digital content combined with active in-class application)
Comparison	Traditional face-to-face instruction, an alternative pedagogy, or a pre-test baseline
Outcomes	Student outcomes: motor-skill learning, motivation, physical activity and engagement, cognitive knowledge, or satisfaction
Study design	Empirical studies (experimental, quasi-experimental, mixed-methods, survey, or qualitative designs)

Table 2. Inclusion and exclusion criteria

Criterion	Inclusion	Exclusion
Language	Published in English	Non-English publications
Document type	Peer-reviewed journal article	Conference paper, book chapter, editorial, or note
Publication period	2021–2025	Published before 2021
Subject area	Physical education or sport pedagogy with student participants	Outside physical education; teacher-only populations; non-activity (e.g., sports-management) contexts
Intervention	Flipped classroom or flipped learning design	Other models (purely online, blended, distance, or feedback-only) without a flipped structure
Outcome	Reports student learning, affective, or behavioural outcomes	No student-outcome evaluation; purely technical, algorithmic, or conceptual papers
Accessibility	Full text retrievable	Full text not retrievable

Study Selection Process

Study selection proceeded through the sequential stages prescribed by PRISMA 2020. The 161 records retrieved from Scopus were first de-duplicated, removing 14 duplicate records and leaving 147 unique records for screening. Titles and abstracts were then screened against the eligibility criteria, and 87 records were excluded as clearly irrelevant—for example, those addressing unrelated disciplines, non-flipped interventions, or populations outside the student body. The remaining 60 reports were sought and retrieved in full, with no reports unobtainable, and were assessed for eligibility against the full criteria. At these stage 37 reports were excluded for documented reasons: review, meta-analysis, or conceptual papers; interventions that were not genuinely flipped (distance, hybrid, blended, digital-feedback, or purely online designs); technical or algorithmic studies lacking a student-outcome evaluation; studies outside the physical-education domain; studies of teacher or pre-service-teacher populations; and a non-activity sports-management context. Twenty-three studies satisfied all criteria and were retained for synthesis. Screening decisions were guided by the predefined criteria, and uncertain cases were resolved through re-examination of the full text against the PICOS frame. Title-abstract and full-text screening were conducted independently by two reviewers; inter-rater agreement was substantial (Cohen's $\kappa = 0.79$ at title-abstract and 0.77 at full text), and disagreements were resolved by discussion until consensus.

Quality Assessment - FICO Framework

Methodological adequacy was appraised using the FICO framework, which evaluates each study against four dimensions: Focus (clarity and relevance of the research aim to flipped physical education), Information (adequacy of methodological reporting, including sample, design, and measures), Context (appropriateness of the educational setting and population), and Outcome (the presence of clearly reported and interpretable student outcomes). Each dimension was rated as adequately, partially, or insufficiently addressed, and only studies judged to satisfy all four dimensions at least partially—with no dimension rated insufficient—were retained. Applying this threshold ensured that included studies offered sufficient transparency and relevance to support meaningful synthesis, while excluding reports whose aims, reporting, setting, or outcomes were too weakly specified to contribute reliable evidence. The appraisal was interpretive rather than score-aggregating, consistent with the heterogeneous designs represented in the corpus.

Data Extraction Procedure

A standardised extraction template was used to record, from each included study, the following fields: author(s) and year; country or setting; study design; sample size and educational level; the sport or activity content; the flipped intervention and the technology used to deliver pre-class material; the comparison condition; the outcome measures; and the principal findings. Extracted information was drawn directly from the bibliographic metadata and abstracts of the source records to preserve fidelity to the primary studies. The structured fields supported both the descriptive characterisation of the corpus (Tables 3 and 4) and the

subsequent thematic synthesis, and they provided the basis for the descriptive bibliographic mapping reported below.

Network and Bibliometric Analysis Methodology

To complement the narrative synthesis, a descriptive bibliographic analysis of the included corpus was performed. The distribution of studies was mapped across three dimensions-year of publication, geographic setting, and primary outcome theme-to characterise the temporal trajectory, international spread, and thematic emphasis of research on flipped physical education. These distributions are visualised in Figures 2 through 4. A formal co-occurrence or co-authorship network analysis using dedicated bibliometric software was beyond the scope of the present review, which prioritised qualitative thematic synthesis of student outcomes; the descriptive mapping nonetheless situates the synthesised findings within the broader structure of the field and signals where research activity is concentrated and where it remains sparse.

Data Analysis and Synthesis

Because the included studies employed heterogeneous designs and outcome measures, a thematic synthesis approach was adopted rather than statistical meta-analysis (Thomas & Harden, 2008). Following established guidance for systematic synthesis (Booth et al., 2016; Gough et al., 2017), findings were first extracted and coded line by line from each study’s reported outcomes; codes were then organised into descriptive themes and refined into the analytical categories used to answer the research questions. The coding process drew on the principles of reflexive thematic analysis, in which themes are actively constructed through iterative engagement with the data rather than passively emerging (Braun & Clarke, 2006). Five outcome themes were derived-motor-skill learning, motivation, physical activity and engagement, cognitive knowledge, and satisfaction-alongside an implementation dimension capturing design and technology. Convergent and divergent findings were examined within each theme to identify patterns of agreement, contradiction, and nuance across studies.

Reporting and Documentation

The review was documented in compliance with the PRISMA 2020 reporting guideline, and the flow of records through identification, screening, eligibility, and inclusion is reported in full in the flow diagram (Figure 1) using counts consistent with the narrative account (Page et al., 2021; Moher et al., 2009). Each numerical transition-from the 161 records identified, through the removal of 14 duplicates and the exclusion of 87 records at title-and-abstract screening and 37 at full-text assessment, to the 23 studies included-is reported identically across the Abstract, Methods, Results, and diagram to ensure internal consistency and auditability.

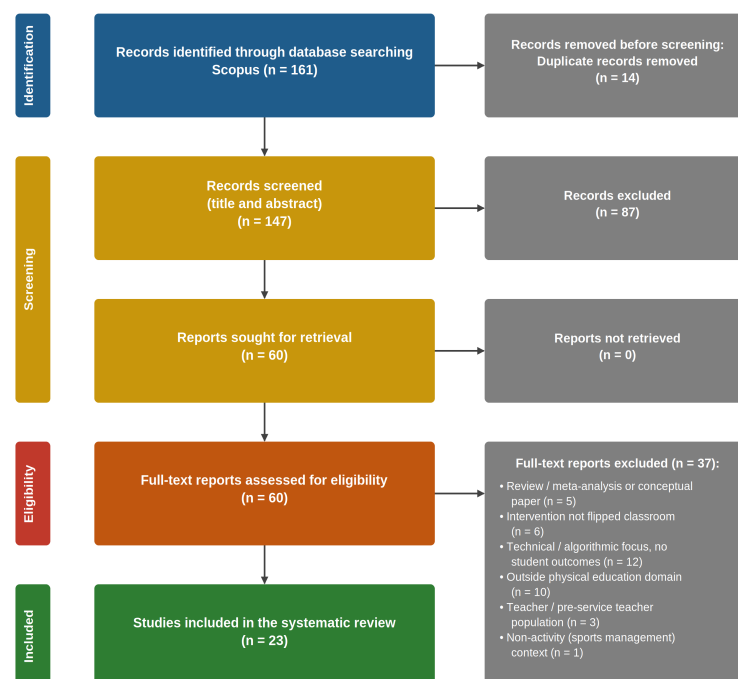


Figure 1. PRISMA 2020 flow diagram of the study selection process
Note. Flow diagram adapted from the PRISMA 2020 statement (Page et al., 2021).

