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EDITORIAL

AI and Academic Publication: The Good, the Bad, and the Ugly

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Abstract

Artificial intelligence has entered academic publication. It is already present in drafting, editing, translation, formatting, reviewing, and manuscript preparation. It is used by students, early-career researchers, senior scholars, reviewers, editors, and publishers. Some uses are minor. Some are substantial. Some are legitimate. Some are not. The task for journals is therefore not to pretend that AI can be excluded from scholarly writing. The task is to decide how it should be used, disclosed, governed, and judged. Academic writing has always involved tools. Authors use word processors, grammar checkers, reference managers, statistical software, translation programs, plagiarism-detection systems, and journal submission platforms. These tools have changed the mechanics of writing and publication. Generative AI changes more than mechanics. It can produce fluent prose. It can summarise complex material. It can imitate disciplinary styles. It can create abstracts, titles, responses to reviewers, tables, outlines, and plausible literature overviews. It can also invent references, distort arguments, conceal weak reasoning, and produce text that appears scholarly without being scholarly. This editorial offers a simple position. AI is not an author. AI is not a scholar. AI is not a source of academic responsibility. It is a tool. Used well, it can support clarity, accessibility, and editorial preparation. Used poorly, it can damage quality. Used dishonestly, it can threaten trust in academic publication. The distinction matters. A journal should not treat all AI use as misconduct. Nor should it treat all AI use as harmless assistance. The proper standard is human accountability.

The Good

There are legitimate uses of AI in academic writing. These should be acknowledged. A blanket rejection of AI would be unrealistic. It may also be unfair. International scholarship takes place across unequal linguistic, institutional, and technological conditions. Many authors write in English as an additional language. Many work without extensive editorial support. Many must prepare manuscripts for journals whose conventions differ from those of their home disciplines or institutions. In such contexts, AI can help authors communicate work that is already theirs.

AI can assist with grammar, syntax, structure, and readability. It can help an author identify long sentences, repeated claims, weak signposting, and unclear transitions. It can support translation and back-translation. It can help prepare abstracts, keywords, cover letters, reviewer-response documents, and plain-language summaries. It can check whether headings

are consistent. It can suggest ways to organise a table. It can help authors convert notes into a structured outline. These uses are not equivalent to outsourcing scholarship. They are forms of editorial assistance, provided that the author controls, checks, and revises the output.

This is especially relevant for an international journal. Sport studies, physical education, coaching, health, movement studies, and sport policy are global fields. They involve authors working across different languages and academic traditions. A journal committed to international scholarship should not confuse linguistic polish with intellectual merit. Nor should it require authors to write like native English speakers before their evidence, argument, and contribution can be recognised. Used with care, AI may reduce some barriers to participation in academic publication.

AI can also improve accessibility. It can help authors produce clearer summaries of technical work. It can support communication with practitioners, policymakers, coaches, teachers, and community organisations. Sport research often has audiences beyond the academy. If AI helps scholars explain their findings more clearly without changing their meaning, it can serve a legitimate scholarly purpose.

These benefits depend on one condition. The author must remain the author. The author must decide what is true, relevant, justified, and properly cited. The author must check every claim. The author must verify every reference. The author must ensure that the final manuscript represents their own knowledge, judgement, analysis, and interpretation.

The Bad

The bad uses of AI are often less dramatic than misconduct, but they still matter. They can weaken scholarship while leaving no obvious trace. A manuscript may become smoother but less precise. It may become more polished but less original. It may become easier to read but harder to trust.

The first risk is unsupported fluency. AI can generate sentences that sound confident. This is dangerous in academic writing because fluency can imitate evidence. A paragraph can appear coherent while making claims that are unsubstantiated, imprecise, or false. A literature review can appear comprehensive while omitting disagreement, simplifying debates, or misrepresenting concepts. This risk is acute in interdisciplinary work. Terms such as embodiment, literacy, inclusion, wellbeing, pedagogy, participation, identity, and development carry different meanings across disciplines. AI may flatten these differences.

The second risk is generic scholarship. AI often produces prose that sounds like academic writing in general. It may include familiar phrases, predictable transitions, and balanced but empty formulations. This can create manuscripts that appear competent but lack argument. Conceptual papers are especially vulnerable. A conceptual article must do more than arrange plausible claims. It must clarify concepts, distinguish positions, engage alternatives, and advance an argument. AI-generated prose can conceal the absence of such work.

The third risk is citation failure. AI may invent references. It may attach real authors to claims they did not make. It may produce inaccurate bibliographic details. It may summarise articles that it has not read. Even when references are real, AI may misstate their relevance. In one audit of literature reviews generated across 42 multidisciplinary topics, 55% of citations produced by GPT-3.5 and 18% of those produced by GPT-4 referred to works that did not exist, frequently attached to real authors and plausible journal titles (Walters & Wilder, 2023). This is not a minor technical issue. Citations are part of the evidential structure of scholarship. If citations cannot be trusted, the argument cannot be trusted.

The fourth risk is dependence. An author may begin by using AI for editing and then rely on it for framing, interpretation, and response to criticism. The boundary between assistance and substitution can become unclear. This is not only an ethical issue. It is also an intellectual issue. Academic writing is part of thinking. When authors revise a sentence, restructure an

argument, or respond to a reviewer, they are not only improving presentation. They are refining judgement. Excessive dependence on AI can interrupt that process.

The fifth risk is inequality. AI may reduce some barriers, but it may create others. Authors with access to better tools, better institutional support, and better training may produce manuscripts that appear more professional. Others may be penalised by AI-detection systems that misclassify translated or second-language writing: one widely cited evaluation of seven commercial AI detectors found an average false-positive rate of 61% on essays written by non-native English speakers, compared with near-zero rates for comparable native-speaker writing (Liang et al., 2023). Editors should therefore be cautious. Surface style is not evidence of misconduct. Detection tools are not proof. Editorial judgement remains necessary.

The Ugly

Some uses of AI are not merely weak practice. They are unacceptable. They damage the trust on which academic publication depends.

AI must not be used to fabricate data, quotations, references, ethical approvals, participant accounts, peer-review comments, reviewer identities, or analytical findings. It must not be used to disguise plagiarism. It must not be used to create duplicate or redundant manuscripts with superficial changes. It must not be used to produce false summaries of literature. It must not be used to conceal the absence of method, evidence, or original contribution.

AI must not be listed as an author. Authorship requires responsibility. Authors must be able to approve the final manuscript, respond to criticism, account for decisions, correct errors, and accept responsibility for the integrity of the work. AI cannot do these things. It cannot hold responsibility. It cannot be accountable to readers, editors, participants, institutions, or the public. Publication ethics bodies converge on this point: neither the Committee on Publication Ethics (COPE) nor the International Committee of Medical Journal Editors (ICMJE) permits AI systems to be credited as authors, on the grounds that authorship carries an accountability that AI cannot hold (COPE, 2023; ICMJE, 2024).

AI use also raises concerns for peer review. Reviewers may be tempted to upload manuscripts into AI systems to summarise them or produce reports. This should be treated with caution. Manuscripts under review are confidential documents. They may contain unpublished data, sensitive information, identifiable material, or intellectual property. Reviewers should not use external AI systems in ways that breach confidentiality, journal policy, or data protection requirements; both COPE and the ICMJE have specifically warned that processing a manuscript through external AI tools may itself constitute a confidentiality breach (COPE, 2023; ICMJE, 2024). A reviewer may use tools to improve the clarity of their own report. They should not outsource judgement.

The most serious risk is not that AI will produce bad sentences. The risk is that AI will make bad scholarship look acceptable. It can add coherence to weak designs. It can give polish to unsupported claims. It can turn thin engagement with literature into prose that appears balanced. It can help authors evade the work of revision. In these cases, AI does not support scholarship. It replaces the visible signs of scholarship with simulation.

Implications for International Sports Studies

These questions matter for International Sports Studies. Sport scholarship is not a single field. It includes empirical, historical, philosophical, sociological, pedagogical, policy-oriented, and practice-based work. It addresses bodies, institutions, cultures, identities, communities, performance, health, education, and social change. This range makes AI use both useful and risky.

In sport and physical education research, context matters. Coaching practices, school systems, movement cultures, gender norms, disability experiences, community sport structures,

and national policies cannot be reduced to generic academic language. AI may assist with language, but it cannot replace situated knowledge. It may help organise a manuscript, but it cannot know whether an interpretation is faithful to a local practice, a cultural tradition, a policy context, or an embodied experience.

The journal's international remit strengthens this point. Authors should be encouraged to write clearly. They should also be encouraged to preserve specificity. Local terms, cultural meanings, historical conditions, and practice-based insights should not be smoothed away in the name of standard academic style. International scholarship does not require uniform prose. It requires intelligible, rigorous, accountable work.

A Practical Position

A workable journal position should distinguish acceptable assistance, questionable dependence, and misconduct.

Authors may use AI tools for grammar checking, language editing, translation support, formatting, outlining, and preliminary feedback on clarity. They may use AI to identify repetition, improve signposting, or prepare administrative documents linked to submission. These uses are acceptable when the author reviews the output and remains responsible for the final manuscript.

Authors should disclose AI use when it has materially shaped the manuscript, in line with the disclosure requirements now adopted by COPE and the ICMJE (COPE, 2023; ICMJE, 2024). This includes AI assistance with drafting, rewriting, translation, literature summary, data analysis, image production, tables, figures, or interpretation. Disclosure should be specific. It should state what tool was used and for what purpose. A vague statement that AI was used "to improve the manuscript" is not sufficient.

Authors should not use AI to generate citations unless each citation is checked against the original source. They should not cite works they have not verified. They should not rely on AI-generated summaries as substitutes for reading. They should not use AI-generated prose to make claims beyond the evidence.

Reviewers should not upload confidential manuscripts into external AI systems unless journal policy permits this and confidentiality can be protected. Editors should not rely on AI-detection tools as decisive evidence of misconduct. Such tools may produce errors. They may also penalise authors who write in English as an additional language. Concerns about AI use should be assessed through evidence, not suspicion.

A disclosure statement might take the following form:

"During preparation of this manuscript, the author used [tool name] for [specific purpose, such as language editing, translation support, formatting, or outline development]. The author reviewed and revised all output and accepts full responsibility for the final content."

Where no AI has been used, a simple statement may be used:

"The author reports that no generative AI tool was used in the preparation of this manuscript."

These statements are not solutions in themselves. Disclosure does not make improper use acceptable. Non-disclosure does not prove misconduct. However, clear statements can support transparency and remind authors that responsibility remains with them.

Conclusion

AI will not disappear from academic publication. Prohibition alone will not work. Uncritical acceptance will also fail. Journals need policies that are clear, proportionate, and enforceable. Authors need guidance that distinguishes support from substitution. Reviewers need standards that protect confidentiality and judgement. Editors need to assess manuscripts by evidence, argument, method, and contribution, not by surface polish alone.

The future of academic publication should not be anti-AI or pro-AI. It should be pro-scholarship. AI may help authors write. It may help them revise. It may help them communicate across linguistic and institutional boundaries. But it cannot replace evidence. It cannot replace interpretation. It cannot replace accountability. It cannot replace the author.

AI can help scholars write, but it must not be allowed to stand in for scholarship.

Declaration of Generative AI and AI-Assisted Technologies in the Writing Process

The authors report that no generative AI tool was used in the preparation of this manuscript.

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ORIGINAL RESEARCH ARTICLE

A Moderated Mediation Model Examining the Influence of Mindfulness on Self-Confidence and Mental Toughness of Thai National Athletes

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mindfulness, self-confidence, mental toughness, sport type, moderated mediation model, good health and well-being

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Abstract

Numerous studies have shown that athletes' dispositional mindfulness is positively associated with sports performance, psychological skills, and mental toughness. This study tested whether self-confidence mediates the association between mindfulness and mental toughness among Thai national athletes and investigated whether sport type moderates this mediation model. Participants included 408 Thai national athletes (M_{age} = 22.52, SD = 5.92) representing individual (n = 219) and team sports (n = 189). Data were collected using the Mindfulness in Sport Questionnaire (Thai version), the Revised Competitive State Anxiety Inventory-2 (CSAI-2R) for self-confidence, and the Thai Mental Toughness Questionnaire. Internal consistency for all scales ranged from 0.76 to 0.97. The results demonstrated that mindfulness significantly predicted both self-confidence and mental toughness, with self-confidence acting as a partial mediator. The moderated mediation analysis (Model 59) was significant (Index of Moderated Mediation = 0.105, 95% CI [0.021, 0.208]). Specifically, the mindfulness-confidence linkage (Path a) was stronger in team sports, whereas the confidence-mental toughness relationship (Path b) was more pronounced in individual sports. This study contributes to the literature by clarifying the mindfulness–self-confidence–mental toughness pathway. Within the Thai context, mindfulness is positioned as a 'naturalised grounding' derived from Buddhist heritage, offering a unique baseline for elite athletes. Finally, the findings suggest that coaches should implement sport-specific mental training—focusing on filtering social noise for team sports and bolstering internal belief for individual sports.

Introduction

In the realm of high-performance sport, psychological factors are recognised as critical determinants distinguishing victory from defeat. In particular, self-confidence and mental toughness are fundamental psychological constructs that enable athletes to realise their maximum potential (Hays et al., 2009; Holland et al., 2010). Across various high-pressure sporting disciplines, psychological resilience and self-belief are critical for performance. Previous research in high-stakes environments—such as football penalty shoot-outs—has demonstrated that confidence plays a pivotal role in execution and maintaining composure during critical moments (Wood & Wilson, 2010; Wood et al., 2015). However, this

during critical moments (Wood & Wilson, 2010; Wood et al., 2015). However, this psychological necessity extends beyond team sports to a wide range of individual and collective disciplines, where competitive state anxiety frequently challenges an athlete's perceived performance levels (Chun et al., 2022).

Over the past decade, mindfulness training has gained widespread attention as a "third-wave" cognitive-behavioural intervention to enhance athletic performance. Rather than focusing on controlling thoughts, mindfulness emphasises non-judgmental awareness of the present moment. Current literature suggests that mindfulness interventions effectively reduce rumination and improve emotion regulation (Mao et al., 2023; Meland et al., 2015), which directly bolsters mental toughness and emotional intelligence in team sports like basketball and soccer (Ajilchi et al., 2019; Oguntuase & Sun, 2022). Furthermore, mindfulness serves as a foundational mechanism for achieving the "flow state," allowing athletes to maintain peak focus during competition (Aherne et al., 2011; Kaufman et al., 2009).

Global mindfulness protocols, such as Mindfulness-Acceptance-Commitment (MAC) and Mindful Sport Performance Enhancement (MSPE), have demonstrated efficacy in increasing sport-specific mindfulness and fostering acceptance of competitive emotions (Josefsson et al., 2019; Glass et al., 2019). Studies across diverse disciplines, including track and field and karate, confirm that these programmes significantly reduce anxiety while enhancing psychological grit (Hut et al., 2021; Harita et al., 2022; Mohebi et al., 2022). However, the effectiveness of these interventions may vary across cultural landscapes. While Western and Chinese contexts often require the "adaptation" of programmes to fit local lifestyles (Su et al., 2019; Myall et al., 2023), other regions may offer different entry points for these practices. In Thailand, while the importance of mental toughness and stress management has long been recognised (Julvanichpong et al., 2010), the study of mindfulness offers a unique perspective. Unlike in North America or Europe, where mindfulness may be perceived as a novel psychological technique, Thai culture possesses a naturalised cultural grounding in mindfulness rooted in Buddhist philosophy and *Dharma* principles (Singnoy et al., 2022). While localised studies have demonstrated the benefits of mindfulness and breathing techniques (Anapanasati) on the accuracy of junior golfers (Khaunphet, 2023), petanque players (Siriwatthanasin et al., 2010), and air rifle shooters, as well as its role in traditional rituals like Wai Khru in Muay Thai (Paphauthananan & Chobpradit, 2022) and specialised awareness training for fencers (Mokkrit et al., 2024), there remains a lack of empirical evidence concerning the complex mediated relationship between mindfulness, self-confidence, and mental toughness among elite Thai national athletes. While preliminary research has validated Thai versions of mindfulness instruments (Singnoy et al., 2020), empirical evidence regarding the impact of mindfulness on self-confidence and mental toughness among Thai footballers remains scarce.

A clearer understanding of the relationship between mindfulness and confidence—specifically how mindfulness mitigates negative self-appraisal (Walker, 2019)—will enable coaches and sport psychologists to design interventions that align with Thai cultural foundations. Consequently, this study aims to examine the influence of mindfulness on mental toughness and self-confidence. It is hypothesised that mindfulness acts as a primary mechanism for psychological adaptation, facilitating performance through a culturally resonant framework (Vella-Fondacaro & Romano-Smith, 2023; Birrer et al., 2012). While previous research has established a general link between mindfulness and performance, this study transcends simple replication by identifying a sport-specific 'divergent mechanism' within a non-Western elite population. Beyond merely applying an established model, this research challenges the 'one-size-fits-all' assumption in mindfulness protocols. It demonstrates that the mediation pathway of self-confidence functions in opposing intensities depending on the social structure of the sport (individual vs. team)—a nuance that remains underdeveloped in Western-centric

literature. Furthermore, by integrating the 'naturalised grounding' framework, this study offers a new theoretical lens for understanding how indigenous cultural predispositions can act as a catalyst for psychological skill acquisition, providing a blueprint for culturally-responsive sport psychology globally.

Research Purpose

By investigating these dynamics among Thai national athletes, this study aims to contribute a unique perspective to the international body of sports psychology. We seek to provide practical guidance for Thai coaches and organisations to optimise mental training protocols that are both scientifically robust and culturally resonant.