Results and Discussions

Study Selection Results

The systematic search of Scopus identified 161 records. After 14 duplicate records were removed, 147 unique records proceeded to title-and-abstract screening, at which 87 records were excluded as irrelevant to the review questions. The full texts of the remaining 60 reports were retrieved and assessed for eligibility, with none unobtainable. Of these, 37 were excluded with reasons: review, meta-analysis, or conceptual papers ($n = 5$); interventions that were not genuinely flipped, such as distance, hybrid, blended, or feedback-only designs ($n = 6$); technical or algorithmic studies without a student-outcome evaluation ($n = 12$); studies outside the physical-education domain ($n = 10$); studies of teacher or pre-service-teacher populations ($n = 3$); and a non-activity sports-management context ($n = 1$). The remaining 23 studies met all eligibility criteria and were included in the synthesis. Figure 1 presents the complete PRISMA 2020 flow of records through the review.

Descriptive Characteristics

The 23 included studies were published between 2021 and 2025, confirming that empirical research on flipped physical education is both recent and accelerating: three studies appeared in 2021, seven in 2022, four in 2023, four in 2024, and five in 2025 (Figure 2). The corpus is geographically concentrated yet international in reach, with Spain contributing the largest share ($n = 7$) and Indonesia the second largest ($n = 5$), followed by China and the Philippines ($n = 2$ each) and single studies from Hong Kong (China), Iraq, Türkiye, Tunisia, Palestine, the United States, and Montenegro (Figure 3). Quasi-experimental and experimental designs dominated the corpus, complemented by cross-sectional surveys, a mixed-methods study, a design-based (research-and-development) study, a qualitative study, and a single-group pre-post design. Table 3 summarises the characteristics and key findings of each included study, and Table 4 classifies the studies by research design, outcome theme, intervention or technology, and reported outcome. The five outcome themes were unevenly represented: motor-skill learning was most common ($n = 8$), followed by motivation ($n = 5$), physical activity and engagement ($n = 4$), cognitive knowledge ($n = 3$), and satisfaction or student experience ($n = 3$), as visualised in Figure 4.

Table 3. Summary of included studies

Title	Author(s) & Year	Country	Method	Key Findings
The effects of the flipped classroom method and mobile phones use in physical education	Jabučanin et al. (2025)	Montenegro	Quasi-experimental (two-group pre/post; $n = 40$, elementary, handball)	The flipped group made significantly greater progress in four of six handball elements and reported more positive attitudes toward PE; gains were largest for moderate-difficulty motor tasks and absent for the most difficult skills.
Flipped learning as a solution to increase motivation and academic achievement: 5 weeks of mixed research	Ridwan et al. (2023)	Indonesia	Mixed-methods experiment ($n = 40$, university)	Flipped learning significantly increased both motivation and academic achievement ($p < .05$), with no equivalent gains in the control group; interviews revealed predominantly positive but some negative student perceptions.
Research on the effect of flipping classroom	Wang et al. (2023)	China	Quasi-experimental	The flipped mode helped rural primary students

Title	Author(s) & Year	Country	Method	Key Findings
teaching model in PE and health teaching in rural primary schools			(teaching experiment, questionnaire, observation; rural primary)	master movement technique and improved interest, emotional engagement, and cooperation, with no significant difference in physical-fitness test results.
Do problem-based learning and flipped classroom models integrated with Android applications based on biomechanical analysis enhance the learning outcomes of pencak silat?	Lubis et al. (2022)	Indonesia	Experimental (n = 76, university; Rasch + independent t-test)	Problem-based learning and flipped classroom with a biomechanics-based Android application significantly improved pencak silat learning outcomes ($p \leq .05$), with the PBL-integrated condition most effective.
Impact of flipped classroom strategy and learning on the acquisition of basic skills among students in the Basketball 1 course at Birzeit University	Yousef et al. (2025)	Palestine	Experimental (three groups, n = 66, university)	The flipped classroom produced the largest statistically significant gains across all basketball skills (chest pass, jump shot, lay-up, dribbling), ahead of learning-through-play and traditional instruction.
Manifestations of 21st century skills development under the SPRING online flipped learning model in a college physical education course	Dimarucot et al. (2024)	Philippines	Qualitative (questionnaire + observation; college, dance)	The SPRING online flipped model enhanced collaboration, creativity, critical thinking, and autonomous self-paced mastery, supporting the development of 21st-century skills for lifelong learning.
The influence of “small private online course + flipped classroom” teaching on physical education students’ learning motivation from the perspective of self-determination theory	Hu et al. (2022)	China	Quasi-experimental (n = 64, university; RM-ANOVA, PLS regression)	SPOC + flipped classroom teaching shifted students toward more self-determined (identified and intrinsic) motivation and raised perceived autonomy, competence, and relatedness support relative to controls.
Comparative analysis of flipped learning versus traditional teaching methods in basketball technical instruction: Effect on students’	Hatami and Savaş (2024)	Türkiye	Quasi-experimental (pre/post control; n = 30, university)	Both flipped and traditional methods significantly improved psychomotor basketball skills, with the flipped group showing

Title	Author(s) & Year	Country	Method	Key Findings
psychomotor achievement levels				significantly greater gains on selected complex skills such as spin moves, cuts, and changes of direction.
Flipped learning to improve students' motivation in physical education	Botella et al. (2021)	Spain	Quasi-experimental (n = 100, primary; pre/post + interviews)	Flipped learning significantly increased intrinsic, identified, and introjected motivation and reduced amotivation, whereas the traditional group declined; students perceived flipped lessons as more fun and efficient with more active class time.
Integrating virtual reality and project based flipped learning in sport massage education: A Tri Pramana based innovation	Doddy Tisna et al. (2025)	Indonesia	R&D (ADDIE) with quasi-experimental evaluation (n = 80, university)	The VR and project-based flipped model significantly improved motor skills and theoretical understanding (p < .05) and raised satisfaction and engagement relative to conventional methods.
Satisfaction level with the implementation of collaborative flipped classroom model in tennis	Hasbullah (2025)	Indonesia	Cross-sectional survey (n = 84, university; validated questionnaire)	Students reported high satisfaction, engagement, and peer collaboration with the collaborative flipped tennis course, supporting its usefulness for acquiring sport-specific knowledge in higher education.
The association of children's motivation and physical activity levels with flipped learning during physical education lessons	Yip and Cheng (2023)	Hong Kong (China)	Quasi-experimental (n = 111, primary; accelerometry + questionnaire)	The flipped group showed significantly higher moderate-to-vigorous physical activity and lower sedentary time; autonomous motivation positively predicted MVPA and negatively predicted sedentary behaviour.
Flipped classroom approach for gymnastics learning in physical education: A quasi-experimental study	Ghorbel et al. (2025)	Tunisia	Quasi-experimental (n = 42, secondary; pre/post control)	The flipped group significantly outperformed controls in motor learning, knowledge acquisition, autonomous motivation, and physical engagement (skill repetitions), while

Title	Author(s) & Year	Country	Method	Key Findings
Flipping the script: An initial exploration of flipped learning as an enhanced alternative to traditional physical education lessons	Killian et al. (2022)	United States	Quasi-experimental / observational (SOFIT; n = 56, middle school; regression)	controlled motivation decreased. Students in flipped lessons spent roughly 55% more class time in moderate-to-vigorous physical activity (about 18 additional minutes) than in traditional lessons, suggesting value for activity promotion in low-SES schools.
The effects of flipped learning on learning and motivation of upper secondary school physical education students	Ferriz-Valero et al. (2022b)	Spain	Quasi-experimental (n = 265, upper secondary; quantitative)	Upper-secondary students gained significantly more conceptual volleyball knowledge and autonomous motivation under flipped learning, with boys developing autonomous motivation more than girls.
Level of satisfaction with the application of the collaborative model of the flipped classroom in the sport of sailing	Caraballo Vidal et al. (2024)	Spain	Cross-sectional survey (n = 80, university; validated questionnaire)	High satisfaction, perceived usefulness, and peer engagement were reported for the collaborative flipped model applied to sailing content in higher education.
Augmented reality and the flipped classroom-A comparative analysis of university student motivation in semi-presence-based education due to COVID-19: A pilot study	Campos-Mesa et al. (2022)	Spain	Cross-sectional comparative survey (pilot; n = 129, university; IMMS)	University students were highly motivated by both augmented-reality and flipped-classroom video materials, with augmented reality scoring higher, underscoring the motivational value of enriched video within flipped designs.
Gamification and flipped learning and their influence on aspects related to the teaching-learning process	Parra-González et al. (2021)	Spain	Quasi-experimental (n = 356; three educational stages; questionnaire)	Gamification was valued more by younger learners whereas flipped learning was valued more by older (pre-university) students, with both methodologies showing strong potential in physical education.
Flipped classroom: A good way for lower secondary physical	Ferriz-Valero et al. (2022a)	Spain	Quasi-experimental (n = 284, lower	Lower-secondary students following the flipped (Edpuzzle) approach showed

Title	Author(s) & Year	Country	Method	Key Findings
education students to learn volleyball			secondary; quantitative)	significantly better conceptual volleyball learning and autonomous motivation than peers taught traditionally.
Flipped learning in physical education: Learning, motivation and motor practice time	Campos-Gutiérrez et al. (2021)	Spain	Quasi-experimental (7 groups, lower secondary; pre/post)	Learning and motivation were equivalent across flipped and traditional groups, but flipped groups achieved significantly greater motor-practice time during physical-education classes. The flipped strategy significantly improved both technical and overall performance of the 100-metre hurdles in female university students compared with traditional real-time explanation.
Effect of using the flipped classroom learning strategy on the technical performance of 100 metres hurdles in female university students	Hameed and Mashkoor (2023)	Iraq	Experimental (two-group pre/post; n = 24, university)	Flipped-classroom students showed significantly higher agentic, behavioural, emotional, and cognitive engagement in basketball than conventionally taught peers.
Assessing the influence of the flipped classroom on physical education students' engagement in basketball learning activities	Wibowo et al. (2024)	Indonesia	Quasi-experimental (static-group comparison; n = 62, university)	A one-group flipped (SPRING) dance implementation yielded generally positive gains in conceptual understanding and procedural fluency but exposed technological, self-regulation, and gender-gap challenges.
A flipped learning model in a college physical education dance course: A non-experimental design	Dimarucot (2022)	Philippines	Non-experimental / one-group pre-post (college, dance)	

Note. Studies are numbered sequentially in order of appearance. Author-year labels distinguishing 2022a/2022b denote two studies by the same first author in the same year.

Table 4. Classification of included studies by theme and method

Author(s) (Year)	Country	Research Design	Theme / Focus	Intervention / Technology	Outcome
Jabučanin et al. (2025)	Montenegro	Quasi-experimental	Motor-skill learning	FC via teacher-sent videos on mobile phones (handball)	Motor skill ↑; attitudes ↑

Author(s) (Year)	Country	Research Design	Theme / Focus	Intervention / Technology	Outcome
Ridwan et al. (2023)	Indonesia	Mixed-methods experimental	Motivation	Flipped Learning programme (university PE)	Motivation ↑; achievement ↑
Wang et al. (2023)	China	Quasi-experimental	Motor-skill learning	FC teaching mode (PE and Health, rural primary)	Skill mastery ↑; attitude ↑; fitness ≈
Lubis et al. (2022)	Indonesia	Experimental	Motor-skill learning	PBL + FC + biomechanics-based Android app (pencak silat)	Skill learning ↑
Yousef et al. (2025)	Palestine	Experimental	Motor-skill learning	FC strategy vs learning-through-play vs traditional (basketball)	Basic skills ↑ (FC best)
Dimarucot et al. (2024)	Philippines	Qualitative	Satisfaction / student experience	SPRING online flipped-learning model (dance)	21st-century skills ↑
Hu et al. (2022)	China	Quasi-experimental	Motivation	SPOC + flipped classroom (basketball; SDT)	Self-determined motivation ↑
Hatami and Savaş (2024)	Türkiye	Quasi-experimental	Motor-skill learning	FL with videos and cards via WhatsApp (basketball)	Psychomotor skill ↑
Botella et al. (2021)	Spain	Quasi-experimental	Motivation	FL with Edpuzzle videos (parkour)	Intrinsic motivation ↑; amotivation ↓
Doddy Tisna et al. (2025)	Indonesia	Design-based (R&D) + quasi-experimental	Motor-skill learning	VR + Project-Based Flipped Learning + Tri Pramana (sport massage)	Motor skill ↑; understanding ↑; satisfaction ↑
Hasbullah (2025)	Indonesia	Cross-sectional survey	Satisfaction / student experience	Collaborative flipped classroom (tennis)	Satisfaction ↑; engagement ↑
Yip and Cheng (2023)	Hong Kong (China)	Quasi-experimental	Physical activity & engagement	Flipped-learning unit (school PE)	MVPA ↑; sedentary time ↓
Ghorbel et al. (2025)	Tunisia	Quasi-experimental	Motor-skill learning	FC blended model via social media (gymnastics)	Motor + cognitive + motivation ↑; engagement ↑