The distinction between individual and team sports may fundamentally alter the psychological pathways of mindfulness and confidence. From a social psychology perspective, team sport athletes operate within a collective dynamic where self-confidence is often susceptible to 'social noise'—such as teammate evaluations and group momentum (Hill & Shaw, 2013). In this context, mindfulness may serve as a critical attentional filter, protecting an athlete's self-belief from external social pressures. Conversely, in individual sports, athletes face a unique state of psychological isolation. Without the social buffer of teammates, reliance on self-confidence becomes the primary driver of resilience and grit (Mental Toughness). Grounded in the Thai cultural context, where collective harmony (team) and solitary meditation (individual) represent different applications of Buddhist mindfulness, we hypothesise that the social structure of the sport will moderate these psychological mechanisms. A critical distinction in this study lies in the 'Naturalised Grounding' of mindfulness within Thai athletic populations. Unlike Western frameworks where mindfulness is often treated as a novel, acquired cognitive intervention, Thai athletes are predisposed to these concepts through a cultural and educational upbringing deeply rooted in Buddhist philosophy. Local evidence supports the efficacy of traditional Anapanasati (Mindful Breathing) across diverse disciplines, from improving accuracy in golf (Khaunphet et al., 2024; Manowong, 2025) and archery (Chantarasarasom, 2009) to enhancing emotional control (Khamtorn, 2019).

This cultural familiarity suggests that mindfulness in Thai athletes functions as a naturalised foundational trait rather than a secondary skill. In Figure 1, we argue that this grounding sharpens the Path a (Mindfulness to Self-Confidence) because the athlete is leveraging an existing cultural 'cognitive baseline.' This is evident in studies where mindfulness combined with concentration significantly improved skill execution in sports like petanque (Siriwatthanasin et al., 2010) and volleyball (Pengmode et al., 2022). Consequently, the conceptual bridge of our model is built on the premise that this culturally reinforced mindfulness provides the psychological stability necessary to foster robust self-belief and, ultimately, mental toughness.

Hypothesis 1 (Mediation): Self-confidence partially mediates the relationship between mindfulness and mental toughness.

Hypothesis 2 (Moderation of Mindfulness to Self-Confidence): Sport type moderates the relationship between mindfulness and self-confidence.

Hypothesis 3 (Moderation of Self-Confidence to Mental Toughness): Sport type moderates the relationship between self-confidence and mental toughness.

Hypothesis 4 (Moderation of Direct Path): The study also tested whether sport type moderates the direct relationship between mindfulness and mental toughness.

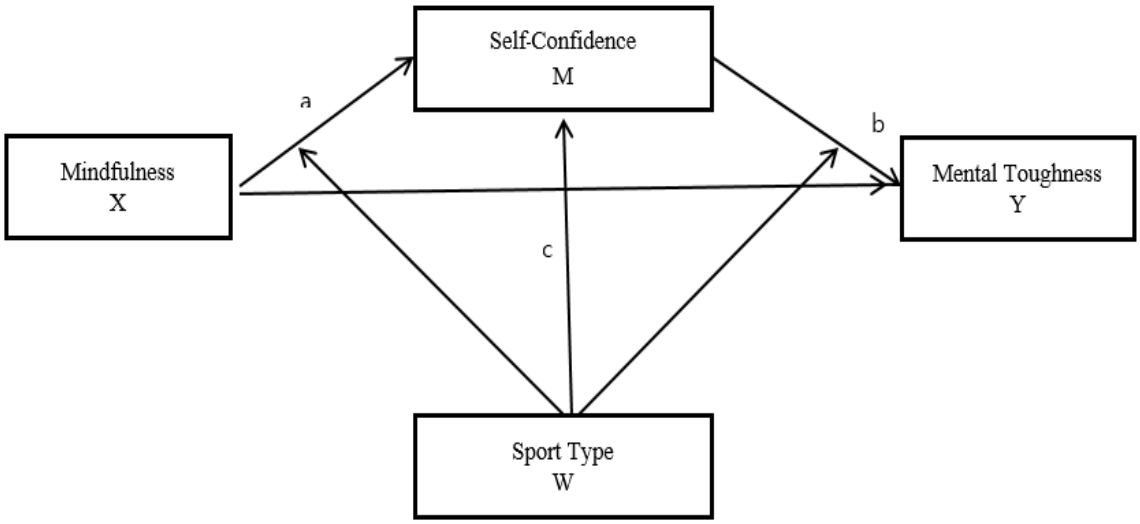

Figure 1. The proposed diagram of the moderated mediation model in the study

Methods and Materials

Participants

The target population for this study consisted of 1,228 elite athletes from 40 sporting disciplines currently in training for the 19th Asian Games. The sample size was determined using the formula of Krejcie and Morgan (1970) with a 3% margin of error, yielding a required sample of 571. To account for potential incomplete responses or data loss, the researchers increased the target sample by 10%, totalling 628 survey distributions. A stratified random sampling method was employed to ensure representation across different sports. The disciplines were first stratified into indoor (24 types) and outdoor (19 types) categories. A lottery method was then used to select 20 indoor sports and 15 outdoor sports. Out of the 628 questionnaires distributed, 408 athletes (217 males, 191 females; M_{age}= 22.52, SD = 5.92) provided complete and valid responses (response rate = 65%), which constituted the final sample for analysis.

Statistical Analysis and Moderation

Framework data were analysed using SPSS (Version 26.0). To address the reviewer's concerns regarding the categorical nature of the moderator (Sport Type), the following analytical framework was implemented below:

- Categorical variable specification: Sport type was treated as a binary/dichotomous variable (0 = Individual Sports, 1 = Team Sports). This approach ensures that the interaction terms in the moderated mediation model are mathematically appropriate for categorical data.
- Moderated Mediation (Model 59). This model was specifically used to test the moderated mediation hypotheses; Hayes' (2018) PROCESS macro (Model 59) was employed. This model simultaneously examined the following paths: (1) the effect of Mindfulness on Self-confidence (Path a), (2) the effect of Self-confidence on Mental Toughness (Path b), and (3) the direct effect of Mindfulness on Mental Toughness (Path c). Additionally, Sport Type was entered as a moderator to test if it influenced all three aforementioned paths.

- Conditional indirect effects: In accordance with best practices for categorical moderators, we do not report effects at ± 1 Standard Deviation. Instead, we report the Conditional Indirect Effects specifically for each category (Individual vs. Team). This allows for a clear comparison of how the mindfulness mechanism functions differently across these two athletic contexts.
- Inference via Bootstrapping: The significance of the moderated mediation was determined using the Index of Moderated Mediation. A bootstrapping procedure with 5,000 resamples was used to calculate 95% confidence intervals (CI). An effect is considered statistically significant if the 95% CI does not straddle zero.

Participant Recruitment and Procedures

Participants were selected through stratified random sampling of athletes representative of Thai national sports associations. The recruitment process followed these steps:

1. Institutional Contact: Official letters were sent to the directors and head coaches of various national sport organisations in Thailand to request permission for data collection.
2. Coach Coordination: Once permission was granted, researchers coordinated with team coaches to identify training sessions where athletes could be briefed on the study.
3. Briefing Sessions: During these sessions, the research team explained the study's objectives, the voluntary nature of participation, and the anonymity of the results.
4. Informed Consent: Athletes who expressed interest were provided with an Informed Consent Form. For athletes under 18, an additional parental consent form was required and collected before survey administration.

Inclusion and Exclusion Criteria

To ensure the sample accurately represented elite-level competitors, the following criteria were applied:

- Inclusion Criteria: (1) Currently active as a Thai national team athlete; (2) minimum of 2 years of international or national competitive experience; (3) aged between 18 and 35 years; and (4) regularly participating in national training sessions (at least 3 times per week).
- Exclusion Criteria: (1) Athletes sidelined by significant physical injuries for more than one month; (2) incomplete survey responses (>10% missing items); and (3) participation in formal mindfulness interventions within the last 6 months.

Survey Administration

The survey was administered using a paper-and-pencil format to ensure a high response rate and allow participants to ask clarifying questions in real time. Data collection took place in controlled environments, typically in team meeting rooms or quiet areas of training facilities, immediately before or after a scheduled training session. To minimise social desirability bias, coaches and administrative staff were asked to leave the room while athletes completed the survey. Researchers provided standardised instructions: "There are no right or wrong answers; please respond based on your honest experience in your sport." The survey took approximately 20–25 minutes to complete. Participants were not provided with financial compensation but were offered a summary of the general findings (aggregate data) upon completion of the study to help inform their future mental training.

Ethical Considerations

This study was conducted in accordance with the Declaration of Helsinki. The protocol was reviewed and approved by the Review Board (IRB) of Burapha University (IRB1-007/2566). All participants were informed that participation was voluntary and that they could withdraw at any time without penalty. Data were anonymised to ensure participant confidentiality. In addition to individual consent, supplementary parental consent was obtained for all participating athletes under 18, ensuring full compliance with ethical standards for minors.

Measurements

1. Demographic variables: Gender is a dichotomous variable within two types of sports: individual sports and team sports.

2. Mindfulness in Sports Questionnaire in Thai Version, developed by Singnoy et al. (2020), is designed to assess mindfulness in sports. It has demonstrated a reliability of 0.76. The scale comprises 15 questions, divided into three components: Awareness, Non-judgment, and Refocusing. These are evaluated on a 6-point scale ranging from 1 (never) to 6 (very often). The statistical fit of the model is as follows: $\chi^2 = 306.82$, df = 87, p = 0.001, CMIN/DF = 3.52, CFI = 0.942, TLI = 0.930, RMR = .093, and RMSEA =0.079, with a 90% confidence interval of .069 to .088. Additional metrics include AIC = 372.82 and ECVI = 0.916.

3. Self-Confidence Questionnaire: The Revised Competitive State Anxiety Inventory-2 (Thai version; CSAI-2R) was used to measure situational self-confidence. The 5-item scale demonstrated good internal consistency with a Cronbach's alpha of 0.90. Confirmatory factor analysis (CFA) was conducted to verify the structural validity, yielding the following fit indices: $\chi^2 = 22.33$, df = 5, p = .001, CMIN/DF = 4.46. The incremental fit indices showed excellent model-data fit, with CFI = .985 and TLI = .971, both exceeding the recommended threshold of .95. While the RMSEA was .092 (90% CI: 0.056, 0.133), slightly above the conventional .08 cutoff, this is often observed in models with small degrees of freedom (df = 5), where RMSEA can be artificially inflated. Given the superior CFI and TLI values, along with an RMR of .012, the scale demonstrates robust structural validity within this elite Thai national athlete sample. These results confirm that the instrument is a psychometrically sound measure for the subsequent mediation analysis.

4. Mental toughness: The mental toughness questionnaire in Thai by Julvanichphong et al. (2010). This questionnaire comprises 36 items and 12 sub-scales, including Self-Efficacy, Mental Self-Concept, Potential, Perseverance, Task Focus, Task Familiarity, Personal Bests, Task Value, Goal Commitment, Positive comparisons, and Stress Minimisation. After analysis, it was observed that the revised short version of the section consists of 12 items across a single dimension, designed to predict mental toughness in Thai athletes. The questionnaire demonstrated high internal consistency ($\alpha = .97$) and uses an 8-point rating scale. The statistical fit of the model was as follows: $\chi^2 = 1929.32$, df = 528, p = .001, CMIN/DF = 3.65, CFI = .870, TLI = 0.845, RMR = 0.073, and RMSEA =0.081 with a 90% confidence interval of 0.077 to 0.085. Additional metrics include AIC = 2205.32 and ECVI = 5.41.

Data analysis and Assumption Testing

Data were analysed using SPSS (Version 26.0), beginning with a rigorous assessment of the assumptions for multivariate regression. Normality for all continuous variables—mindfulness,

self-confidence, and mental toughness—was confirmed through Skewness values for all primary variables, which ranged from -1.23 to 0.10, and Kurtosis values, which ranged from -0.90 to 1.68 (Table 1). These values fall well within the acceptable thresholds of ±2 and ±7, respectively, indicating that the data meet the assumptions of normal distribution for multivariate analysis. Linearity was verified by inspecting scatterplots, which exhibited consistent linear trends, while the Durbin-Watson statistic was utilised to confirm the independence of observations, with values near 2.0. To address potential multicollinearity, a correlation matrix and Variance Inflation Factors (VIF) were examined; the highest correlation was observed between self-confidence and mental toughness ($r = 0.57$), well below the 0.80 threshold, and all VIF values were below 2.5. To test the proposed statistical relationships, we utilised the SPSS PROCESS macro (Model 59) developed by Hayes (2018), which allows for the simultaneous testing of mediation and moderated mediation. Given the cross-sectional design of this study, the model evaluates statistical associations rather than temporal causality. We employed a bootstrapping method (5,000 resamples) to generate 95% confidence intervals (CI) for the indirect effects, where an effect is considered significant if the CI does not include zero. For the moderated mediation analysis, the moderator (Sport Type) was treated as a categorical/binary variable, and conditional effects were calculated separately for individual and team sports to provide a culturally and contextually resonant framework for the Thai athletic context.

Table 1. Descriptive Statistics and Normality Testing (N = 408)

Variables	Sub-scales	*M*	*SD*	Skewness	Kurtosis
Mindfulness	Awareness	4.55	0.98	-0.48	-0.17
	Non-Judgment	3.19	1.29	0.1	-0.9
Self-Confidence	Refocusing	4.55	0.98	-0.6	0.02
	Confidence	3.24	0.64	-0.83	0.53
	Self-Efficacy	6.68	1.15	-1.06	1.36
Mental Toughness	Mental Self-Concept	6.52	1.3	-1.19	1.68
	Potential	6.79	1.04	-0.92	0.53
	Task Focus	6.93	1.06	-0.77	0.76
	Task Familiarity	6.94	0.98	-1.05	0.98
	Personal Bests	7	0.99	-1.23	1.25
	Task Values	6.91	1	-1.03	1.07
	Goal Commitment	6.93	1.01	-0.98	0.46
	Positivity	6.67	1.03	-1.07	1.64
	Stress Minimization	6.3	1.26	-0.69	0.46
	Positive comparisons	6.78	1.39	-0.96	1.10
	Persistence	6.94	1.18	-0.99	1.02

Results

Descriptive and Correlation Analyses

Table 2 presents the Pearson correlation matrix for the primary variables—mindfulness, self-confidence, and mental toughness. As hypothesised, mindfulness exhibited significant positive correlations with both self-confidence and mental toughness. Furthermore, self-confidence was strongly and positively associated with mental toughness. Notably, sport type (individual vs. team) did not show a significant correlation with any of the psychological constructs, suggesting that these traits were distributed consistently across different sport formats in this elite sample.

Table 2. Descriptive statistics and correlations for study variables

	Variables	*M*	*SD*	1	2	3	4
1.	Mindfulness	4.10	0.54	-			
2.	Self-confidence	3.24	0.64	0.42**	-		
3.	Mental toughness	6.77	0.89	0.49**	0.57**	-	
4.	Type of sport	0.46	0.49	-0.07	0.03	0.01	-

Note. $N = 408$. *M* and *SD* represent mean and standard deviation, respectively. ** $p < .01$.

Test of Mediation Effect

The mediation analysis (Table 2) confirmed that self-confidence partially mediates the relationship between mindfulness and mental toughness. The model was statistically significant, $F(2, 405) = 132.08$, $p < .001$, explaining 39.2% of the variance in mental toughness ($R^2 = 0.392$). Both the direct effect of mindfulness on mental toughness and the indirect effect through self-confidence were significant, as indicated by 95% bias-corrected confidence intervals that did not contain zero. This suggests that mindfulness not only directly supports mental toughness but also enhances it indirectly by increasing an athlete's self-confidence.

Test of Moderated Mediation Effects

The moderated mediation analysis (Model 59) examined whether the social structure of the sport (individual vs. team) moderated the mediation pathways. As shown in Table 3, sport type significantly moderated the path from mindfulness to self-confidence and the path from self-confidence to mental toughness. However, the direct interaction between mindfulness and sport type on mental toughness was not significant, suggesting the direct benefits of mindfulness on toughness are consistent across sport types.

To interpret the interactions, conditional effects were analysed separately for individual and team sports. For the path from mindfulness to self-confidence, the effect was significantly stronger for team sport athletes ($B = 0.70$, $p < .001$) compared to individual sport athletes ($B = 0.36$, $p < .001$). This interaction is visualised in Figure 2, where the slope representing team sports is noticeably steeper, indicating that increments in mindfulness yield higher gains in self-confidence in team environments.

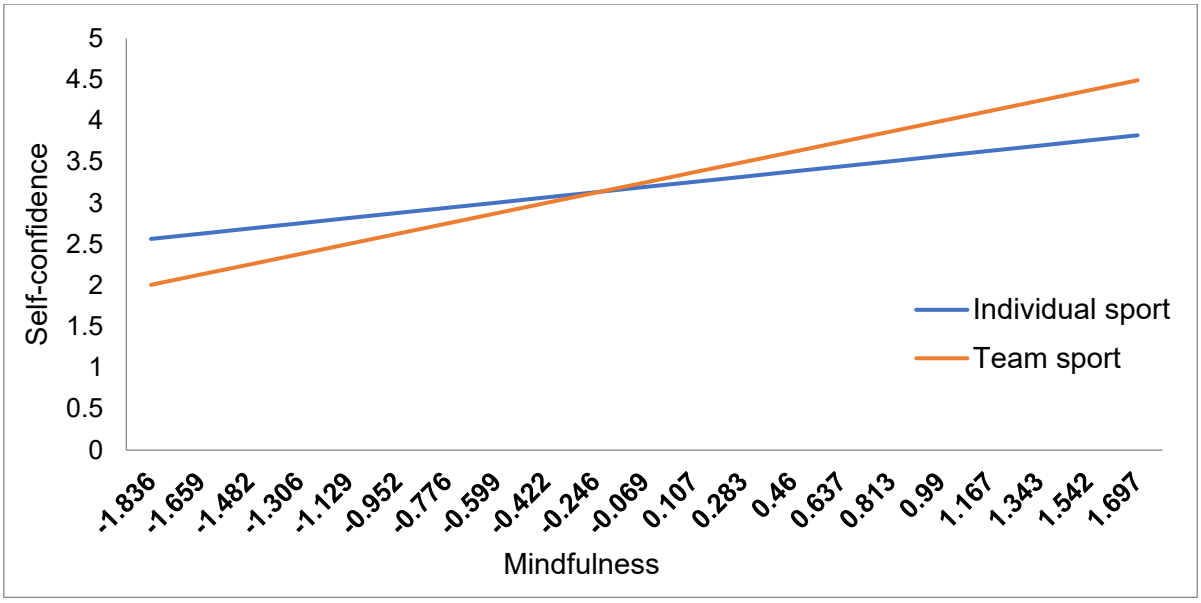

Figure 2. Moderation of the effect of mindfulness on self-confidence by sport type

Conversely, the effect of self-confidence on mental toughness was stronger for individual sport athletes ($B = 0.96$, $p < .001$) than for team sport athletes ($B = 0.64$, $p < .001$). As shown in Figure 3, the interaction plot illustrates that while both groups benefit from increased self-confidence, athletes in individual sports demonstrate a higher sensitivity to these changes, suggesting that self-confidence is a more critical driver of mental toughness when social support from teammates is absent. These findings indicate that while the mediation mechanism exists in both groups, team sport athletes derive more confidence from mindfulness. In contrast, individual sport athletes rely more heavily on that confidence to maintain mental toughness.

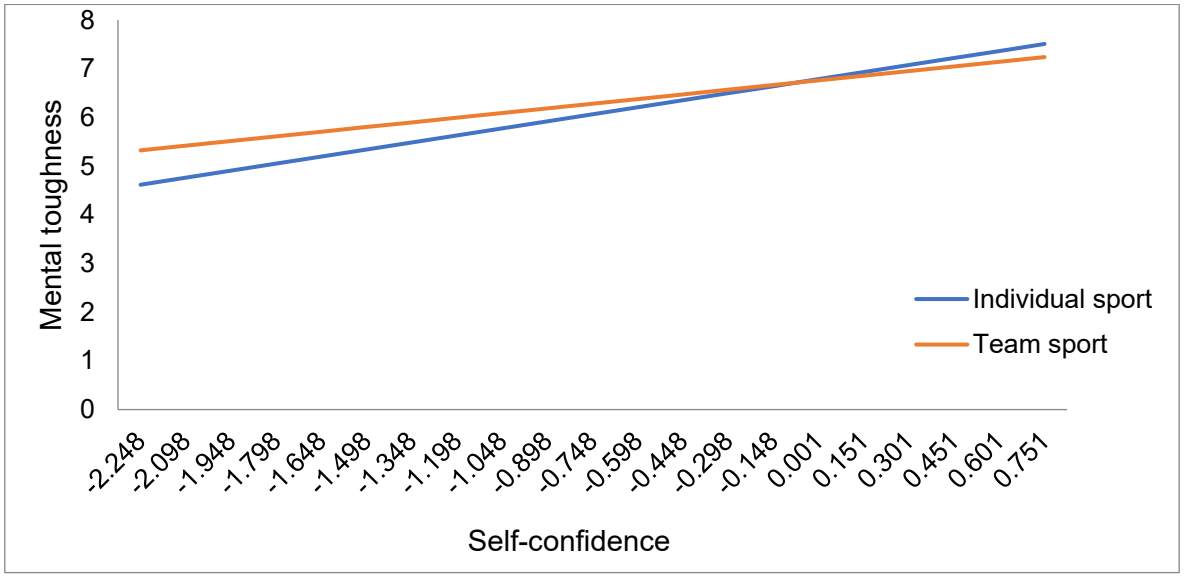

Figure 3. Moderation of the effect of self-confidence on mental toughness by sport type

Finally, the formal test of moderated mediation was conducted. The Index of Moderated Mediation was 0.105 (95% CI [0.021, 0.208]), confirming that the indirect effect of mindfulness on mental toughness through self-confidence was significantly different between individual and team sports. Specifically, the indirect pathway was stronger for team sport athletes compared to individual sport athletes.

Table 3. Mediation analysis of mindfulness on mental toughness

Model	Path	*B*	SE	*t*	*p*
Model 1	c (total effect)	0.794	0.070	11.232	0.001
Model 2	a	0.495	0.052	9.427	0.001
Model 3	b	0.611	0.095	10.272	0.001
	c'(direct effect)	0.491	0.069	7.055	0.001
Bootstrap estimate	Indirect effect	Effect	SE	95% CI	
		0.303	0.049	0.211 - 0.405	

Abbreviations: SE = standard error, CI = confidence interval, Bootstrap n = 5,000, Bootstrap CI method = Bias-corrected

To interpret the interaction effects as shown in Table 3, conditional effects were analysed (Table 4). For Path a (Mindfulness to Self-Confidence), the interaction was statistically significant (B = 0.347, p = .001, 95% CI [0.139, 0.554]). As visualised in Figure 2, the relationship was significantly stronger for team sport athletes (B = 0.70) compared to individual sport athletes (B = 0.36).

Conversely, for Path b (Self-Confidence to Mental Toughness), the interaction was also significant but in the opposite direction (B = -0.325, p = .004, 95% CI [-0.547, -0.103]). As illustrated in Figure 3, the association was more pronounced for individual sport athletes (B = 0.96) than for team sport athletes (B = 0.64). This suggests that while mindfulness boosts confidence more effectively in team environments, self-confidence remains the more critical driver of resilience for athletes in solitary individual sports.

Table 4. Conditional effects for sport type

Predictor Variables	*B*	SE	t	p	95% CI [LL, UL]
Outcome: Self-Confidence (Mediator)					
Constant	1.758	0.285	6.164	0.001	[1.197, 2.319]
Mindfulness (MF)	0.356	0.068	5.216	0.001	[0.222, 0.490]
Sport Type (ST)	-1.345	0.435	-3.085	0.002	[-2.202, -0.488]
MF × ST (Interaction)	0.347	0.105	3.286	0.001	[0.139, 0.554]
R^2 = 0.204, F(3,404)=34.57, p<0.001					
Outcome: Mental Toughness (DV)					
Constant	2.173	0.372	5.831	0.001	[1.440, 2.905]
Self-Confidence (SC)	0.963	0.083	11.616	0.001	[0.801, 1.127]
Mindfulness (MF)	0.478	0.087	5.481	0.001	[0.306, 0.649]
Sport Type (ST)	0.992	0.545	1.819	0.069	[-0.079, 2.063]
SC × ST (Interaction)	-0.325	0.113	-2.876	0.004	[-0.547, -0.103]
R^2 = 0.412, F(4,403) = 70.42, p<0.001					

Discussion

The analysis supports the hypothesis that mindfulness contributes to mental toughness, with self-confidence as a mediating variable. Mindfulness was associated with higher self-confidence, and this confidence further contributes to mental toughness. The primary objective of this study was to examine the mediating role of self-confidence in the relationship between mindfulness and mental toughness among elite Thai athletes, while exploring how these pathways vary between individual and team sport contexts. Our findings confirm that mindfulness significantly predicts mental toughness, a relationship partially explained by the boost in situational self-confidence. Furthermore, the moderated mediation analysis reveals that the competitive structure of the sport—whether team-based or individual—determines the relative strength of these psychological pathways.

The Mindfulness–Self-confidence–Mental Toughness Pathway

The significant mediation effect observed in this study aligns with established theoretical frameworks identifying mindfulness as a foundational mechanism for performance enhancement and the development of elite mental qualities (Kaufman et al., 2009; Josefsson et al., 2019; Birrer et al., 2012). By fostering a non-judgmental awareness of the present moment, mindfulness helps athletes mitigate "negative self-appraisal," which is a primary psychological barrier to self-belief (Walker, 2019; Röthlin et al., 2016). When athletes are mindful, they develop the ability to observe intrusive thoughts—such as doubt during a high-stakes moment—as transitory mental events rather than absolute truths. This cognitive distancing prevents the erosion of confidence that typically follows a mistake or a period of high pressure.

Beyond mere focus, mindfulness meditation has been shown to counteract self-control depletion (Friese et al., 2012), effectively preserving the cognitive and emotional resources needed to maintain situational confidence under the high-stakes pressure of elite competition (Compte & Postlewaite, 2004). This mental stability is critical, as confidence acts as a vital buffer against competitive state anxiety and ruminative thinking (Chun et al., 2022; Mao et al., 2023). Our results confirm that mindfulness provides the cognitive clarity required to sustain self-belief, which subsequently serves as the primary driver for mental toughness. In elite sports, mental toughness is defined by the ability to remain resilient, focused, and persistent in the face of adversity (Harita et al., 2022). By stabilising confidence, mindfulness ensures that an athlete's "internal engine" remains functional even when external conditions are unfavourable, allowing the consistent effort and focus required for world-class performance (Hays et al., 2009).

The significant moderated mediation observed in this study reflects a unique cultural synergy. The Path b (Self-Confidence to Mental Toughness) is reinforced by the Thai emphasis on 'Awareness' (Sati), which serves as a shield against psychological depletion. This aligns with recent Thai research on Breath and Movement Awareness Programmes (BMAP) in fencing (Mokrid et al., 2024) and imagery training in dragon boat racing (Raktavee, 2023), where heightened self-awareness directly translated into sustained competitive grit.

Furthermore, the interaction effects suggest that 'Naturalised Grounding' allows team athletes to filter social pressure, while providing individual athletes with the solitary persistence required in combat or precision sports. This cultural interpretation is supported by localised findings that combine mindfulness with physical strength training to enhance performance in basketball (Paso et al., 2022) and Muay Thai (Paphauthananan & Chobpradit, 2022). Thus, the pathways in our model are not merely statistical artefacts but are deeply embedded in the Thai cultural ethos of mental training.

Cultural Contextualisation: Naturalised Grounding vs. Western Samples

A critical contribution of this research is exploring these psychological pathways within a Thai population, highlighting what we define as "naturalised cultural grounding." In most Western sport psychology research, mindfulness is often introduced as a secularised clinical intervention or a novel cognitive skill that requires significant conceptual shifts for athletes to adopt. In contrast, Thai athletes are predisposed to these concepts from a young age through a cultural and educational upbringing deeply rooted in Buddhist philosophy and Dharma (Kaewpornsawan et al., 2012; Purananon, 2017).

Specifically, the Thai approach to mindfulness remains centred on a distinct three-step cognitive cycle: Awareness (Sati), Letting Go, and Returning to the Task (Samadhi). Unlike models that focus solely on relaxation, the Thai protocol emphasises the active redirection of focus. Thai athletes are taught from their earliest years in the national education system to recognise a wandering or distressed mind, consciously "let go" of the attachment to that distraction, and immediately return to the present duty. This cultural familiarity implies that Thai athletes do not face conceptual barriers. The core tenets are already integrated into the Thai cognitive lexicon and social fabric, allowing for an intuitive transition from psychological awareness to athletic confidence.

This "home-field advantage" is supported by local research across diverse Thai sporting disciplines. For instance, the Mindfulness of Thailand (MOT) protocol's emphasis on Anapanasati (mindful breathing and movement) has been shown to improve accuracy in petanque (Siriwatthanasin et al., 2010), junior golf (Khaunphet, 2023), and air rifle shooting (Wongsomboon, 2020). Even in traditional combat arts like Muay Thai, rituals like Wai Khru serve as structured mindfulness exercises that help practitioners transition from daily life to a "warrior" mindset (Paphauthananan & Chobpradit, 2022). A breath-and-movement awareness programme was shown to be effective in developing mindfulness among fencing athletes (Mokkrit et al., 2024).

Consequently, the robust mediation pathways observed in this study are bolstered by this lifelong immersion, making mindfulness a more potent and accessible resource for Thai athletes preparing for international events like the 19th Asian Games (Singnoy et al., 2022).
While this study positions Thai athletes within a framework of 'naturalised grounding' due to the cultural prevalence of Buddhist philosophy, it is important to acknowledge that this claim remains theoretical and inferential. The present study did not empirically measure participants' religious practices or spiritual depth; therefore, the cultural grounding is offered as a conceptual interpretation rather than a direct empirical finding.

The Moderating Role of Sport Type

Our results confirm a 'divergent mechanism' based on the social structure of the sport. In team settings, the mindfulness-to-confidence pathway (Path a) was more pronounced, indicating that mindfulness functions as an attentional filter against social evaluation and group pressure. In contrast, individual sport athletes showed a stronger reliance on the confidence-to-mental toughness pathway (Path b), as they lack the social buffer provided by teammates and must rely almost exclusively on their internal self-belief to maintain grit. This research identifies distinct psychological dynamics based on the social structure of the sport. In team settings, the mindfulness-to-confidence pathway was found to be significantly more pronounced. This finding suggests that mindfulness is particularly vital for managing the external social distractions and interpersonal pressures inherent in collective environments (Hill & Shaw, 2013). In sports like football, volleyball, or basketball, an athlete's confidence can be vulnerable to team fluctuations, social friction, coach critiques, or the looming fear of letting down the group. Mindfulness allows team athletes to improve attentional control (Baltar & Filgueiras, 2018) and remain centred, maintaining individual self-confidence regardless of the group's

performance or external noise (Ajilchi et al., 2019). By practising mindfulness, team athletes can "filter" social pressure, ensuring their self-belief remains stable even when the team's collective momentum is low.

Conversely, the individual sport context demonstrated a significantly stronger path from self-confidence to mental toughness. Without teammates to share the psychological burden or provide immediate social support, individual athletes experience a unique state of "psychological isolation." In these disciplines, the relationship between self-belief and toughness is nearly one-to-one; if confidence wavers, the athlete has no social buffer to prevent a collapse in toughness. For these athletes, self-confidence serves as the primary "shield" that translates mindfulness-induced awareness into the grit and perseverance required for elite competition (Mohebi et al., 2022). In high-pressure individual disciplines like karate (Harita et al., 2022), tennis (Terzioğlu & Çakir-Çelebi, 2024), or track and field (Hut et al., 2021), mindfulness acts as a "resource-conserving strategy" (Li et al., 2023). Our results suggest that for the isolated athlete, self-belief is the central engine for mental toughness, allowing them to remain "tough yet compassionate" toward themselves during solitary struggles (Stamatis et al., 2020). This underscores that while mindfulness is universally beneficial, its application must be context-specific: it protects the team athlete from the group, while it empowers the individual athlete to be their own source of strength.

Limitations and Future Research

Despite the high-level sample of national athletes, several limitations must be acknowledged. First, the cross-sectional design prevents the establishment of temporal or definitive causal relationships; while the model is statistically robust, it reflects associations rather than developmental processes. Second, the reliance on self-report measures may introduce social desirability bias, as elite athletes may feel pressured to report higher levels of toughness or confidence to align with the "warrior" archetype of national representation. Third, while the Thai context provides unique insights into "naturalised grounding," the results may not be directly generalisable to non-Buddhist or highly secularised athletic populations where mindfulness lacks a similar cultural scaffold. Future research should employ longitudinal or experimental methods and incorporate objective metrics, such as heart rate variability or other physiological stress markers (Meland et al., 2015), to validate these self-reported trends over time.

Conclusion

In conclusion, this study offers a comprehensive understanding of the psychological mechanisms underpinning elite athletic performance in the Thai context. The research provides three primary contributions as follows.

First, regarding the theoretical contribution, our findings clarify the mindfulness–self-confidence–mental toughness pathway. The results demonstrate that self-confidence serves as a crucial partial mediator, suggesting that mindfulness does not merely bolster resilience directly but does so by stabilising an athlete's self-belief. This clarifies the cognitive "chain of command" required to maintain mental toughness under high-stakes competitive pressure.

Second, the cultural-contextual contribution resides in the introduction of the "naturalised grounding" framework. By situating the study within Thai Buddhist society, we highlight how a cultural predisposition toward mindfulness can facilitate the adoption of sport psychology interventions. This framework differentiates Thai athletes from Western samples, suggesting that mindfulness is not an alien cognitive skill but a culturally resonant practice already integrated into their social and educational fabric.

Third, the applied implications offer a clear roadmap for sport-specific mental training. Coaches and sport psychologists are encouraged to move beyond a "one-size-fits-all" approach. For team sports, mindfulness training should focus on protecting athletes from external social distractions. In contrast, for individual sports, interventions should prioritise leveraging mindfulness to build the robust self-belief necessary for solitary persistence. Ultimately, these insights provide Thai sports organisations with a culturally tailored strategy to optimise the mental health and performance of their national athletes.

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Declaration of Generative AI and AI-Assisted Technologies in the Writing Process

During the preparation of this manuscript, the authors used Gemini AI to assist with improving language clarity, grammar, and phrasing. The authors carefully reviewed and revised the output to ensure its accuracy and take full responsibility for the content of the final manuscript.

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ORIGINAL RESEARCH ARTICLE

Developing a Mixed-Reality Framework for Innovative Movement Education: A Mixed-Methods Study

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Abstract

The advent of the emerging technologies era opened up new modes of digital learning tools, such as Augmented Reality (AR), Virtual Reality (VR) and Mixed Reality (MR). As an expressive form of physical education, performing arts (e.g., dance/movement processes) require individualised learning modes to respond to students' diverse needs guided by physical educators. Literature shows that MR is a transformative tool for the rapidly evolving field of movement/physical education. This mixed-method research aims to develop a survey instrument to examine the 'Needs' of physical education learners, as well as their understanding and acceptance of hybrid learning modes. The study also proposes the 'MENG' framework to guide module design and support students' online learning through MR. Instrument validation showed high learner acceptance, evidenced by an 85% survey response rate. Correlation analysis revealed statistically significant relationships ($p < .01$) among 'Internet Usage'(IU), 'Students' Understanding'(SU) of MOOC+SPOC, and 'Students' Attitudes'(SA) towards Blended Learning, with correlation coefficients of .644, .712, and .962, respectively, indicating a moderate positive relationship among these three variables. Complementing these findings, the qualitative research using 'Exemplary-case Analysis'(ECA) revealed that MR-driven educational systems enable the creation of personalised and engaging learning experiences tailored to learners' individual styles and diverse preferences. Through integrating MR into physical education, educators can create engaging and contextualised learning environments to meet the needs of learners from diverse sociocultural backgrounds. Moreover, it also facilitates curricular adjustments for students' learning through hybrid mode. This study contributes to advancing Sustainable Development Education by leveraging MR to innovate and personalise physical education.