Author(s) (Year)	Country	Research Design	Theme / Focus	Intervention / Technology	Outcome
Killian et al. (2022)	United States	Quasi-experimental (observational)	Physical activity & engagement	Flipped Learning Approach vs traditional (middle-school PE)	MVPA ↑ (~18 min)
Ferriz-Valero et al. (2022b)	Spain	Quasi-experimental	Cognitive / knowledge acquisition	FL via Edpuzzle (volleyball, upper secondary)	Cognitive learning ↑; autonomous motivation ↑
Caraballo Vidal et al. (2024)	Spain	Cross-sectional survey	Satisfaction / student experience	Collaborative flipped classroom (sailing)	Satisfaction ↑; usefulness ↑
Campos-Mesa et al. (2022)	Spain	Cross-sectional comparative survey	Motivation	AR videos vs traditional videos within FC (university PE)	Motivation ↑ (AR > FC video)
Parra-González et al. (2021)	Spain	Quasi-experimental	Motivation	Gamification vs flipped learning contrast (PE)	Method value varies by stage
Ferriz-Valero et al. (2022a)	Spain	Quasi-experimental	Cognitive / knowledge acquisition	FC via Edpuzzle (volleyball, lower secondary)	Cognitive learning ↑; autonomous motivation ↑
Campos-Gutiérrez et al. (2021)	Spain	Quasi-experimental	Physical activity & engagement	FL via Edpuzzle (Valencian ball)	Motor-practice time ↑; learning ≈
Hameed and Mashkooor (2023)	Iraq	Experimental	Motor-skill learning	FC learning strategy (100 m hurdles)	Technical performance ↑
Wibowo et al. (2024)	Indonesia	Quasi-experimental	Physical activity & engagement	FC approach (basketball, engagement)	Engagement ↑ (all dimensions)
Dimarucot (2022)	Philippines	Non-experimental (one-group pre-post)	Cognitive / knowledge acquisition	FL SPRING framework (college dance, remote)	Understanding ↑; challenges noted

Note. Country reflects the reported study setting or the corresponding author's affiliation where the setting was not explicitly stated.

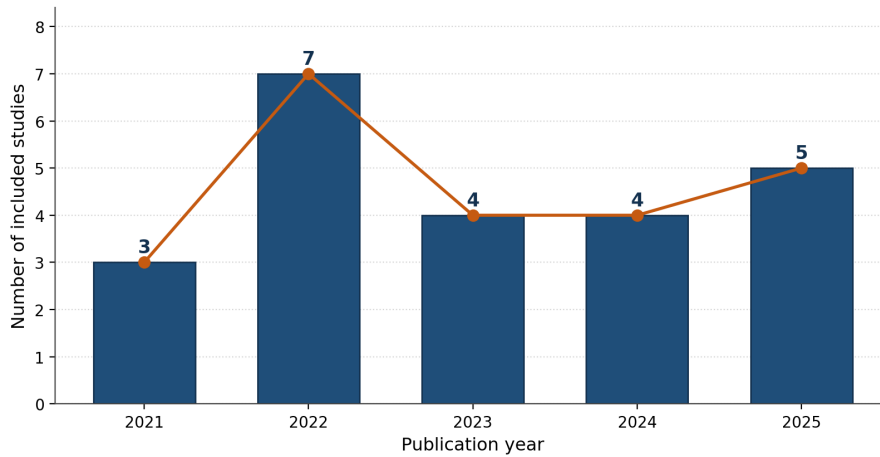


Figure 2. Distribution of included studies by year of publication (2021–2025)

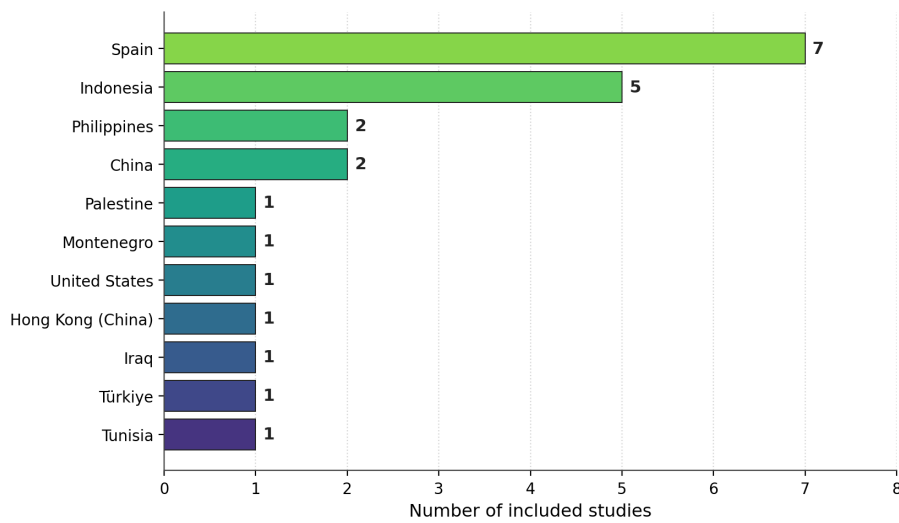


Figure 3. Geographic distribution of included studies by reported setting

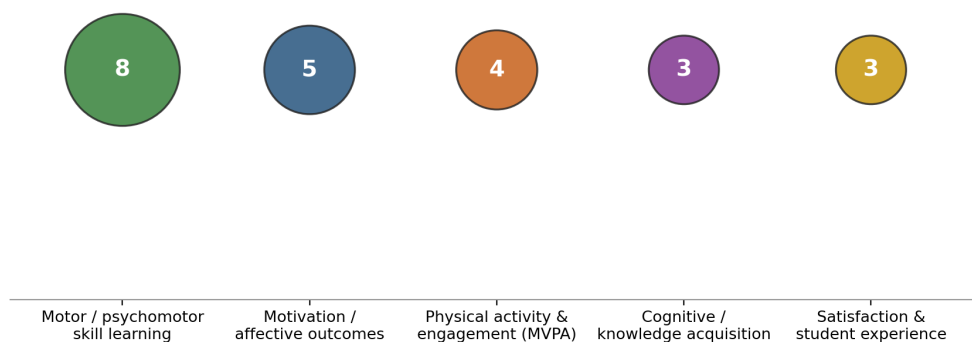


Figure 4. Thematic Distribution of Primary Student Outcomes Across Include Studies (N=23)

Thematic Synthesis

Findings for RQ1: Implementation of the Flipped Classroom in Physical Education

Across the corpus, implementation followed a recognisable common structure-pre-class delivery of technical or conceptual content followed by active in-class application-while diverging considerably in the technologies and content used to enact it. Video was the near-universal pre-class medium, but the platforms varied widely. Several Spanish studies used the Edpuzzle video-annotation platform to deliver and check pre-class viewing

for content such as parkour, volleyball, and Valencian ball (Botella et al., 2021; Ferriz-Valero et al., 2022a; Ferriz-Valero et al., 2022b; Campos-Gutiérrez et al., 2021), whereas other implementations relied on mobile messaging and social-media channels: handball videos sent to pupils' mobile phones (Jabučanin et al., 2025), basketball videos and task cards distributed via WhatsApp (Hatami & Savaş, 2024), and a blended gymnastics model delivered through social media (Ghorbel et al., 2025). More elaborate designs combined the flipped structure with additional tools and frameworks, including a problem-based learning sequence supported by a biomechanics-based Android application for pencak silat (Lubis et al., 2022), a small-private-online-course (SPOC) configuration for basketball (Hu et al., 2022), augmented-reality video materials (Campos-Mesa et al., 2022), and an immersive virtual-reality, project-based design grounded in the Tri Pramana philosophy for sport-massage education (Doddy Tisna et al., 2025).