Keywords:
sustainable development education, individualised learning, innovative physical education module, mixed-reality, educational system, quality education

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Introduction

The advent of the emerging technologies era has opened up different modes of digital learning tools such as Augmented Reality (AR), Virtual Reality (VR) and the most recent Mixed Reality (MR). As an expressive form of performing art, physical education guided by educators requires individualised learning modes to respond to students' diverse needs. This article details the development of a framework for an innovative movement education module using MR technology. The framework is grounded in a mixed-methods approach, combining quantitative findings from survey validation with qualitative insights from literature and Exemplary-Case Analysis (ECA). MR integrates virtual elements into the real environment, creating an immersive learning experience (Azuma, 1997; Milgram & Kishino, 1994). In other words, MR is a further development of VR. It allows people to experience current objects or scenes things that don't literally exist. This technology projects virtual elements into the real-world environment, creating an interactive feedback loop between the physical and virtual realms, thereby enhancing the immersion and effectiveness of the learning experience.

Problem Statement

The online teaching mode is friendly for subjects that focus on theory, because even in the classroom, teachers will use PPT, multimedia, projection and other teaching equipment. The shift to online teaching mode itself will not lower the quality of teaching (Elhaty et al., 2020; Gamage et al., 2020). However, in fields that emphasise movement demonstration, such as sports (Griffiths et al., 2022), dance (Li et al., 2022), piano (Topalak, 2022), calligraphy (Li, 2020), and musical instruments (Vaizman, 2022), there is a significant mismatch between current teaching methods and the effective presentation and breakdown of 3D movements.

This approach fails to offer action demonstrations, immediate evaluations or interactions, resulting in three issues: a) One-way, two-dimensional video transmission limits learners' ability to observe the instructor's movement demonstrations from multiple perspectives, thereby hindering their comprehension of movement intent and increasing cognitive load. b) The network latency and the absence of co-located interaction with the instructor significantly diminish kinesthetic feedback and real-time correction, thereby increasing the likelihood of errors in students' motor learning (Svatos et al., 2022). c) The isolation inherent in virtual learning environments impedes the nuanced and embodied interactions between teachers and students, making it imperative to develop online teaching frameworks capable of addressing these limitations.

Gaps in Existing Digital Learning Tools for Physical Education

Scholars have explored the application of augmented reality and virtual reality technologies in education. For instance, Li et al. (2022) conducted a study during the pandemic, revealing that online dance instruction via the ZOOM platform could substantially enhance students' 4C skills, including creativity, communication, collaboration, and critical thinking. Dastane et al. (2024) proposed integrating metaverse, virtual reality, and extended reality technologies into organisational development, as well as optimising training programmes to enhance employee productivity. Griffiths et al. (2022) found that social media platforms, blogs, and mobile applications are increasingly utilised in career development. Although most studies have primarily focused on theoretical frameworks rather than practical, kinesthetic learning experiences, empirical research examining the positive impact of digital tools on learning and practice within physical education remains limited. This study addresses a critical gap by leveraging the unique features of mixed reality, such as the overlay of virtual movements onto real limbs, multi-angle visualisation, and real-time performance assessment, to improve the efficiency of motor skill instruction in online physical education, offering a technical solution that surpasses the limitations of traditional AR/VR tools.

Limitations of AR/VR in Physical Education Transfer

Although AR/VR technologies have demonstrated initial potential in the domain of sports education (Dastane et al., 2024), they predominantly rely on a passive observation-based instructional model and have not effectively addressed the fundamental challenges inherent in sports education:

a) a) Cognitive gap: learners are unable to visualise their own bodies during virtual instruction, leading to an absence of movement-based feedback (Li et al., 2022);

b) Technical gap: VR normally locks students into a single viewpoint, limiting their ability to see 3D movements or break down effectively, thereby compromising learning effectiveness (Xu et al., 2023);

c) Pedagogical gap: current implementations of AR/VR and other information and communication technologies (ICT) lack functionality for real-time error detection and correction. In other words, "timely corrective feedback" allows learners to acquire skills more efficiently (Salmoni et al., 1984). Current AR/VR/digital teaching tools are limited in providing real-time assessment and precise observation of learning during complex motor tasks, such as rapid jumps, turns, flips, and joint angle adjustments. MR technology can address this limitation through skeletal tracking and instantaneous performance evaluation.

MR as an Integrative Solution: Addressing the Deficiencies of Online Teaching and AR/VR

Although the online teaching format has made significant contributions to the dissemination of theoretical knowledge (Griffiths et al., 2022), it presents certain limitations in disciplines such as physical education and dance.

a) Assessment constraints, as they are unable to accurately evaluate movement execution (Elhaty et al., 2020);

b) Deficiencies in interactive instruction, particularly the absence of embodied, real-time guidance during remote online learning (Lakoff, 2012);

c) Contextual shortcomings, as two-dimensional video-based or prerecorded instructional formats may neglect individual differences in motor skill development (Gardner, 2011; Özdemirci, 2025; Pasandi & Abadi, 2025).

The application of AR/VR technology has been largely confined to passive observation and cannot address the aforementioned pedagogical challenges. In contrast, the MR-based physical education approach proposed in this study has the potential to bring about transformative changes in the field of education by effectively addressing the identified gaps：

1. Cognitive gap (lack of kinesthetic feedback): By utilising the capability of MR technology to integrate virtual environments with real-time interaction, students are able to observe and imitate the movements of virtual instructors, thereby effectively addressing the challenge of delayed correction of movement errors that occurs in traditional online teaching settings (Lee & Schmidt, 2025).

2. Technical gap (Perspective Limitation): By leveraging the flexibility and transparency inherent in MR technology, students can observe the virtual teacher’s movements from multiple vantage points. This effectively overcomes the limitation of a singular visual perspective commonly encountered in traditional online teaching settings, where instructors are restricted to a fixed frontal view of the screen (Chavez et al., 2025).

3. Teaching gap (lack of real-time assistance): By using the real-time motion-capture capability of MR technology, the system can synchronise learners' movements with those of a virtual teacher, thereby enhancing instructional effectiveness. This "timely correction and feedback" mechanism offers essential support to individuals undergoing motor learning (Salmoni et al., 1984). Furthermore, it functions as a virtual digital instructor operating within the learner's "Zone of Proximal Development" (ZPD), facilitating guided learning in accordance with Vygotsky's theory (1978).

Integrating MR technology and an innovative teaching model addresses the limitations of previous online teaching approaches. By synthesising Mayer's multimedia learning principles with Vygotsky's sociocultural theory, this model effectively mitigates a key challenge in distance education the "disconnect between physical engagement and cognitive processing." Operating within a deeply realistic simulated environment, it has overcome significant technical barriers. The author posits that this represents a novel pedagogical framework capable of achieving scalability, sustainable development, cost-effectiveness, and pedagogical innovation in physical education (Chu & Feng, 2021; Xu et al., 2023).

Theoretical Foundations of MENG Framework

The design of the MENG (Mixed-Reality in movement to ENGage students) module is grounded in three foundational theoretical perspectives, each underpinning a distinct dimension of the MR learning environment. Mayer's Cognitive theory of Multimedia Learning (Mayer, 2005) emphasises that learning is enhanced through the coordinated use of multiple processing channels. This principle directly informs the MR system's dual-channel presentation approach, integrating visual demonstrations with physical feedback to minimise extraneous cognitive load. Vygotsky's sociocultural theory (1978), particularly the concept of the ZPD, serves as the foundational theoretical framework for designing the MR physical system. Through features such as real-time bone overlap and corrective feedback, it is designed to act as a digital scaffold within the learner's ZPD.

In addition, to better accommodate the diverse preferences of learners in the design of mixed reality (MR) teaching scenarios, this study employed Gardner's theory of multiple intelligences (MI) as a heuristic design framework (Gardner, 2011). Given the ongoing debate about its empirical validity in educational contexts, this study does not interpret MI as a psychological or cognitive science-based theory for explaining learning mechanisms. Instead, within the scope of this research, MI functions primarily as a systematic classification tool. The proposed intelligence dimensions such as bodily-kinesthetic, musical-rhythmic, and logical-mathematical serve as practical categories for observing, describing, and classifying the varied learning tendencies and strengths exhibited by students in MR environments.

The Synthesis of Theoretical Frameworks: An Integrated Perspective

This study synthesises Mayer's and Vygotsky's theories to address core gaps in online physical education. Salomon's (1981) view of media as symbolic systems is integrated to elucidate how MR representations reshape motor cognition. Gardner's multiple intelligences theory is then applied as a heuristic to personalise instruction. This integrated framework operates through three mechanisms:

a) *Kinesthetic Feedback as an Extension of Multimodal Learning*

Real-time skeletal overlay, as a signature feature of MR technology, provides kinesthetic feedback in sports education and, together with visual demonstration, forms a dual-channel learning system, providing effective visual assistance for learners.

b) Providing Scaffolding Feedback Within the ZPD

This real-time feedback functions as a digital guide within students' ZPD, helps students progress towards autonomous performance (Vygotsky, 1978). Virtual teachers continuously offer expert guidance, support the development of motor skills, and gradually achieve learning autonomy.

c) A Pathway to Personalised Learning

MR technology integrates virtual and real worlds to create rich and fascinating learning scenarios. And meets the needs of personalised education by supporting a variety of learning activities, such as action imitation, rhythm synchronisation and self-assessment.

The Advantages of MR Technology in Physical Education

First, MR addresses mainly challenges for students from the technology perspective: low efficiency, insufficient accuracy, and difficulty keeping pace with movement rhythms. By superimposing the virtual teacher's avatar directly onto the learner's own body, it creates an immersive teaching scene to promote the embodied learning (Schack & Mechsner 2006), effectively solving the above problems. From the teaching perspective, MR provides students with actionable feedback, such as correcting their movements, helping them improve and remember better, which reduces their workload (Lindgren & Johnson-Glenberg 2013; Sigrist et al. 2013).

Second, MR transforms teaching models by supporting contextualised and interactive learning. It can be equipped with a remote teaching training and operation evaluation system, providing multiple materials such as dance works, physical teaching demonstrations, and test teaching content, so students can master the teaching content at multiple levels and dimensions and learn independently and effectively execute and internalise the movements.

Third, it ensures high-quality physical skill practice that students are not subject to space or geographical restrictions (Osman et al., 2024), and can conduct online training anytime and anywhere, verify learning results, supervise learning intensity, mobilise learning enthusiasm, and conduct tests and questionnaires through students' learning results, information feedback, and other means are used to continuously improve the teaching process to ensure that the teaching level is not inferior to offline teaching.

In summary, by addressing the documented shortcomings of online practical education, this study provides a feasible and systematic MR-based hybrid module for fields such as dance and sport.

Research Objectives and Research Questions

According to the review and analysis, it can be concluded that several research issues remain unresolved by previous studies:

1. How can learners' individualised motor skill learning needs be effectively quantified within a blended learning environment, thereby overcoming the limitations of MOOC and SPOC in providing personalised support?
2. How can corrective guidance be delivered for learners' movement performance through a mixed reality interface, addressing the shortcomings of AR and VR in terms of real-time feedback mechanisms?

This study proposes an online sports teaching model that integrates MR (Mixed Reality) technology, grounded in the instruction of online movement-based courses such as dance. The model aims to effectively address the limitations inherent in MOOC/SPOC teaching approaches, including the lack of optimal perspective observation, educational supervision, and real-time feedback. Furthermore, it seeks to enhance the constrained functionalities currently present in sports education, training, assessment, and learning processes. The main research objectives of this paper are as follows：

RQ1: How can students' learning needs in MR-based movement education be identified through a validated survey instrument?

RQ2: How can MR be exemplified as an innovative pedagogical tool grounded in established learning theories?

Mixed Research Method

This study employs a mixed-methods research design in accordance with the principle of methodological triangulation and validation strategies that enhance replication of findings (Creswell & Clark, 2017; Tashakkori & Teddlie, 2010). This mixed-research study integrated quantitative research (instrument validation) as well as qualitative research [module development following the 'Design and Development Research' (DDR) (Richey & Klein, 2007) but with only exemplary cases (i.e. students involved in the piloting of the module) reported in this article]. In the quantitative research part, the author made a survey instrument, namely "Blended Arts Curriculum Awareness Survey Questionnaire (BACASQ)" refer to Figure 1, and conducted construct validation of survey items through Exploratory Factor Analysis using SPSS.

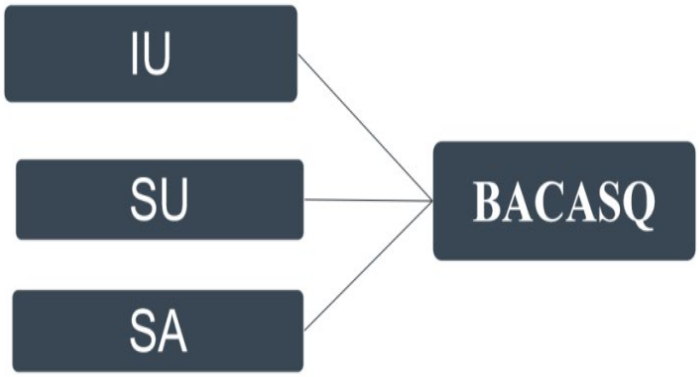

Figure 1. Conceptual framework for Blended Arts Curriculum Awareness Survey Questionnaire (BACASQ)

Research Variables Definition and Measurement Framework

BACASQ developed in this study served as the core instrument for the author's doctoral research. It was designed to collect data on students' background information, their acceptance of blended learning, and their attitudes towards MR technology. Two experts in artificial intelligence and education jointly developed the questionnaire. Following a small-scale pilot test (n = 10), it was refined for logical structure, item numbering, and instructional clarity before being distributed online. The theoretical framework of the questionnaire is grounded in three independent variables:

Internet Usage (IU)

This variable evaluates students' engagement with digital tools during online courses, including frequency of use, study duration, proportion of daily study time, and level of interest. It assesses students' proficiency with digital devices and internet usage habits—specifically accessibility, average daily online time, study time allocation, and preference for MOOC platforms. IU serves as an indicator of students' readiness to adapt to future educational technology environments and functions as a prerequisite for implementing MR-based instruction.

Students' Understanding of MOOC+SPOC (SU)

This variable measures students' cognitive understanding and practical experience with the blended learning model (MOOC + SPOC). It includes items related to familiarity with platform functionalities, frequency of use, and intrinsic motivation for learning. SU is used to gauge students' willingness to adopt MR educational technologies and to evaluate their foundational knowledge prior to implementation.

Students' Attitudes towards blended learning (SA)

This section analyzes students' attitudinal tendencies and behavioural intentions towards the "online + offline" hybrid learning model. It explores the relationship between the innovative sports education module and students' attitudes towards online learning, predicts their potential acceptance of the MR module, and identifies their demands and interests in MR technology-based instruction with particular emphasis on its interactive capabilities.

The *Dependent Variable (DV)* is defined as students' expectations and awareness regarding MOOC/SPOC courses or hybrid physical courses. Measurement items for this variable are adapted from existing literature and tailored to the context of this study. Figure 3 further situates the proposed MENG module within the contemporary blended learning landscape, depicting its role as an MR-enhanced layer interacting with MOOC and SPOC environments.

The quantitative data, collected through validated instruments, are utilised to identify patterns in learner needs, subsequently, the qualitative data were subjected to an in-depth analysis using 'Exemplary-Case Analysis' (ECA), to provide insights into how these needs are manifested within the context of MR sports education. The term "Exemplary-Case Analysis" (ECA) was introduced by Patton (2014), denotes the purposeful selection of information-rich cases. The cases selected in this study effectively illustrate how MR addresses individualised learning needs. We conducted a thematic analysis (Braun & Clarke, 2006) of the data extracted from student logs to identify recurring patterns and themes pertinent to the research questions.

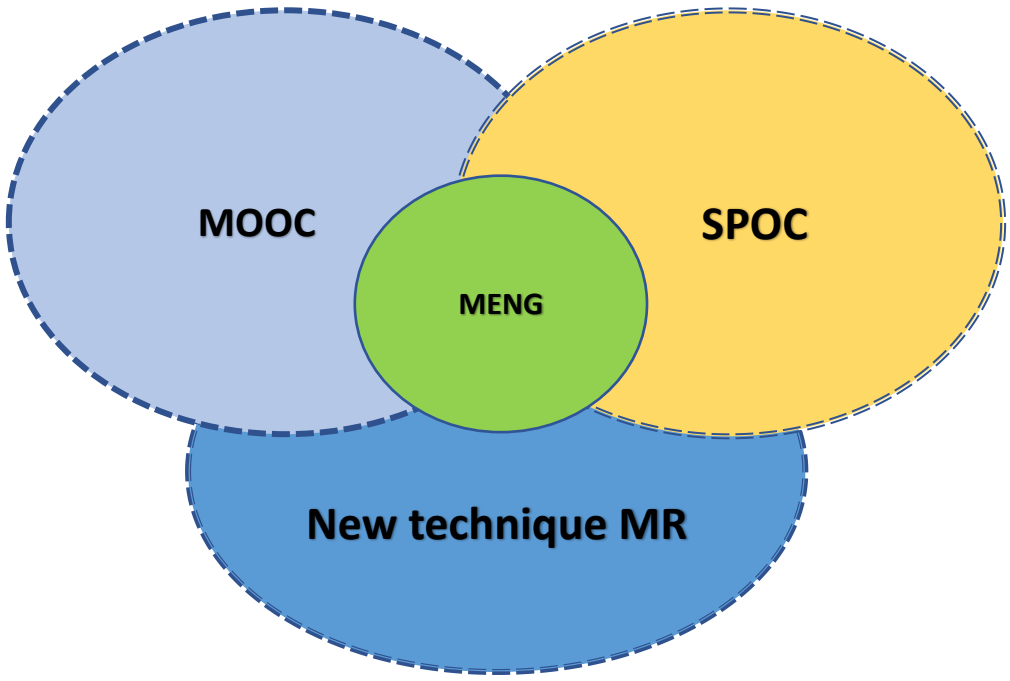

Figure 3. Visualisation of the relationship between variables Conceptual Design

The Rationality of the Research Background

According to the article by Chu and Feng, MR technology can reduce site maintenance costs by 60%, decrease the labour costs associated with repetitive teaching by educators, and extend the reusable cycle of teaching resources, thereby significantly lowering overall expenses for schools (Chu & Feng, 2021). Shaanxi Province is a region where educational inequality is particularly pronounced (Liu, 2024). In this province, rural students who constitute 43.5% of the sample (as shown in Table 1) face significant challenges in accessing quality physical education. This study employed a purposive sampling approach to recruit preschool education majors from a private university in Shaanxi province. Although they were not physical education majors, their curriculum extensively incorporated action demonstration components such as dance and motor skill training, making them suitable participants for research in physical education. Conducting research at the preschool education level holds strategic significance for the following reasons: a) Rural students often encounter issues such as limited funding, a shortage of qualified physical education teachers, and inadequate teaching facilities. MR technology offers a cost-effective solution to these challenges. For example, learning can be facilitated using standard headsets, virtual instructors can substitute for human teachers, and instruction can take place remotely, such as at home. b) The findings of this study may offer scalable solutions applicable to similar educational environments worldwide. Thus, this research in Shaanxi province aligns with the resource constraints typical of developing regions. MR is well-suited for implementation in such contexts due to its affordability, which justifies the initiation of this research.

Table 1. Basic information about the case sample in frequency statistical analysis

Frequency analysis results				
Name	Options	Frequency	Percentage	Cumulative Percentage
Gender	Boy	10	11.8	11.8
	Girl	75	88.2	100
Level of interest in dance	Not interested at all	1	1.2	1.2
	Lose interest in	1	1.2	2.4
	Normal/Neutral	59	69.4	71.8
	Quite interested	10	11.8	83.5
	Very interested	14	16.5	100
Foundation in dance	Very poor	6	7.1	7.1
	Poor	23	27.1	34.1
	Normal/Neutral	43	50.6	84.7
	Good	10	11.8	96.5
	Beyond comparison or Very good	3	3.5	100
Use which way to seek solutions	Ask the teacher for advice	15	17.6	17.6
	Communicate with classmates	36	42.4	60
	Search online	26	30.6	90.6
	Think for oneself	7	8.2	98.8
	Skip directly	1	1.2	100
Come from countryside/city	Countryside (estimated 300 km)	37	43.5	43.5
	City (estimated 100 km)	48	56.5	100
	Total	85	100	100

Quantitative Analysis and Discussion on Results

RQ1: How can students' learning needs in MR-based movement education be identified through a validated survey instrument?

A survey instrument was designed by the author to develop a research model based on the framework identified with hypothesis testing activities. The investigation items were validated through review by 2 experts and pilot testing and adhered to best practices of the mixed-methods approach (Tashakkori & Teddlie, 2010). This survey consists of 21 questions to measure the constructs relevant to this study and aims to investigate students' understanding and awareness of distance online movement, including physical, art, dance, etc. Each question was measured by a five-point Likert scale. For instance, '1' denotes 'strongly disagree', '2' denotes 'disagree', '3' denotes 'neutral', '4' denotes 'agree' and '5' denotes 'strongly agree'. Data were collected through the 'Wenjuanxing' platform online, with a total of 100 respondents. However, 85 respondents completed the survey; another 15 provided no feedback. Hence, the response
rate was 85%. The specific data analysis results are as follows:

Socio Demographic Data

The socio-demographic data are shown in Table 1. Among the samples participating this time, there were 75 girls, accounting for 88.2% of the total. Among them, the highest level of interest in movement demonstration education is average, at 69.4%, and 43 (50.6%) people with a basic level of body movements chose average. There are 36 students (42.4%) are willing to choose to solve learning difficulties through communication with their classmates, and 56.5% of them are from cities. The author summarises the Internet usage of these samples in Table 2.

Table 2. Results of students' frequency analysis of Internet use

Name	Options	Frequency	Percentage(%)	Cumulative Percentage(%)
Can use electronic devices	strongly disagree	1	1.2	1.2
	Disagree	2	2.4	3.5
	Neutral	37	43.5	47.1
	Agree	28	32.9	80
	strongly agree	17	20	100
Average time online per day	<1h	0	0	0
	1-3h	7	8.2	8.2
	3-5h	47	55.3	63.5
	5h-7h	24	28.2	91.8
	>7h	7	8.2	100
The ratio of online study time to my total study time	0	1	1.2	1.2
	<20%	2	2.4	3.5
	20%-30%	58	68.2	71.8
	30%-50%	17	20	91.8
	>50%	7	8.2	100
The main reasons to use the Internet	Other	1	1.2	1.2
	Recreation	6	7.1	8.2
	Live	53	62.4	70.6
	Work	20	23.5	94.1
	Study	5	5.9	100

Favorite way to communicate online	Other	1	1.2	1.2
	Email	2	2.4	3.5
	QQ	43	50.6	54.1
	Weibo	25	29.4	83.5
	WeChat	14	16.5	100
	Total	85	100	100

According to the questionnaire statistics, approximately half of the students have equipment that supports their online learning. The students who choose online time between 3–5 hours a day are the most, accounting for 55.3%, and 68.2% said they spend 20%-30% of their study time online; 62.4% of students said their biggest reason for using the Internet was for life, followed by work, entertainment and life. It can be seen that students' frequency of using the Internet for learning is not high. Regarding how students use the Internet to communicate, 50.6% chose QQ, followed by Weibo, WeChat, and Email. This evidence shows that students have sufficient hardware conditions to engage in online course learning and are familiar with using the Internet. If teachers can guide and make use of their daily online time, students' learning efficiency can be considerably improved.

Reliability and Validity Analysis

The data collected from the respondents were analysed using SPSS 26.0 statistical software with the following output of reliability and validity analysis as summarised in Table 3: Alpha α of the instrument variables, respectively, .808, .717, and .976; all of them were greater than 0.7, indicating that the overall reliability of the instrument is relatively excellent and has good internal consistency. Before using factor model analysis, factor model adaptability analysis was carried out on the scale data. The KMO value of the scale data was .881 > .6, and Bartlett's test of sphericity at the 0.05 significance level was passed ($P < 0.05$). This report indicates that the data of scale in this survey is particularly suitable for factor analysis.

Table 3. Test results of reliability and validity

Reliability Statistics			**KMO and Bartlett's Test**
Scale	Number of Items	Alpha	
Internet Usage	5	0.808	
Students' understanding of MOOC+SPOC	3	0.717	0.881
Students' attitudes towards blended learning	14	0.976	

Exploratory Factor Analysis (EFA) result

An exploratory factor analysis (EFA) was conducted. It should be noted that although the sample size (n = 85 for 21 items) is sufficient for the initial exploration in the framework development research, it is relatively small. Therefore, the identified factor structure should be regarded as provisional and awaits validation with a larger sample in the future. The Kaiser–Meyer–Olkin (KMO) measure of sampling adequacy was satisfactory (KMO = .881). Bartlett's test of sphericity presented values of chi-square (χ^2) = 2057.885, df = 210, and $p < .001$, which are extremely significant, thus assuming that the variables present elevated correlations.

Structural validity is to investigate the dimension division of the scale. The results of factor analysis will be discussed as follows:
According to the variance contribution rate analysis Table 4, a total of three main factors can be extracted from the 21 questions with reliability, which can reflect 74.595% > 60% of the information in the total table. Therefore, the three factors extracted this time are ideal in completely extracting and explaining the information of the original scale. Further, combined with the Table 5 Scree plot, it is clear to show that the 21 items of the scale can be divided into 3 dimensions according to the similarity of content.

After the three dimensions are obtained, it is necessary to continue to investigate which items are included in each dimension, and continue to analyse the following post-rotation load matrix in Table 6.

Looking at the Rotated Component Matrix, we can understand the result of EFA:
a) a) The load of Q13-Q22 on component 1 is relatively large, higher than 0.5, and the load of these items in other dimensions is inferior than 0.5, which means that it can be summarised as factor 1. In combination with the research content of these items, factor 1 can be named "Students' attitudes towards blended learning" (SA).
b) b) The load of Q9, Q11, and Q12 on component 2 is relatively large, higher than 0.5, and the load of these items in other dimensions is less than 0.5, which means that it can be summarised as factor 2. Combined with the research content of these items, factor 2 can be named "Students' understanding of MOOC+SPOC”（SU）.
c) The load of Q6, Q7, Q8, and Q10 on component 3 is relatively large, higher than 0.5, and the load of these items in other dimensions is less than 0.5, which means that it can be summarised as factor 3. Combined with the research content of these items, factor 3 can be named "Internet Usage"(IU).
After the adaptability verification, it is determined that the data of the scale in this survey is highly suitable for factor analysis.

Correlation Analysis Result

Pearson correlation analysis was selected to investigate the correlation between SA, SU and IU, and the results were as follows Table 7.

There was an extremely significant positive correlation ($p < .01$) between SU and IU (.477**). Moreover, there was a highly significant positive correlation ($p < .01$) between SA and IU (.439**). At the same time, there was a very significant positive correlation ($p < .01$) between SA and SU (.583**). As well as the overall satisfaction with IU, SU, and SA, respectively, the correlation values were .644, .712, and .962, and all the correlation values indicate a significant positive correlation ($p < .01$). It means there is a positive correlation between those three variables. These significant positive correlations, particularly the strong association between SA and IU ($r = .962$, $p < .01$), indicate that the sampled learners exhibit a relatively high level of acceptance of technology-enhanced learning. To further explore the nature of this acceptance and its specific manifestations in the MR learning environment, this paper employs the qualitative method of exemplary case analysis (ECA). The detailed analysis results are presented as follows.

Ethical Considerations

This study was conducted in accordance with the ethical principles outlined in the Declaration of Helsinki. Written informed consent was obtained from all participants prior to their involvement. Participants were fully informed about the purpose and procedures of the study, as well as the intended use of their data for academic research. Anonymity and confidentiality were maintained throughout the study to protect participants' privacy.

Table 4. Explained total variance

Component	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	11.983	57.063	57.063	11.983	57.063	57.063	9.836	46.84	46.84
2	2.192	10.436	67.499	2.192	10.436	67.499	3.069	14.616	61.456
3	1.49	7.096	74.595	1.49	7.096	74.595	2.759	13.139	74.595
4	0.941	4.48	79.075						
5	0.647	3.081	82.157						
6	0.619	2.947	85.104						
7	0.562	2.677	87.781						
8	0.503	2.396	90.177						
9	0.405	1.929	92.106						
10	0.323	1.536	93.642						
11	0.283	1.346	94.988						
12	0.228	1.085	96.073						
13	0.2	0.952	97.025						
14	0.159	0.759	97.785						
15	0.125	0.597	98.382						
16	0.099	0.474	98.856						
17	0.078	0.372	99.227						
18	0.059	0.283	99.51						
19	0.053	0.25	99.76						
20	0.035	0.165	99.925						
21	0.016	0.075	100						

Extraction Method: Principal Component Analysis.

Table 5. Scree Plot

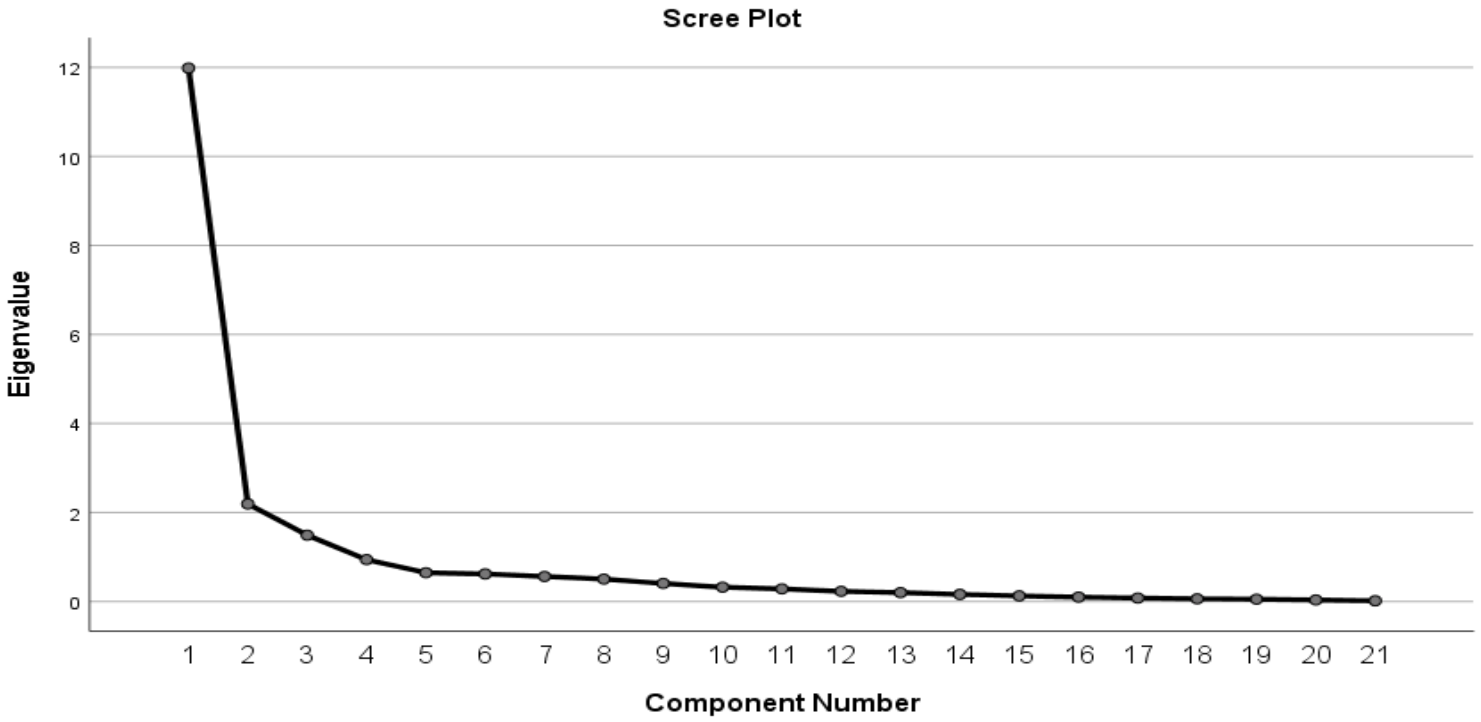

Table 6. Rotated Component Matrixa and Factor Loadings

Rotated Component Matrixa				
Items	**Scale Description**	**Component**		
		Factor 1	**Factor 2**	**Factor 3**
20	I think blended learning based on network platform can promote learning better	0.911		
19	For online + physical classroom, I need to get the teacher's guidance	0.898		
21	I am willing to take the initiative to do the exercises or tests released before the class in blended learning	0.896		
17.E	The following is the learning style I prefer: Online + Classroom teaching	0.891		
22	Blended learning will issue self-evaluation or after-class test, I am willing to take the initiative to review and summarize	0.89		
18	If the teacher uses the teaching method of network + physical classroom, my attitude	0.886		
15	If there is an online platform to aid earning, I am willing to learn the relevant resources on this platform	0.878		
17.C	The following is the learning style I prefer: Online learning	0.878		
17.D	The following is the learning style I prefer: Online + physical class	0.859		
16	If there is an online platform to assist learning, I am willing to interact with teachers and classmates through this platform	0.783		
17.A	The following is the learning style I prefer: Neither like	0.718		
17.B	The following is the learning style I prefer: Classroom teaching	0.666		
13	Which of the following MOOCs and SPOC platforms I have visited	0.657		
14	I prefer a results-only evaluation	0.554		
11	I am familiar with MOOCs and SPOC?		0.745	
12	I have visited MOOC or SPOC platforms		0.69	
9	The main reason I use the Internet is Others/Entertainment/Life/Work/Learning		0.623	
7	The average time I spend online per day is approximately			0.808
6	I have access to use electronic devices with Internet access (such as mobile phones, computers, iPads, etc.)			0.767
10	My favorite way to communicate online is Others/Email/QQ/Weibo/WeChat			0.685
8	According to previous experience, the proportion of my online study time as compared to my total study time is			0.662
	Extraction Method: Principal Component Analysis. Rotation Method: Varimax with Kaiser Normalization. a Rotation converged in 6 iterations.			

Table 7. Pearson correlation analysis result

	1 IU	2 SU	3 SA	4 Overall awareness
1 IU	1			
2 SU	.477**	1		
3 SA	.439**	.583**	1	
4 Overall awareness	.644**	.712**	.962**	1

N = 85; **p < .01

Qualitative Analysis and Discussion on Results

Exemplary cases were selected using purposeful sampling (Patton, 2014), guided directly by the quantitative findings. Specifically, the strong positive correlation between SA and IU (r = .962) reflects a high degree of technological acceptance. Therefore, a two-step screening approach was implemented: 1) quantitative screening to identify students exhibiting elevated composite scores on the SA and IU scales; 2) qualitative purposeful sampling to deliberately select individuals with diverse self-reported learning preferences from this subgroup.

RQ2: How can mixed reality be exemplified as an innovative pedagogical tool grounded in established learning theories?

Qualitative Analysis Anchoring on Relevant Theories

Qualitative data analysis is implemented in response to RQ2. The researchers' exemplary-case analysis (ECA) revealed that MR-driven educational systems can create individualised, engaging experiences. To analyse and address the diverse learning preferences reflected in the data, MI theory serves as a heuristic framework, and this approach aims to promote quality education (SDG No.4) in sustainable development education. This study is anchored in the sociocultural theoretical framework of Soviet psychologist Lev Semenovich Vygotsky, as the samples involved come from diverse sociocultural backgrounds before entering a physical or movement education programme. He believed that parents, caregivers, peers, and culture play a major role in a person's higher-order brain functions. He thought that human development relies on social interaction and, therefore, can differ among cultures (Vygotsky, 1978; Daramola et al., 2024).

The concept of multiple intelligences is a theory developed by Harvard psychologist Howard Gardner, who first outlined his theory in his 1983 book Frames of Mind: A Theory of Multiple Intelligences, arguing that there are nine types of human intelligence: 1. Visual-spatial, 2. Linguistic-verbal, 3. Logical-mathematical, 4. Body-kinesthetic, 5. Musical, 6. Interpersonal, 7. Intrapersonal, 8. Naturalistic, 9. Existential intelligence. This theory offers a comprehensive understanding of the various abilities and talents people possess and is widely welcomed by educators (Gardner, 2011). This article just needs four of them. The author, according to the learner's unique style, creates a personalised MR movement education (Gardner, 2011; Al-Qatawneh et al., 2021). By integrating MR into the learning process with exemplary cases extracted from the movement education module, as illustrated in Figure 2, movement educators can promote illustrative, engaging, and contextualised learning environments that meet the needs of learners from diverse socio-cultural backgrounds. Moreover, it facilitates curriculum implementation by enabling flexible adjustments to support students' learning in a hybrid mode.