Implementation also spanned the full range of educational stages and a broad spectrum of sport content. At the school level, studies addressed primary pupils learning fundamental movement and handball (Wang et al., 2023; Jabučanin et al., 2025), middle-school physical activity (Killian et al., 2022), and secondary-school gymnastics, volleyball, and parkour (Ghorbel et al., 2025; Ferriz-Valero et al., 2022a; Ferriz-Valero et al., 2022b; Botella et al., 2021). At the university level, implementations covered basketball, tennis, sailing, athletics, dance, and applied courses such as sport massage (Yousef et al., 2025; Hasbullah, 2025; Caraballo Vidal et al., 2024; Hameed & Mashkoo, 2023; Dimarucot, 2022; Dimarucot et al., 2024; Doddy Tisna et al., 2025). This breadth indicates that the flipped model has been considered adaptable across both closed, technique-oriented skills and more open or expressive activities, although the concentration of school-level work in a few countries tempers claims of generalisability.

Methodologically, implementation was evaluated predominantly through quasi-experimental and experimental comparisons with traditional instruction, frequently using pre–post designs with control groups (for example, Hatami & Savaş, 2024; Ghorbel et al., 2025; Yip & Cheng, 2023; Wibowo et al., 2024). A smaller set of studies adopted cross-sectional satisfaction surveys (Hasbullah, 2025; Caraballo Vidal et al., 2024; Campos-Mesa et al., 2022), a mixed-methods design integrating quantitative outcomes with student interviews (Ridwan et al., 2023), a qualitative analysis of skills development (Dimarucot et al., 2024), a design-based development-and-evaluation study (Doddy Tisna et al., 2025), and a single-group pre–post implementation (Dimarucot, 2022). Sample sizes ranged from small classes of roughly two dozen learners to multi-group studies exceeding 250 participants (Ferriz-Valero et al., 2022a; Ferriz-Valero et al., 2022b; Parra-González et al., 2021). In sum, the answer to RQ1 is that flipped physical education has been implemented through video-led pre-class preparation delivered by an expanding array of platforms, applied across all educational stages and many sports, and evaluated chiefly through short comparative experiments—an active but methodologically uneven field.

Findings for RQ2: Effects on Student Learning Outcomes

Motor-skill learning was the most frequently examined outcome and yielded the most consistently favourable results. Flipped instruction produced significantly greater psychomotor gains than traditional teaching in basketball (Yousef et al., 2025; Hatami & Savaş, 2024), handball (Jabučanin et al., 2025), the 100-metre hurdles (Hameed & Mashkoo, 2023), pencak silat (Lubis et al., 2022), and gymnastics (Ghorbel et al., 2025), and improved technique mastery among rural primary pupils (Wang et al., 2023). The virtual-reality, project-based design likewise raised motor performance alongside theoretical understanding (Doddy Tisna et al., 2025). A recurring nuance is that advantages were clearest for skills of moderate complexity and sometimes attenuated for the most difficult tasks (Jabučanin et al., 2025) or concentrated in particular complex movements (Hatami & Savaş, 2024), suggesting that pre-class preparation supports, but does not replace, supervised practice of demanding skills.

Motivational outcomes were similarly positive but more conditional. Flipped designs increased intrinsic and autonomous motivation and reduced amotivation in primary parkour (Botella et al., 2021), shifted students toward more self-determined motivation in a SPOC-supported basketball course (Hu et al., 2022), and raised both motivation and academic achievement in a university mixed-methods study (Ridwan et al., 2023). Enriched video formats further amplified motivation, with augmented-reality materials scoring above conventional flipped videos (Campos-Mesa et al., 2022). However, the motivational advantage was not universal: one large multi-stage comparison found that flipped learning was valued more by older, pre-university learners whereas gamification appealed more to younger pupils (Parra-González et al., 2021), and another study reported equivalent motivation across flipped and traditional groups despite other benefits (Campos-Gutiérrez et al., 2021). These patterns are consistent with self-determination theory, indicating that flipped designs most reliably enhance motivation when they genuinely expand learner autonomy and competence support.

Evidence on physical activity and engagement was encouraging and practically significant. Flipped lessons increased moderate-to-vigorous physical activity and reduced sedentary time among primary pupils, with autonomous motivation predicting greater activity (Yip & Cheng, 2023), and middle-school pupils accumulated substantially more active minutes—approximately 18 additional minutes per lesson—under a flipped approach (Killian et al., 2022). Flipped groups also achieved greater motor-practice time within class even where learning gains were comparable to traditional instruction (Campos-Gutiérrez et al., 2021), and university students reported higher agentic, behavioural, emotional, and cognitive engagement in basketball (Wibowo et al., 2024). Cognitive-knowledge outcomes were positive across secondary volleyball cohorts, where flipped learners gained more conceptual understanding and autonomous motivation than peers (Ferriz-Valero et al., 2022a; Ferriz-Valero et al., 2022b), and a single-group dance implementation reported improved understanding while exposing self-regulation and technological challenges (Dimarucot, 2022). Satisfaction outcomes were uniformly high in collaborative flipped designs for tennis and sailing (Hasbullah, 2025; Caraballo Vidal et al., 2024) and in a model fostering twenty-first-century skills in dance (Dimarucot et al., 2024). The principal exception to the favourable pattern was physical fitness, which showed no significant flipped advantage in the one study to test it directly (Wang et al., 2023). The answer to RQ2 is therefore that flipped physical education tends to improve motor skill, motivation, in-class activity and engagement, conceptual knowledge, and satisfaction, while its impact on physical fitness remains unproven.

Comparative and Critical Analysis

Comparison across the corpus reveals a clear methodological centre of gravity and several underused designs. Quasi-experimental and experimental pre–post comparisons predominate, which is appropriate for detecting short-term effects on skill and motivation but leaves the field reliant on designs that seldom employ randomisation, blinding, or extended follow-up. Cross-sectional satisfaction surveys, although valuable for capturing student experience, cannot isolate causal effects and may be susceptible to novelty and self-selection. The relative scarcity of mixed-methods and qualitative work—represented here by only a handful of studies (Ridwan et al., 2023; Dimarucot et al., 2024; Dimarucot, 2022)—limits understanding of the mechanisms and lived experiences underlying the quantitative effects. Sample sizes vary by an order of magnitude, and the most rigorous large-sample studies cluster in a few national and educational contexts, which constrains external validity.

A further critical observation concerns the confounding of the flipped structure with the enriched active practice it enables. Because flipped conditions frequently devote more class time to movement than traditional lessons, observed gains in skill or activity may reflect increased practice opportunity as much as the inversion of content delivery per se (Campos-Gutiérrez et al., 2021; Killian et al., 2022). The accumulating use of additional technologies—augmented and virtual reality, gamification, biomechanics applications—similarly entangles the flipped design with the motivational pull of novel media (Campos-Mesa et al., 2022; Doddy Tisna et al., 2025; Lubis et al., 2022). Methodological evolution over the review period is nonetheless visible: more recent studies increasingly incorporate validated motivational instruments, objective activity monitoring, and theoretically grounded analyses, signalling a maturing field that is beginning to move beyond simple outcome comparison toward mechanism-oriented inquiry.