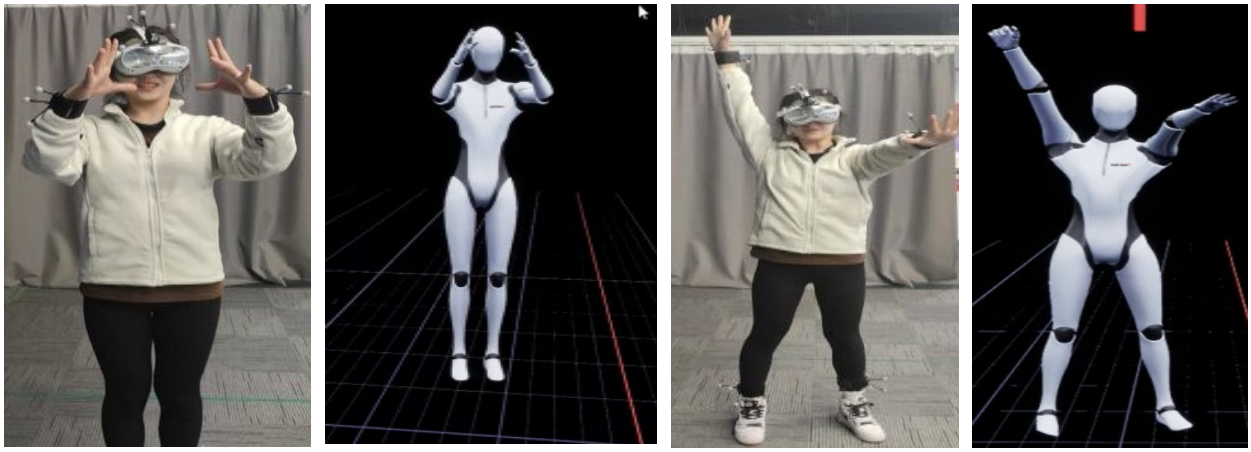

Figure 2. Facilitating the Development of Students' Motor Skills through Virtual Teacher Guidance

Data Collection Methods Supported by Blended Mode Platforms

This study integrates the aforementioned concept into the design of the questionnaire items, ensure the systematic consistency and coherence between the application of theoretical frameworks and the utilisation of empirical evaluation tools, for example: Q19 highlights the necessity of teacher guidance for learners, which is closely associated with the theory of social interaction. In this context, the online platform within the "online + physical classroom" model can be considered a cultural tool that facilitates learning and interaction. Q16 talks about interaction with teachers and classmates, social interaction theory and cultural tools theory. The learning process is collaborative and interaction with teachers and peers is the basis of Vygotsky's theory (social interaction promotes cognitive development), online platform can be used as digital tool for interaction and learning, Q10 talks about cultural tools theory, QQ, WeChat, Weibo and other online communication methods are language and symbols system emphasised by Vygotsky for communication, and communication itself is social interaction.

Email/QQ/Weibo/WeChat is used for information exchange and cognitive development, and understand the key to students accept blended learning and MR. At the same time, Salomon's theory of symbolic representation (1981) also highlights the significance of symbolic systems in cognitive processing. This theoretical framework is evident in Q10 emphasis on digital communication platforms such as QQ and WeChat. As digital symbolic systems, these platforms facilitate kinesthetic feedback, such as virtual bone overlay in MR technology, thereby effectively reshaping an individual's cognitive structure related to motor skills. Mayer's theory of multimedia learning (2005) suggests that the integration of multiple modalities can enhance cognitive processing. Q20 investigates the incorporation of visual and kinesthetic dual feedback by learners in blended learning environments. Q21 corresponds to the concept emphasised in Mayer’s theory, which highlights the importance of active participation in constructing deeper understanding.

Under this platform, students train on movement learning that is divided into two parts. Through the MR system, a virtual bone map is designed in advance in the system (as aforementioned in Figure 2), based on the motion capture technology, forming a virtual human, and completing a series of movements. The students follow the movements according to the demonstration movements made by the skeleton diagram. No matter where students come from or where they are, they can learn online movement through this technology.

Analytical Procedure

This study conducted a systematic coding of the relevant content using a set of thematic labels (e.g., Bodily/Kinesthetic, Music/Rhythm) to categorise student feedback, as presented in Table 8. The qualitative data obtained from student journals. The thematic analysis method proposed by Braun and Clarke (2006) was employed for data analysis. The analytical process rigorously adhered to the six phases of thematic analysis:

1) Familiarisation with the data content;
2) Generation of initial codes (e.g., "interaction with virtual teachers," "perceived improvement in accuracy," "appreciation of multi-angle views");
3) Identifying themes related to personalised learning experience and learning needs;
4) Reviewing these themes;
5) Ultimately defining them;
6) Preparing the report.

The analysis was guided by key concepts from Vygotsky's sociocultural theory of learning, which were used to interpret how the features of MR support student learning and address diverse educational needs.

Qualitative Insight: Confirming the Impact of MR on Diverse Learning Needs

The journal of the students additionally substantiated the quantitative findings on SA. They conveyed a strong level of enthusiasm and interest in the application of MR in physical learning. Notably, these qualitative responses included specific examples illustrating how MR effectively addressed key limitations identified in the research, such as the lack of kinesthetic feedback, offering a clear explanation for the students' highly positive attitudes, as reflected in their high SA scores. For example, students commonly noted a "reduced motion error rate," a finding that aligns closely with the factor loading of Q20 (.911). This demonstrates the perceived efficacy of the real-time feedback mechanism provided by MR in enhancing learning outcomes. Similarly, students reported being "more willing to communicate with the instructor" within the virtual environment. This observation corresponds directly with Q19 (.898) and provides empirical support for Vygotsky's theory, which emphasises the importance of social interaction in cognitive development.

The reduction in error rates observed during motor learning, along with the emphasis on real-time feedback assessment, illustrate the advantages and preferences associated with body coordination and motor skill acquisition in the MR physical environment. These findings are categorised as experiences related to the domain of BK. Moreover, within the virtual environment, they were more inclined to communicate with teachers, finding the experience highly engaging. This aligns with Vygotsky's (1978) perspective that social interaction and guided support are essential factors in cognitive development, particularly within the Zone of Proximal Development. The students believe that these characteristics are essential for improving the acquisition of physical skills and enhancing cognitive engagement. On the other hand, participants believed that innovative teaching methods would enhance their motivation to actively explore knowledge. The reflections documented in the journal illustrate the varied learning preferences among students. Some learners rely on visual feedback, others engage in rhythm-synchronised learning, and some are accustomed to action-stack strategies for self-correction. This MR-based teaching approach can effectively support learners with diverse needs while also promoting the development of a range of motor skills. Combined with factor analysis, the findings indicated that "I think blended learning based on network platform can promote learning better" (Q20 = .911) and "For online + physical classroom, I need to get the teacher's guidance" (Q19 = .898) in the questionnaire. Additionally, "I am willing to take the initiative to do the exercises or tests released before the class in blended learning" (Q21 = .896). The three factors with the highest factor loading values exhibit consistency, thereby ensuring

the reliability of the qualitative analysis presented in this study. These qualitative insights not only confirm the high factor loadings of items such as Q19 and Q20 but also deepen our understanding by illustrating specific learning outcomes, including reduced error rates and increased willingness to communicate that support the observed positive statistical associations.

Discussion

The results presented in Table 6 indicate an extremely strong loading value for SA (e.g., Q19 = .898, Q20 = .911, Q21 = .896), which aligns with the findings from the qualitative analysis. Both quantitative (Q19, Q20) and qualitative data indicate that a reduction in movement errors is associated with a greater willingness to communicate with the coach, which reflects the core mechanism of the proposed framework.

Specifically, the reduction in movement errors and the high scores on items related to instructional clarity (Q20) indicate that the MR system effectively reduced unnecessary cognitive load, which is consistent with the principles of multimedia learning. Additionally, the increased interaction with the virtual coach and the improvement in movement accuracy suggest that the MR-based feedback functioned as a digital scaffold within students' ZPD, providing targeted support for skill acquisition. Features such as rhythm synchronisation further demonstrate that MENG is capable of adapting to different learning preferences and offering practical design insights for educators. Figures 4–6 show how MR effectively engages students in movement learning.

This real-time embodied experience of observation and learning is believed to enhance learning outcomes by grounding cognitive representations in physical actions (Wilson, 2002; Barsalou, 2008). The primary advantage of this study lies in the ability of MR technology to completely harness this potential to support physical education (Lindgren & Johnson-Glenberg, 2013). The movements observed through MR technology can reduce errors, suggesting that real-time skeleton overlay and enhanced feedback play a critical role in physical education, particularly for novice learners (Wulf & Shea, 2002; Schmidt & Lee, 2019).

The above findings validate the conceptual framework constructed in this study (Table 9). This framework systematically integrates motor learning theories with specific functions through four theory-driven MR innovations: (1) real-time skeletal overlay, (2) multi-angle observation, (3) rhythm-synchronised feedback, and (4) scaffolded self-comparison. It aims to address core shortcomings in online sports education, such as the lack of feedback and limited perspectives. These functions collectively transform traditional passive video learning into an interactive and immersive educational experience.

In conclusion, the empirical results of this study support the validity of the MENG framework. In the immersive learning environment constructed by MR, the multimodal design based on multimedia learning theory reduced students' cognitive load, while the real-time feedback provided in accordance with the theory of the zone of proximal development effectively promoted the acquisition of motor skills. Embodied interaction achieved through symbolic media (Salomon, 1981) has reshaped the cognitive representation of movement. Furthermore, the system’s inclusive design demonstrates accommodating diverse intelligence profiles, as illustrated through scenarios inspired by concepts such as Gardner’s multiple intelligences, enabling personalised and differentiated learning experiences. The collaborative effect of these theories in the teaching process has jointly verified the potential of the MENG framework in enhancing students’ motor skills and learning engagement, providing a blueprint for designing future human-centered immersive learning environments.

Table 8. Classify student feedback using Gardner's theory of multiple intelligences as a heuristic framework

Criterion	Student A	Student B	Student C
Body/Kinesthetic (BK)	The body movements are well-coordinated.	It provides a comprehensive perspective on the virtual teacher, thereby enhancing cognitive understanding.	Appreciating an issue from multiple perspectives is highly intriguing and offers valuable insights.
Music/Rhythm (MR)	Motor skills are generally easier to acquire and master through practice and repetition.	The accuracy of controlling music has improved.	With the integration of technology, learning efficiency can be significantly enhanced compared to independent learning.
Logical/Mathematical (LM)	It is evident that the error rate associated with the movement has decreased.	The success rate of the action has increased.	The movements can now be synchronised with the beats, and individuals are able to independently perform a sequence of movements in a timely manner.
Intrapersonal (INR)	The interaction with the virtual teacher is highly engaging, and I find this teaching method to be both effective and enjoyable.	I find this technology to be highly innovative. The kinesthetic feedback feature facilitates regular self-reflection.	This technology has effectively reduced the communication barriers between myself and my instructor.

Table 9. Motor Learning Mechanisms Embedded in MENG Framework

MR Design Feature	Motor Learning Theory	Theoretical Action Mechanism	Target Dance Deficit
Real-time Skeleton Overlay (Fig 5)	Visuomotor Coupling (Lee & Schmidt, 2025)	Virtual bones function as an instantaneous spatial reference for the detection and analysis of errors.	To address the issue of inaccurate limb positioning and positioning discrepancies during the online teaching process.
Multi-angle Observation (Fig 4 - 6)	Egocentric Encoding (Chavez et al., 2025)	Enable learners to observe movements from critical angles, including the positioning of the arms above the head and low-angle footwork, among others.	To address the limitation of a single teaching screen in online education, Mixed Reality (MR) enables students to observe the teacher's movements from a full 360-degree perspective within a virtual environment.
Rhythm-synchronised feedback (Fig 5)	Symbolic Mediation of Rhythm (Salomon, 1981)	Real-time auditory cues, such as metronome pulses, elicit precise muscle adjustments to align with the choreography tempo, thereby synchronizing movement phrasing with musical beats.	When the limbs are moving rapidly, such as during a teacher's demonstration of high-speed actions like rotation, jumping, and flipping, students can control the teaching screen within the MR environment and utilize functions such as pause, acceleration, deceleration, and repetition for enhanced instructional viewing.
Student's First-Person Perspective (Fig 5)	Scaffolded Feedback & Comparison (Vygotsky, 1978; Salomon, 1981)	The learner's actions partially coincide with those of the teacher, facilitating timely comparison and enabling effective error correction.	To address the issue of the absence of kinesthetic feedback during online learning

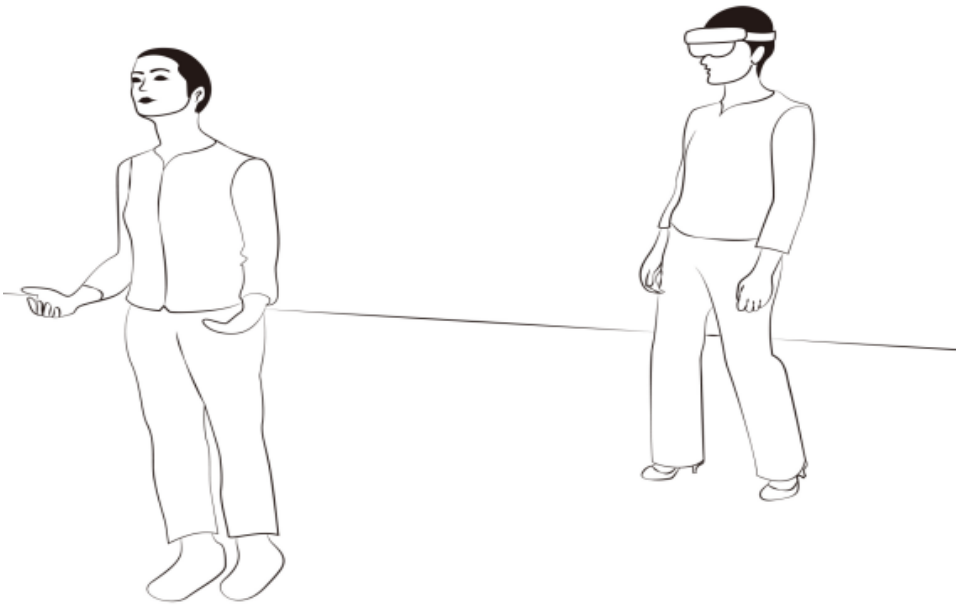

Figure 4. Student's First-Person Perspective: Virtual Instructor Superimposed in the Real-World

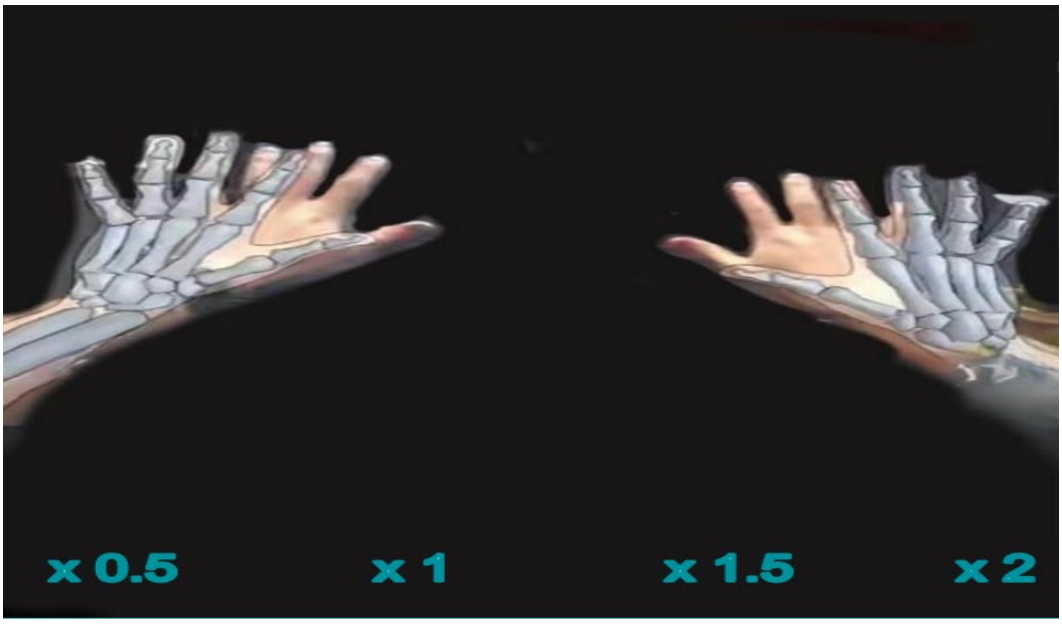

Figure 5. Student's First-Person Perspective: Exploring Embodied Cognition within the Overlap of Virtual and Real Actions

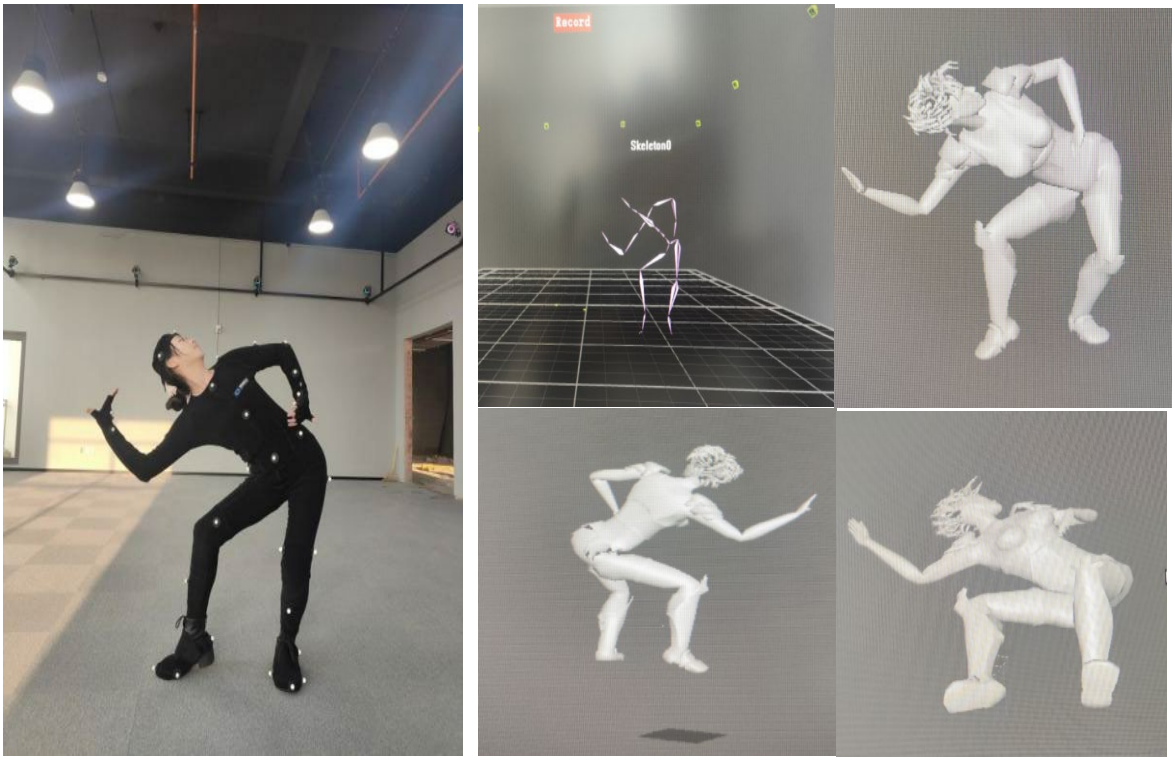

Figure 6. MR Omnidirectional Perspective: Enabling Multi-dimensional Observation and Knowledge Acquisition

Conclusion

The advent of the emerging technology era has opened up different models of digital learning tools, such as AR, VR and the latest MR (Meng et al., 2025). As a form of performance art, movement education requires a personalised learning model to influence the diverse needs of students under the guidance of educators. This study demonstrates that MR can transform physical education by providing personalised, cost-effective learning that adapts to student needs (Wu et al., 2023). This article reports on a mixed methods study that has developed a survey instrument to examine the module's learners' needs and understand their understanding and acceptance of hybrid models in physical education including dance and sport.