Discussion

Interpreted as a whole, the evidence indicates that the flipped classroom is a viable and generally beneficial approach in physical education, particularly for psychomotor learning, motivation, and the intensity of in-class engagement. The most plausible interpretation is that relocating technical and conceptual instruction to a pre-class phase frees contact time for guided, individualised practice, and that this redistribution, rather than any property of video itself, is the most likely driver of the observed gains; this remains an inferential reading, however, because the available studies did not include the moderator or meta-regression analyses needed to test the mechanism directly. This reading is consistent with the embodied nature of the subject: pre-class viewing appears to prime learners cognitively, but improvement still depends on the supervised, active rehearsal that the freed class time makes possible.

Theoretically, the findings reinforce the relevance of self-determination theory to flipped physical education. Designs that expand learner autonomy over the pace and place of preparation, and that support competence through structured feedback, are those most consistently associated with autonomous motivation and engagement (Hu et al., 2022; Botella et al., 2021; Yip & Cheng, 2023). Where flipped designs add little genuine autonomy support, motivational advantages diminish or disappear (Campos-Gutiérrez et al., 2021; Parra-González et al., 2021). The synthesis thus extends motivational theory into an embodied domain and suggests that the mechanism of benefit is at least partly motivational rather than purely informational. This motivational interpretation should be read cautiously. Only a minority of the primary

studies employed validated self-determination instruments (for example, scales of autonomous motivation or basic psychological need satisfaction), and none permitted a test of whether fidelity to autonomy-supportive design moderated effects. The heterogeneity of motivational measurement across the corpus therefore limits the strength of any causal claim about the proposed mechanism.

Practically, the review offers actionable guidance. Teachers can use concise, accountable pre-class videos-supported by accessible platforms such as video-annotation tools or mobile messaging-to protect lesson time for active practice, and can expect the clearest returns for technique acquisition and in-class activity, including among pupils in low-resource settings (Killian et al., 2022; Wang et al., 2023). Designers should pair pre-class content with structured, autonomy-supportive in-class tasks, and should anticipate that the hardest skills will still require substantial supervised rehearsal. Collaborative flipped formats appear well suited to higher-education sport courses where satisfaction and peer engagement are valued (Hasbullah, 2025; Caraballo Vidal et al., 2024). Situated against prior reviews, these findings are broadly congruent with cross-disciplinary meta-analyses reporting modest achievement advantages for flipped instruction (Strelan et al., 2020; van Alten et al., 2019; Hew & Lo, 2018) and with the physical-education-specific scoping review that identified an expanding but methodologically limited field (Østerlie et al., 2023). They also align with the recent physical-education meta-analysis reporting favourable effects on intrinsic motivation, self-efficacy, and satisfaction (Wu et al., 2025), while adding an outcome-organised account that distinguishes robust domains (motor skill, motivation, activity) from weaker ones (fitness). The principal contradiction in the literature concerns motivation and fitness: motivational gains, though common, are contingent on design and learner age, and the single direct test of fitness found no advantage (Wang et al., 2023; Parra-González et al., 2021). These tensions most likely reflect differences in intervention dosage, autonomy support, and outcome sensitivity rather than fundamental disagreement about the model's value.

At least three research gaps follow from this synthesis. First, evidence on physical fitness and on the long-term retention of skill and motivation is scarce, leaving the durability and health relevance of flipped physical education unresolved. Second, the geographic and stage concentration of studies-especially the clustering of rigorous work in a few countries-limits confidence in cross-cultural generalisability. Third, few studies disentangle the flipped structure from the additional practice time and novel technologies bundled with it, so the model's independent contribution remains uncertain. The review itself has at least three limitations. It drew on a single database (Scopus) and English-language, peer-reviewed journal articles, which may have excluded relevant work; it employed an interpretive quality appraisal rather than a fully standardised risk-of-bias instrument; and the heterogeneity of designs and measures precluded statistical meta-analysis, so conclusions rest on narrative synthesis. Accordingly, three concrete future directions are warranted: conducting larger, randomised, and longer-term trials with delayed retention testing and objective fitness measures; broadening the evidence base across underrepresented countries, age groups, and activity types; and designing studies that isolate the flipped mechanism-for example, by equating practice time across conditions and by testing autonomy-support components directly. In summary, RQ1 is answered by characterising flipped physical education as a video-led, pre-class-preparation model implemented across diverse platforms, stages, and sports and evaluated chiefly through short comparative experiments; RQ2 is answered by the finding that the approach reliably improves motor-skill learning, motivation, in-class physical activity and engagement, cognitive knowledge, and satisfaction, while its effect on physical fitness remains unsupported by current evidence.

Conclusions

This systematic review of 23 studies establishes that the flipped classroom is a promising and broadly effective approach in physical education. In answer to the first research question, the model has been implemented through video-led pre-class preparation delivered by an expanding range of platforms-from mobile messaging to augmented and virtual reality-across primary, secondary, and higher education and a wide variety of sports. In answer to the second, flipped designs consistently improved motor-skill learning, motivation, in-class physical activity and engagement, cognitive knowledge, and satisfaction, although their effect on physical fitness remains unproven. The review's core contribution is an outcome-organised synthesis that distinguishes well-supported benefits from uncertain ones and clarifies the conditions under which flipping succeeds. For practice, teachers can protect active lesson time and support motivation through accountable pre-class content. These conclusions are tempered by recurrent methodological weaknesses across the corpus—infrequent randomisation, frequent reliance on quasi-experimental designs without active control conditions, modest samples, and short intervention windows with little delayed retention testing. Future research should therefore prioritise pre-registered randomised controlled trials that are adequately powered (indicatively, group sizes able to detect at least a moderate effect, $d \approx 0.5$, at 80% power), use validated motor,

motivational, and fitness measures, run for at least a full instructional term, and include delayed post-tests to establish retention, across a wider range of countries, age groups, and activities.