Furthermore, by integrating MR into the learning process outlined in the module, educators can promote an engaging and contextualised learning environment. Since mixed reality promotes personalised learning, it provides inclusive education for all, including students from different socio-cultural backgrounds, thereby actively contributing to the integration of quality education with new emerging technologies, which is also part of the Sustainable Development Goals. Moreover, MR technology not only facilitates curriculum implementation in hybrid modes but also holds significant promise for the education sector by promoting sustainability and contributing to several Sustainable Development Goals.

Summary and Implications for Academia

Theoretical and Methodological Contributions

By analyzing the shortcomings of online movement teaching, this study provides a feasible, systematic and targeted curriculum or module using hybrid teaching for college teaching. This will not only improve the theoretical explanatory power but also enhance the practice of blended teaching in college movement education. It also contributes to the theoretical and

methodological advancement of training, providing a framework for integrating modern educational resources into college movement teaching and fostering innovation in the AI era.

Practical Implications for Teaching and Curriculum Design

The significance of this study lies in creating a novel teaching module using a mixed research method to enhance the online teaching mode. It examines whether mixed reality teaching may be a useful method for movement education in higher vocational colleges in Shaanxi Province, China. The research serves as an example of how MR techniques can be used to teach students physical education to facilitate learning and demonstrate the effectiveness of this course. The research findings indicate that MR can serve as a valuable tool for educators by enabling the development of a comprehensive teaching framework encompassing instructional design, management, assessment, and supervision, thereby supporting learner success.

Limitations of MR Technologies for the Education Sector and Future Research

First, due to time constraint, no more Confirmatory Factor Analysis (CFA) is made.
Second, the sample size for the exploratory factor analysis was moderate. Future research could validate it in a larger sample. Third, it was found that the correlation between the two variables in the quantitative analysis, 'students' attitudes towards blended learning (SA) and 'Internet Usage (IU)', was extremely high (r = .962). This might reflect a certain degree of construct overlap in the measurement tools or be influenced by common method bias. Future research should further distinguish and validate these different related constructs.
Fourth, since this research will incorporate different technologies, the first difficulty faced is the possible lack of support from MR-related technology companies to provide technical services/experience for this project. As the researcher's background is not in computer science, it was challenging to identify the most suitable MR-related technology company for collaboration. Thus, this area presents numerous novel challenges, such as nomenclature, modern technology involves tools. Fifth, this research requires collaboration with content/technology experts because MR is a modern concept. Due to no researcher who is studying physical major and computer major at the same time, it is a challenge for the author to find the best experts who are really proficient in both specialties. Sixth, it might face technical failures. New technology must involve extra facilities and systems, which is one part of the problem will make the progress of this research more difficult. For example, there may be issues with the digital divide and Internet access, etc. Seventh, the experiment took place in Shaanxi province, China, and the subjects were students from higher vocational colleges in private universities in the province, majoring in preschool education. This is also the restriction of this technology in the programme process. If more professional students can try to experience MR technology, and more universities and provincial and municipal schools participate in this project, the data obtained will be more perfect and reliable.

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Disclosure statement

The author declares no conflicts of interest related to this research.

Declaration of Generative AI and AI-Assisted Technologies in the Writing Process

During the preparation of this manuscript, the authors used DeepSeek to assist with improving language clarity, grammar, and phrasing. The authors carefully reviewed and revised the output to ensure accuracy and consistency with the intended meaning and take full responsibility for the content of the final manuscript.

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ORIGINAL RESEARCH ARTICLE

Beyond the Games: Media Visibility and Framing of the Paralympic Games in Greece (2016–2024)

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Abstract

In recent years, the media visibility and framing of the Paralympic Games have received considerable attention because of their potential to raise awareness of disability and promote societal change. This study had two objectives: (i) to examine the media visibility of the 2016, 2020, and 2024 Paralympic Games in Greek media, and (ii) to analyse how the Games were framed in selected national newspapers and news websites. Quantitative and qualitative content analyses were employed. The quantitative analysis measured the total hours of coverage provided by ERT, Greece's official Paralympic media rights holder, and the number of articles published by nine selected national newspapers and news websites (N = 814: 203 in 2016, 210 in 2020, and 401 in 2024). The qualitative analysis examined the same 814 articles using nine coding units: Informative, Athlete First, National Success, Publicity, Supercrip/Superhuman, Multidimensional, Impact of the PG, Business, and Political/Legal. The visibility of the Paralympic Games in the selected newspapers and news websites increased by 3.45% from 2016 to 2020 and by 90.95% from 2020 to 2024. In contrast, ERT television coverage declined by 6.96% from 2016 to 2020 and by a further 9.35% from 2020 to 2024. In 2016, Athlete First and National Success were the dominant coding units, while Athlete First remained dominant in 2020 and 2024. The underrepresentation of foreign athletes' achievements, including world records, and the continued prominence of the National Success frame indicate a strong nationalistic focus and suggest that the broader significance of the Paralympic Games may be undervalued in Greek media. Although the low prevalence of the Supercrip/Superhuman frame is encouraging, the nationalistic focus may limit broader recognition of Paralympic accomplishments.

Introduction

The media play an important role in shaping social attitudes, beliefs, and perceptions by influencing what is considered socially acceptable (McQuail, 1977). Because people spend considerable time engaging with media, this influence extends beyond entertainment: the media can reinforce existing stereotypes or, in some cases, challenge them and affect social realities (Biagi, 2014; Zucker, 1978).

In representations of disability, media coverage has been criticised for contributing to social marginalisation through limited visibility and simplified or stereotypical narratives (Pullen et al., 2022). According to mediated contact theory, people may form perceptions and

attitudes towards disability through the media (Ortiz & Harwood, 2007). Perceptions of people with disabilities are therefore closely linked to how they are portrayed.

Although visibility has increased over time, representation remains uneven (DePauw & Gavron, 2005). People with disabilities continue to be underrepresented in the media, even though they comprise approximately 16% of the global population (Brittain, 2008; World Health Organization, 2023). When disability is represented, coverage often relies on outdated or medicalised narratives that portray people with disabilities as dependent, abnormal, objects of pity, asexual, or even villainous in fictional accounts (Esmail et al., 2010; French & Le Clair, 2018; Norazit, 2010; Teng & Tang, 2020). Such portrayals reflect the medical model of disability, which treats disability as a deviation from an idealised body rather than as a natural aspect of human diversity (French & Le Clair, 2018).

Within disability sport, media coverage can shape public understanding of both athletes and disability (Rees et al., 2019). The Paralympic Games (PG), the largest sporting event for athletes with disabilities, provide a unique platform for increasing the visibility of disability sport in global media (Brittain, 2008). Despite this potential, coverage of the PG remains limited and is often accompanied by stereotypical or inspirational narratives that may reinforce existing biases (Brittain, 2008; Tynedal & Wolbring, 2013).

The International Paralympic Committee (IPC) promotes a vision of an inclusive world through Para sport (IPC, 2016), and achieving this vision is closely linked to the quality and extent of media representation. Effective representation can shape societal perceptions, reduce prejudice, promote social inclusion, and enhance public awareness of disability sport (Souza et al., 2020). The impact of the PG can be strengthened through greater media coverage and sustained commitment from stakeholders, including sports governing bodies, media organisations, and broadcasters (Chatzigianni, 2018).

Disability and Media in Greek Society

In Greece, policies and services for people with disabilities developed later than in many Western European countries, partly because of the country's historical and political challenges during the early twentieth century (Balias & Kiprianos, 2005). Periods of conflict, including the Balkan Wars (1912–1913) and the Italian and German invasions (1940–1941), contributed to economic instability and delayed the development of social policy. Substantial efforts to support people with disabilities emerged after democracy was restored in 1974 following the fall of the military junta. This period marked the first major initiative to provide education for children with disabilities (Balias & Kiprianos, 2005).

Although progress followed, particularly after Greece joined the European Union (EU) in 1981, barriers to full social integration have persisted in areas such as education and sport (Avgerinos, 2000; Balias & Kiprianos, 2005). In recent decades, Greek constitutional and legal frameworks have increasingly recognised disability rights. Article 4 of the Greek Constitution establishes equal rights and obligations for all Greek citizens, irrespective of disability status, while Article 21(6) provides for measures that support autonomy, professional integration, and participation in the country's social, economic, and political life (Hellenic Parliament, 2019).

In practice, however, policies often focus on subsidies rather than structural measures that support long-term financial independence. Data from the 2003 Labour Force Survey illustrate these challenges: 18.2% of the Greek population had a chronic health condition or disability, yet only 18.4% of this group was economically active (Gavalas & Papanis, 2013). Employment therefore remained low, despite educational attainment, and healthcare provision became increasingly constrained during the economic crisis. Many people depend on government subsidies, which may be suspended during lengthy medical re-examination procedures (Koutsothanasi & Katsarou, 2014).

Recent Eurostat data highlight continuing challenges across Europe. In 2023, approximately 27% of the EU population aged 16 years or older reported some form of disability. Among people with disabilities in the EU, 17% of those aged 20–64 were unemployed in 2020, while 28.8% of people with disabilities aged 16 and over were at risk of poverty or social exclusion in 2024. Moreover, data from the Council of the European Union (2024) show that in Greece, the proportion of people with disabilities was 23.1% in the same year. These figures indicate that, despite legislative progress, the social and economic integration of people with disabilities in Greece remains incomplete. Addressing these challenges requires a shift from passive financial support towards policies that promote autonomy, employment opportunities, and meaningful inclusion in all areas of society.

Within this broader social context, media representation plays an important role in shaping public perceptions of disability. Although disability is no longer hidden in Greek society, stigma and marginalisation persist (Koutsothanasi & Katsarou, 2014). Zoniou-Sideri et al. (2006) described a 'new visibility' of disability in Greece during the twenty-first century, linked to broader efforts towards inclusion. However, greater visibility does not necessarily produce more balanced representation, and media coverage may continue to reproduce outdated terminology and stereotypical frames (Kim et al., 2017).

The Paralympic Games in Comparison with the Olympic Games

The Olympic Games (OG) and the PG have been hosted in the same city since the 1988 Seoul Games, reflecting sustained collaboration between the International Olympic Committee (IOC) and the IPC (Kim et al., 2017). The events are also connected through their scheduling, as the PG begin shortly after the OG conclude (Pappous et al., 2011). The term 'Paralympic' derives from the Greek preposition para, meaning 'next to', rather than from the word paraplegic (IPC, 2016). The name therefore signifies that the PG take place alongside the OG. Both events pursue high standards of sport and performance (Purdue, 2013), and athletes in the two events show similar levels of motivation, self-esteem, and body image (Dieffenbach & Statler, 2012). These similarities support the expectation of equitable public and media attention.

In practice, the PG receive substantially less media visibility than the OG (Ellis & Goggin, 2015; Tynedal & Wolbring, 2013). Historical factors may partly explain this disparity. The first modern OG were held in 1896, whereas the PG began in 1960 (Gold & Gold, 2007). The OG have also been televised for longer, beginning in 1936, while regular television coverage of the PG began in 1992 (Rees et al., 2018). Nevertheless, several decades have passed since Paralympic broadcasting began, and coverage, the number of participating athletes, and the popularity of the Games have all grown (Kolotouchkina et al., 2021). Substantial inequalities in coverage of the two events nonetheless remain (De Léséleuc et al., 2010).

Agenda-setting theory provides a useful framework for understanding the consequences of these disparities. The theory proposes that the media visibility of an event influences how the public perceives its importance (Baran & Davis, 2003; McCombs & Shaw, 1972). The systematic prioritisation of the OG may therefore lead audiences to perceive the PG as a secondary sporting event.

Evidence from several countries illustrates this disparity. For example, American newspapers published 2,561 articles about the 2002 Winter OG in Salt Lake City but only 13 about the 2002 Winter PG (Golden, 2003). Similarly, between 1955 and 2012, 10,487 articles addressed the OG, compared with only 246 concerning the PG (Tynedal & Wolbring, 2013). In South Korea, coverage of the 2004 OG included 220 photographs and 261 articles, whereas coverage of the 2004 PG included only 17 photographs and 16 articles (Chang & Crossman, 2009).

Broadcast media show similar patterns. In Canada, the 2012 OG received approximately 5,500 hours of television coverage, while the PG received only one hour per day on television, supplemented by 500 hours online (Maika & Danylchuk, 2016). In the United Kingdom, approximately 100,000 hours were broadcast for the OG, compared with 500 hours for the PG (Ormsby, 2012). A similar pattern appeared in Singapore, where the 2016 OG were broadcast for 12 hours per day and the PG for two hours per day. These differences illustrate how media agendas prioritise Olympic sport over Paralympic sport.

Grigoris Polichronidis, Greece's flag bearer at the 2016 PG, noted that the PG receive substantially less media visibility than the OG, even though they are equally spectacular (News24/7, 2016). He also identified barriers such as smaller budgets, fewer broadcast outlets, fewer staff, and limited coverage of many Paralympic sports. Research likewise indicates that Paralympic athletes and Olympic athletes receive different levels of social recognition and financial reward (Brooke, 2019; Tynedal & Wolbring, 2013). In Singapore, for example, an Olympic gold medallist received SGD 1 million, whereas a Paralympian who won two medals and set world records received SGD 200,000 per medal (Brooke, 2019). These inequalities reinforce a hierarchy of perceived value in which social structures favour Olympic achievements.

This pattern reflects a belief among some media producers and programmers that Olympic coverage is more important than Paralympic coverage (Brittain, 2004, 2008). As a result, the PG may be marginalised within society (Smith, 2016).

Inequality in media coverage of the OG and PG extends beyond the number of articles or broadcast hours. Differences also occur in broadcast channels, scheduling (including access to peak viewing periods), and the placement of articles in print journalism, all of which shape audience exposure and engagement (Chang & Crossman, 2009). In Australia, for example, the PG were broadcast on 7Two, a Seven Network channel promoted as an entertainment channel.

In contrast, the OG were broadcast across three Seven Network channels and highlighted on the network's primary channel, Channel 7. Paralympic coverage was frequently scheduled outside peak viewing periods (Rees et al., 2018). In the United Kingdom, the 2012 OG were broadcast by the BBC, while the PG were aired on Channel 4 (The Guardian, 2011). Carole Neale (2000, as cited in Brittain, 2004) criticised coverage of the Sydney PG because it was limited to one hour per day and often aired while people were travelling home from work, whereas the OG received prime-time and continuous live coverage.

Limited visibility directly affects audience engagement: one study reported that 80% of respondents did not watch the PG at all (Brooke, 2019). Disparities also extend to media personnel, with approximately 9,000 journalists covering the OG compared with only 700 journalists, producers, and photographers assigned to the PG (Brooke, 2019). From an agenda-setting perspective, these differences signal that the PG are less important and reinforce the marginalisation of the Games and their athletes.

Media Coverage of the Paralympic Games

The PG remained largely invisible in the media until the mid-1970s. The 1976 Toronto Games marked the first local broadcast, although coverage was limited (Flindall, 2020). International coverage developed gradually: the 1992 PG were broadcast across Europe for the first time, while the Tokyo 2020 PG reached audiences in 177 territories (Flindall, 2020; IPC, 2021). At the Paris 2024 PG, all 22 Paralympic sports received coverage for the first time, producing the most comprehensive media coverage of the Games to date (IPC, 2024).

Research has developed alongside this growth in coverage. Pappous et al. (2011) analysed photographic coverage of the 2000 and 2008 PG in Greece, Spain, France, the United Kingdom, and Germany, identifying increases in all countries except Spain. Their study provided early evidence concerning Greek media coverage, although it focused on selected

newspapers across five countries. Increased Greek coverage may have been associated with Greece's hosting of the 2004 PG and the establishment of the Hellenic Paralympic Committee in 1999 (Hellenic Paralympic Committee, 2019; Pappous et al., 2011). A subsequent study found that coverage of the 2012 PG exceeded that of the 2008 PG by 3,070 lines of text, 79 items, and 129 photographs (Solves et al., 2019). Media attention to paratriathlon also increased from no recorded articles before 2009 to 61 articles in 2016 (Wolbring & Martin, 2018). Australia similarly experienced substantial growth in Paralympic coverage across multiple platforms between 2004 and 2012 (Naar, 2016).