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References

- Akçayır, G., & Akçayır, M. (2018). The flipped classroom: A review of its advantages and challenges. *Computers & Education*, 126, 334–345. <https://doi.org/10.1016/j.compedu.2018.07.021>
- Bai, Y. (2018). Research on the design method of physical education curriculum based on the flipped classroom concept. *Educational Sciences: Theory & Practice*, 18(5), 1604–1611. <https://doi.org/10.12738/estp.2018.5.059>
- Bergmann, J., & Sams, A. (2012). Flip your classroom: Reach every student in every class every day. International Society for Technology in Education.
- Bishop, J. L., & Verleger, M. A. (2013). The flipped classroom: A survey of the research. In Proceedings of the 120th ASEE Annual Conference & Exposition (Paper 6219). American Society for Engineering Education.
- Booth, A., Sutton, A., & Papaioannou, D. (2016). Systematic approaches to a successful literature review (2nd ed.). Sage.
- Botella, Á. G., García-Martínez, S., García, N. M., Olaya-Cuartero, J., & Ferriz-Valero, A. (2021). Flipped learning to improve students' motivation in physical education. *Acta Gymnica*, 51, e2021.012. <https://doi.org/10.5507/ag.2021.012>
- Braun, V., & Clarke, V. (2006). Using thematic analysis in psychology. *Qualitative Research in Psychology*, 3(2), 77–101. <https://doi.org/10.1191/1478088706qp063oa>
- Campos-Gutiérrez, L. M., Sellés-Pérez, S., García-Jaén, M., Ferriz-Valero, A., & Cejuela-Gutiérrez, J. J. (2021). Flipped learning in physical education: Learning, motivation and motor practice time. *Revista Internacional de Medicina y Ciencias de la Actividad Física y del Deporte*, 21(81), 63–81. <https://doi.org/10.15366/rimcafd2021.81.005>
- Campos-Mesa, M.-C., Castañeda-Vázquez, C., González-Campos, G., & Del Castillo-Andrés, Ó. (2022). Augmented reality and the flipped classroom-A comparative analysis of university student motivation in semi-presence-based education due to COVID-19: A pilot study. *Sustainability*, 14(4), 2319. <https://doi.org/10.3390/su14042319>
- Caraballo Vidal, I., Pezelj, L., Ramos-Álvarez, J. J., & Guillen-Gamez, F. D. (2024). Level of satisfaction with the application of the collaborative model of the flipped classroom in the sport of sailing. *Education Sciences*, 14(2), 150. <https://doi.org/10.3390/educsci14020150>
- Dimarucot, H. C. (2022). A flipped learning model in a college physical education dance course: A non-experimental design. *International Journal of Human Movement and Sports Sciences*, 10(2), 217–226. <https://doi.org/10.13189/saj.2022.100217>
- Dimarucot, H. C., Andres, E. C. A., Matitu, B. C., & Santiago, R. B. (2024). Manifestations of 21st century skills development under the SPRING online flipped learning model in a college physical education course. *European Journal of Educational Research*, 13(1), 413–424. <https://doi.org/10.12973/eujer.13.1.413>
- Doddy Tisna, G., Putra Laksana, A. A. N., Widhiyanti, K. A. T., & Utamayasa, I. G. D. (2025). Integrating virtual reality and project based flipped learning in sport massage education: A Tri Pramana based innovation. *Physical Education Theory and Methodology*, 25(5), 815–824. <https://doi.org/10.17309/tmfv.2025.5.13>
- Espada, M., Navia, J. A., Rocu, P., & Gómez-López, M. (2020). Development of the learning to learn competence in the university context: Flipped classroom or traditional method? *Research in Learning Technology*, 28, 2251. <https://doi.org/10.25304/rlt.v28.2251>
- Ferriz-Valero, A., Østerlie, O., García-Martínez, S., & Baena-Morales, S. (2022a). Flipped classroom: A good way for lower secondary physical education students to learn volleyball. *Education Sciences*, 12(1), 26. <https://doi.org/10.3390/educsci12010026>
- Ferriz-Valero, A., Østerlie, O., Penichet-Tomas, A., & Baena-Morales, S. (2022b). The effects of flipped learning on learning and motivation of upper secondary school physical education students. *Frontiers in Education*, 7, 832778. <https://doi.org/10.3389/educ.2022.832778>

- Ghorbel, A., Trabelsi, O., Yaakoubi, M., Souissi, M. A., & Gharbi, A. (2025). Flipped classroom approach for gymnastics learning in physical education: A quasi-experimental study. *International Journal of Sports Science & Coaching*, 20(2), 567–579. <https://doi.org/10.1177/17479541241301382>
- Gough, D., Oliver, S., & Thomas, J. (2017). *An introduction to systematic reviews* (2nd ed.). Sage.
- Hameed, N. H., & Mashkoo, N. B. (2023). Effect of using the flipped classroom learning strategy on the technical performance of 100 metres hurdles in female university students. *SporTK*, 12, 26. <https://doi.org/10.6018/sportk.556961>
- Hasbullah, B. (2025). Satisfaction level with the implementation of collaborative flipped classroom model in tennis. *Qubahan Academic Journal*, 5(1), 1–12. <https://doi.org/10.48161/qaj.v5n1a1506>
- Hatami, O., & Savaş, S. (2024). Comparative analysis of flipped learning versus traditional teaching methods in basketball technical instruction: Effect on students' psychomotor achievement levels. *Journal of Physical Education and Sport*, 24(6), 1499–1508. <https://doi.org/10.7752/jpes.2024.06170>
- Hew, K. F., & Lo, C. K. (2018). Flipped classroom improves student learning in health professions education: A meta-analysis. *BMC Medical Education*, 18, 38. <https://doi.org/10.1186/s12909-018-1144-z>
- Hinojo Lucena, F. J., López Belmonte, J., Fuentes Cabrera, A., Trujillo Torres, J. M., & Pozo Sánchez, S. (2019). Academic effects of the use of flipped learning in physical education. *International Journal of Environmental Research and Public Health*, 17(1), 276. <https://doi.org/10.3390/ijerph17010276>
- Hinojo-Lucena, F. J., Mingorance-Estrada, Á. C., Trujillo-Torres, J. M., Aznar-Díaz, I., & Cáceres Reche, M. P. (2018). Incidence of the flipped classroom in the physical education students' academic performance in university contexts. *Sustainability*, 10(5), 1334. <https://doi.org/10.3390/su10051334>
- Hu, T., Zhang, M.-L., Liu, H., Liu, J.-C., Pan, S.-J., Guo, J.-H., Tian, Z.-E., & Cui, L. (2022). The influence of “small private online course + flipped classroom” teaching on physical education students' learning motivation from the perspective of self-determination theory. *Frontiers in Psychology*, 13, 938426. <https://doi.org/10.3389/fpsyg.2022.938426>
- Jabučanin, B., Perić, D., & Mašanović, B. (2025). The effects of the flipped classroom method and mobile phones use in physical education. *Croatian Journal of Education*, 27(1), 145–168. <https://doi.org/10.15516/cje.v27i1.6130>
- Khudair, K. N., Hassan, A. A., & Hassan, M. A.-S. (2020). The effect of inverted learning by the (Edmodo) platform in motivation motor performance of some skills of artistic gymnastics for students. *Indian Journal of Forensic Medicine & Toxicology*, 14(4), 2635–2641. <https://doi.org/10.37506/ijfmt.v14i4.11989>
- Killian, C. M., Espinoza, S. M., Webster, C. A., Long, B., Urtel, M., Mays Woods, A., & D'Agostino, E. M. (2022). Flipping the script: An initial exploration of flipped learning as an enhanced alternative to traditional physical education lessons. *International Journal of Environmental Research and Public Health*, 19(22), 15188. <https://doi.org/10.3390/ijerph192215188>
- Lage, M. J., Platt, G. J., & Treglia, M. (2000). Inverting the classroom: A gateway to creating an inclusive learning environment. *The Journal of Economic Education*, 31(1), 30–43. <https://doi.org/10.1080/00220480009596759>
- Liberati, A., Altman, D. G., Tetzlaff, J., Mulrow, C., Gøtzsche, P. C., Ioannidis, J. P. A., Clarke, M., Devereaux, P. J., Kleijnen, J., & Moher, D. (2009). The PRISMA statement for reporting systematic reviews and meta-analyses of studies that evaluate health care interventions: Explanation and elaboration. *PLoS Medicine*, 6(7), e1000100. <https://doi.org/10.1371/journal.pmed.1000100>
- Lubis, J., Haqiyah, A., Kusumawati, M., Irawan, A. A., Hanief, Y. N., & Riyadi, D. N. (2022). Do problem-based learning and flipped classroom models integrated with Android applications based on biomechanical analysis enhance the learning outcomes of pencak silat? *Journal of Physical Education and Sport*, 22(12), 3025–3035. <https://doi.org/10.7752/jpes.2022.12381>
- Moher, D., Liberati, A., Tetzlaff, J., & Altman, D. G. (2009). Preferred reporting items for systematic reviews and meta-analyses: The PRISMA statement. *PLoS Medicine*, 6(7), e1000097. <https://doi.org/10.1371/journal.pmed.1000097>
- O'Flaherty, J., & Phillips, C. (2015). The use of flipped classrooms in higher education: A scoping review. *The Internet and Higher Education*, 25, 85–95. <https://doi.org/10.1016/j.iheduc.2015.02.002>
- Østerlie, O., & Kjelaas, I. (2019). The perception of adolescents' encounter with a flipped learning intervention in Norwegian physical education. *Frontiers in Education*, 4, 114. <https://doi.org/10.3389/educ.2019.00114>
- Østerlie, O., & Mehus, I. (2020). The impact of flipped learning on cognitive knowledge learning and intrinsic motivation in Norwegian secondary physical education. *Education Sciences*, 10(4), 110. <https://doi.org/10.3390/educsci10040110>

- Østerlie, O., Sargent, J., Killian, C., Garcia-Jaen, M., García-Martínez, S., & Ferriz-Valero, A. (2023). Flipped learning in physical education: A scoping review. *European Physical Education Review*, 29(1), 125–144. <https://doi.org/10.1177/1356336X221120939>
- Page, M. J., McKenzie, J. E., Bossuyt, P. M., Boutron, I., Hoffmann, T. C., Mulrow, C. D., Shamseer, L., Tetzlaff, J. M., Akl, E. A., Brennan, S. E., Chou, R., Glanville, J., Grimshaw, J. M., Hróbjartsson, A., Lalu, M. M., Li, T., Loder, E. W., Mayo-Wilson, E., McDonald, S., ... Moher, D. (2021). The PRISMA 2020 statement: An updated guideline for reporting systematic reviews. *BMJ*, 372, n71. <https://doi.org/10.1136/bmj.n71>
- Parra-González, M. E., López-Belmonte, J., Segura-Robles, A., & Moreno-Guerrero, A.-J. (2021). Gamification and flipped learning and their influence on aspects related to the teaching–learning process. *Heliyon*, 7(2), e06254. <https://doi.org/10.1016/j.heliyon.2021.e06254>
- Ridwan, M., Suherman, W. S., Nurhasan, N., Haryanto, H., & Setiawan, E. (2023). Flipped learning as a solution to increase motivation and academic achievement: 5 weeks of mixed research. *Aloma*, 41(2), 71–82. <https://doi.org/10.51698/aloma.2023.41.2.71-82>
- Ryan, R. M., & Deci, E. L. (2000). Self-determination theory and the facilitation of intrinsic motivation, social development, and well-being. *American Psychologist*, 55(1), 68–78. <https://doi.org/10.1037/0003-066X.55.1.68>
- Sargent, J., & Casey, A. (2020). Flipped learning, pedagogy and digital technology: Establishing consistent practice to optimise lesson time. *European Physical Education Review*, 26(1), 70–84. <https://doi.org/10.1177/1356336X19826603>
- Segura-Robles, A., Fuentes-Cabrera, A., Parra-González, M. E., & López-Belmonte, J. (2020). Effects on personal factors through flipped learning and gamification as combined methodologies in secondary education. *Frontiers in Psychology*, 11, 1103. <https://doi.org/10.3389/fpsyg.2020.01103>
- Strelan, P., Osborn, A., & Palmer, E. (2020). The flipped classroom: A meta-analysis of effects on student performance across disciplines and education levels. *Educational Research Review*, 30, 100314. <https://doi.org/10.1016/j.edurev.2020.100314>
- Thomas, J., & Harden, A. (2008). Methods for the thematic synthesis of qualitative research in systematic reviews. *BMC Medical Research Methodology*, 8, 45. <https://doi.org/10.1186/1471-2288-8-45>
- Tranfield, D., Denyer, D., & Smart, P. (2003). Towards a methodology for developing evidence-informed management knowledge by means of systematic review. *British Journal of Management*, 14(3), 207–222. <https://doi.org/10.1111/1467-8551.00375>
- van Alten, D. C. D., Phielix, C., Janssen, J., & Kester, L. (2019). Effects of flipping the classroom on learning outcomes and satisfaction: A meta-analysis. *Educational Research Review*, 28, 100281. <https://doi.org/10.1016/j.edurev.2019.05.003>
- Van Raemdonck, V., Aerenhouts, D., Monsieurs, K., & De Martelaer, K. (2017). A pilot study of flipped cardiopulmonary resuscitation training: Which items can be self-trained? *Health Education Journal*, 76(8), 946–955. <https://doi.org/10.1177/0017896917727561>
- Vaughn, M., Hur, J. W., & Russell, J. (2019). Flipping a college physical activity course: Impact on knowledge, skills, and physical activity. *Journal of Pedagogical Research*, 3(3), 87–98. <https://doi.org/10.33902/jpr.vi0.126>
- Wang, J., Austria, R. S., & Lei, Y. (2023). Research on the effect of flipping classroom teaching model in PE and health teaching in rural primary schools. *International Journal of Information and Education Technology*, 13(9), 1953–1960. <https://doi.org/10.18178/ijiet.2023.13.9.1953>
- Wibowo, C., Nopiyanto, Y. E., Raibowo, S., Insanisty, B., Kardi, I. S., Ibrahim, Rasyono, Defliyanto, & Cs, A. (2024). Assessing the influence of the flipped classroom on physical education students' engagement in basketball learning activities. *Physical Education Theory and Methodology*, 24(4), 539–547. <https://doi.org/10.17309/tmfv.2024.4.01>
- Wu, Q., Han, Z., Hao, Z., Chen, J., & Pan, Y. (2025). Impact of flipped classroom method in physical education on the intrinsic motivation, self-efficacy, and learning satisfaction: A meta-analysis. *PLoS ONE*, 20(5), e0324609. <https://doi.org/10.1371/journal.pone.0324609>
- Yip, P. K., & Cheng, L. (2023). The association of children's motivation and physical activity levels with flipped learning during physical education lessons. *European Physical Education Review*, 29(4), 545–561. <https://doi.org/10.1177/1356336X231170990>
- Yousef, I., Kayed, M., Liftawi, S., Hamdan, S., Alnuaimi, J., & Al-Kilani, H. (2025). Impact of flipped classroom strategy and learning on the acquisition of basic skills among students in the Basketball 1 course at Birzeit University. *Frontiers in Sports and Active Living*, 7, 1660007. <https://doi.org/10.3389/fspor.2025.1660007>