The London 2012 PG represented a pivotal moment for Paralympic media visibility, largely because of Channel 4's dedicated efforts. Its 'Meet the Superhumans' campaign sought to increase visibility through approximately 500 hours of coverage and the introduction of the Lexi graphics system, which helped audiences understand athlete classification (Channel 4, 2012). Despite these advances, concerns remain about the temporary nature of this visibility (Bush et al., 2013). Overall, Paralympic visibility has increased internationally, but equitable coverage has not yet been achieved.

Media Narratives in Paralympic Coverage

Media portrayals of Paralympic athletes can shape public perceptions of both disability and athletic performance (Pearson & Misener, 2024). Research has identified recurring narratives that reflect and influence societal attitudes towards disability. Tynedal and Wolbring (2013), for example, identified two dominant narratives in The New York Times: the supercrip and the suffering entity. The supercrip narrative portrays athletes as extraordinary for performing activities that are considered routine for people without disabilities. This framing may devalue the abilities of people with disabilities, reflect low societal expectations, and reproduce the medical model of disability (Bruce, 2014; Pullen et al., 2019; Rees et al., 2019; Silva & Howe, 2012). Such narratives are often expressed through personal stories selected for their emotional appeal (Howe, 2011; McGillivray et al., 2021).

Elements of the supercrip narrative and gendered representation have also appeared in otherwise positive coverage, including coverage of the London PG and the Glasgow 2014 Commonwealth Games (McPherson et al., 2016). Beyond personal or emotional storytelling, media coverage may employ the cyborg narrative, which emphasises the integration of technological devices with athletes' bodies to enhance performance, sometimes suggesting performance beyond that of athletes without disabilities (Howe, 2011).

Multiple narratives may coexist and shape public perceptions in different ways. Canadian media coverage of the 2016 PG was categorised into four principal frames: overcoming disability, which was the most dominant and was often expressed through supercrip, superhuman, or cyborg narratives; Athlete First; Informative, which educated audiences about the PG; and Multidimensional, which represented athletes' roles beyond sport. Although the overcoming-disability frame may negatively affect social perceptions, the other three frames have been associated with more positive perceptions (Pearson & Misener, 2021). Kim et al. (2017) identified a broader set of frames: supercrip/superhuman (14.0%), optimism (18.8%), factual information about events, schedules, and records (17.0%), competition involving medal counts or rivalries (7.9%), emotional or personal stories (4.0%), business matters such as sponsorship and infrastructure (1.1%), interest in the PG (12.5%), publicity for the host city or country (5.8%), identity and social integration (13.9%), legal or political matters (1.4%), and other issues (2.7%).

Other studies have identified frames such as Athlete First, victimisation, personal stories, and infantilisation (De Léséleuc et al., 2010; Maika & Danylchuk, 2016). These frames show how media representation may shift attention away from athletic performance and towards continuous positivity or the social dimensions of the Games (Renwick, 2016). Nationalistic

frames are also common, particularly in coverage of medal success. As in Olympic coverage, nationalism can align with ableist norms by making athletes with disabilities socially recognisable primarily through their national identity (Bruce, 2014; Pullen et al., 2019).

Frames and athlete portrayals that align with ableist norms tend to receive more media attention, contributing to a hierarchy of disabilities and the persistence of the cyborg athlete. Certain impairments, including amputation, paralysis, blindness, and paraplegia, are represented more frequently, while others remain underrepresented (Tynedal & Wolbring, 2013). The hierarchy also appears to favour acquired disabilities, which may be perceived as more appealing to audiences (Ellis, 2008; McGillivray et al., 2021).

The prominence of stereotypical frames may partly reflect structural factors, including insufficient media training, limited preparation or pre-Games research among media personnel, and athletes' restricted control over their representation. These conditions may impede a shift towards more performance-focused coverage (Pappous & Gómez-Iniesta, 2025; Pearson & Misener, 2024).

The literature therefore identifies 15 recurring narratives in media coverage of the PG: (1) factual information; (2) competition information; (3) emotional or personal stories about athletes with disabilities; (4) superhuman narratives; (5) optimism; (6) business-related matters; (7) interest in the PG; (8) publicity for the host city or country; (9) identity; (10) legal and political matters; (11) Athlete First; (12) overcoming disability, often expressed through supercrip, superhuman, or cyborg narratives; (13) Informative coverage that educates audiences about the PG; (14) Multidimensional coverage of athletes' roles beyond sport; and (15) National Success, or an 'us' narrative.

Media coverage of the PG has attracted substantial international research interest (Brooke, 2019; Flindall, 2020; Kolotouchkina et al., 2021; Maika & Danylchuk, 2016; Pearson & Misener, 2021, 2024; Solves et al., 2019; Souza et al., 2020). The present study examines Greek media coverage of the 2016, 2020, and 2024 PG by combining a quantitative analysis of visibility on ERT and in selected newspapers and news websites with a qualitative analysis of framing and dominant narratives. It addresses the underexplored Greek context and assesses whether internationally documented frames, including supercrip, overcoming-disability, and nationalistic narratives, also appear in Greek media. In doing so, the study applies agenda-setting and mediated contact theories while exploring potential cultural variations in Paralympic coverage. Given the historically delayed development of disability services and structures in Greece, compared with other European countries, Greek coverage might be expected to prioritise overcoming-disability and supercrip narratives.

Materials and Methods

This study addressed two objectives: (i) to examine the media visibility of the 2016, 2020, and 2024 PG in Greek media, and (ii) to analyse how the Games were framed. A mixed-methods design combined quantitative and qualitative content analyses. Data on the Tokyo 2020 PG were collected from 2021 because the Games were postponed due to the COVID-19 pandemic. For consistency with the official event name and to facilitate comparison, this article refers to the event as the 2020 PG throughout.

Media Visibility: Quantitative Analysis

The quantitative component measured the media visibility of the PG by examining the frequency and extent of coverage across two media channels:

(i) ERT, Greece's official Paralympic media rights holder, for the 2016, 2020, and 2024 Games; and

(ii) selected Greek online newspapers and news websites.

Television Coverage

The total number of hours of television coverage provided by the Greek national broadcaster ERT was calculated. Data were extracted from ERT's publicly available online programme schedules, which provided the precise start and end times of each broadcast. Included programmes comprised live and recorded coverage of the Games and summary programmes.

For each edition of the PG, broadcast end times were entered in Column A of an Excel spreadsheet, and start times were entered in Column B. Both columns were formatted as [h]:mm:ss. The formula =A-B was used to calculate the duration of each broadcast, and the SUM function was then used to calculate the total number of broadcast hours for each edition.

Online Newspapers and News Websites

Media visibility was also assessed by calculating the number of articles about the PG published by selected online newspapers and news websites.

Articles published during a defined period, one week before the Games, throughout the Games, and one week after the Games, were considered. The periods are shown in Table 1. This timeframe captured the lead-up to each event, the Games themselves, and their immediate aftermath. All articles published by the selected outlets during each period were examined, and only articles directly related to the PG or Paralympic athletes were included. Because tags and keywords were used inconsistently across outlets, relevant articles were identified manually rather than solely through tag or keyword searches. This procedure was important because the number of articles constituted a central measure of media visibility.

To assess reproducibility, the calculation of total broadcast hours and the identification of relevant newspaper and news-website articles were each independently repeated three times. No discrepancies were observed across repetitions.

Table 1. Dates of the Paralympic Games and timeframe for article selection

Games	Dates of the Games	Timeframe
Paralympic Games 2016	7–18 September 2016	31 August–25 September 2016
Paralympic Games 2020	24 August–5 September 2021	17 August–12 September 2021
Paralympic Games 2024	28 August–8 September 2024	21 August–15 September 2024

Selection of Newspapers and News Websites

The most prominent Greek newspapers and news websites were identified from three sources, as shown in Table 2: the SCImago Media Rankings, the BBC, and 4 International Media & Newspapers (4imn), an international directory of newspapers. Using multiple sources increased the likelihood that widely used outlets were represented. Local outlets and outlets whose 2016 articles were inaccessible, approximately nine years after publication, were excluded. Nine newspapers and news websites met the criteria and were included in the analysis (Table 3): Naftemporiki.gr, Tanea.gr, Kathimerini.gr, Tovima.gr, Newsit.gr, Newsbomb.gr, News24/7.gr, Iefimerida.gr, and Reporter.gr.

Table 2. Top Greek newspapers and news websites according to the SCImago Media Rankings, 4imn, and the BBC

Top 10 Greek newspapers – SCImago	Top 10 Greek newspapers – 4imn	Top 5 Greek newspapers – BBC
In.gr	Tanea.gr	Tanea.gr
Protothema	Tovima.gr	Tovima.gr
Naftemporiki	Kathimerini.gr	Kathimerini.gr
Newsit.gr	Naftemporiki	Naftemporiki
Newsbomb.gr	Ethnos.gr	Ethnos.gr
Ethnos.gr	Eleftherotypia.gr	
Kathimerini.gr	Dimokratiki.gr	
Tanea.gr	Espresso.gr	
News24/7.gr	Reporter.gr	
Iefimerida.gr	Rizospastis.gr	

Table 3. Final newspapers and news websites included in the study

	Included	Excluded
Final Newspapers	Naftemporiki.gr Tanea.gr Kathimerini.gr Tovima.gr Newsit.gr Newsbomb.gr News24/7.gr Iefimerida.gr Reporter.gr	In.gr Protothema Ethnos Eleftherotypia Espresso

Media Framing: Content Analysis

A content analysis of articles from the nine selected outlets was conducted to examine how the PG were framed in Greek media. The dataset comprised 814 articles: 203 concerning the 2016 PG, 210 concerning the 2020 PG, and 401 concerning the 2024 PG.

Coding Process

Coding units were developed from literature on the framing of disability sport (Bruce, 2014; De Léséleuc et al., 2010; Kim et al., 2017; Pearson & Misener, 2021), following an approach previously used by Thomas and Smith (2003). Searches were conducted in Scopus, ProQuest, and Google Scholar, as well as publisher platforms including Elsevier and Springer, using the terms Paralympic Games, media, framing, visibility, media portrayal, and media coverage.

Frames identified in previous studies were collated to develop the final coding units. Frames that were labelled differently but described similar narrative patterns were consolidated into nine coding units, as shown in Table 4.

Table 4. Development of coding units from existing literature

Content units from literature	Description of content units from literature	Final coding units
Factual Information	Event information, game schedule, or game record	Informative
Competition Information	Medal counts, or rival relationship among the athletes	
Informative	Providing information	
Emotional	Personal stories about the athletes with disabilities	Supercrip/ Superhuman
Overcoming Disability	Focusing on overcoming disability	
Superhuman	Any 'supercrip' type athlete	
Optimism	Educational role model, positive future for people with disabilities, positive images of the Paralympic Games and athletes with disabilities, building a more equitable society, or changing attitudes towards people with disabilities	Impact of the PG
Interest	Interest in PG	
Identity	Social integration, self-recognition	Multidimensional
Multidimensional	Representing also the athlete's role outside the sport	
Athlete First	Focusing on athletic performance	Athlete First
National Success	Focusing on national athletes' success	National Success
Legal and Political	Legal or political support for athletes with disabilities	Political/Legal
Publicity	Major city image and publicity through hosting the Paralympic Games	Publicity
Business	Sponsorship opportunities or infrastructure development	Business

The Supercrip/Superhuman coding unit combined three closely related frames from previous literature: emotional narratives, overcoming disability, and superhuman or supercrip portrayals. These frames present athletes as inspirational figures whose courage, dedication, and hard work enable them to defy the odds and accomplish the seemingly impossible.

Factual Information, Competition Information, and Informative were combined into the Informative coding unit, which covered information about the PG, events, schedules, records, and competition. Interest and Optimism were combined into Impact of the PG, which included interest in the Games and narratives concerning a positive future for people with disabilities, positive images of the PG and Paralympic athletes, a more equitable society, and changing attitudes towards disability.

Identity, defined as social integration and self-recognition, was incorporated into the Multidimensional unit because both categories addressed athletes' lives and social roles beyond sport.

The Business, Publicity, Athlete First, National Success, and Political/Legal categories were retained without consolidation. The nine final coding units used in this study are presented in Table 4.

A single coder conducted the analysis. Before coding began, the coder reviewed the literature included in this study on disability sport and Paralympic media framing to become familiar with recurring narratives and framing approaches. The operational definitions and examples in Table 4 served as a coding guide. The coder then applied the definitions systematically to all articles, reading each article in full and comparing its content with the coding units.

Each article was assigned a maximum of two coding units. A second unit was assigned only when both frames were clearly present. When a possible second frame was uncertain or borderline, only the most strongly represented unit was recorded. If the primary frame was ambiguous, the article was re-read in full and compared again with the operational definitions.

Each assignment of a coding unit was treated as one coding entry so that an article could contribute up to two entries. An Excel spreadsheet was used to organise the coding. For each article, the applicable coding unit or units were recorded by entering 1 in the corresponding column. The SUM function was used to calculate the total occurrences of each coding unit for each outlet. This procedure was conducted separately for the 2016, 2020, and 2024 PG. Three tables were then produced to present the coding units across the nine outlets, one for each edition of the Games.

The separate collection and analysis of data for each edition enabled comparison of media visibility and framing across the 2016, 2020, and 2024 PG and provided a descriptive account of change in Greek media coverage over time. Because the study used a single coder, the findings were interpreted as descriptive trends and no generalisable claims were made.

Ethics

All television schedules, programmes, and newspaper or news-website articles included in the study were publicly accessible. No personal or private data were collected or stored. Because the research did not involve human participants or animals, formal ethical approval was not required.

Limitations of the Study

The principal limitation is that one researcher conducted all coding. The researcher's background and experience may have therefore influenced coding decisions, and intercoder reliability could not be assessed. The study was also limited to selected newspapers and news websites and excluded other outlets and media formats, which restricts the scope of the findings. Finally, because this is the first study to examine both the visibility and framing of the PG in Greek media, no directly comparable national data were available. The results should therefore be interpreted as descriptive rather than generalisable.

Results

Visibility of the Paralympic Games on ERT

The total number of hours of coverage on ERT was used to assess the broadcast visibility of the PG. Coverage was examined separately for the 2016, 2020, and 2024 editions. As shown in Table 5, ERT broadcast 115 hours in 2016, 107 hours in 2020, and 97 hours in 2024. Figure 1 shows a gradual decline in broadcast visibility, with a 6.96% reduction from 2016 to 2020 and a further 9.35% reduction from 2020 to 2024.

Table 5. Total broadcast hours of the 2016, 2020, and 2024 Paralympic Games by ERT channel

Year of Event	Total Broadcast Hours
2016	115
2020	107
2024	97

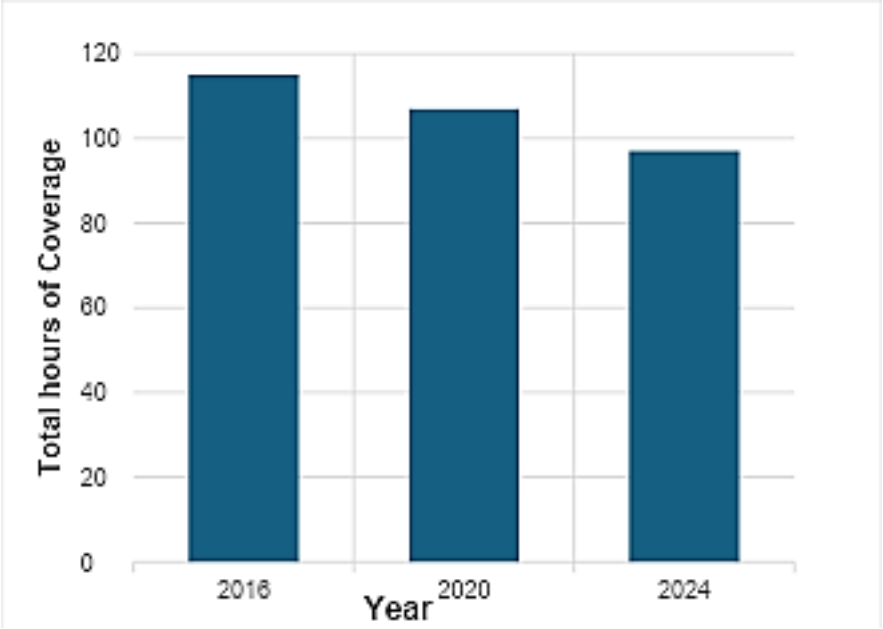

Figure 1. Total hours of ERT media coverage for each Paralympic Games (2016–2024)

Visibility of the Paralympic Games in Selected Greek Newspapers and News Websites

In contrast to television coverage, the number of articles published by the selected newspapers and news websites increased across the three editions. As shown in Table 6 and Figure 2, 203 articles were identified for the 2016 Games, 210 for the 2020 Games (an increase of 3.45%), and 401 for the 2024 Games (a further increase of 90.95%). This pattern indicates substantial growth in attention within the selected outlets, particularly between 2020 and 2024.

Some articles from the 2016 Games were no longer accessible because they had been published approximately nine years before the study. To improve comparability across the three editions, outlets with inaccessible 2016 data were excluded.

Table 6. Number of articles on the 2016, 2020, and 2024 Paralympic Games in selected Greek newspapers and news websites

Outlet / Event	Paralympic Games 2016	Paralympic Games 2020	Paralympic Games 2024
Naftemporiki.gr	17	29	18
Tanea.gr	22	19	29
Kathimerini.gr	18	12	22
Tovima.gr	17	13	21
Newsit.gr	37	38	122
News24/7.gr	8	10	47
Iefimerida.gr	51	40	65
Newsbomb.gr	30	47	71
Reporter.gr	3	2	6
TOTAL	203	210	401

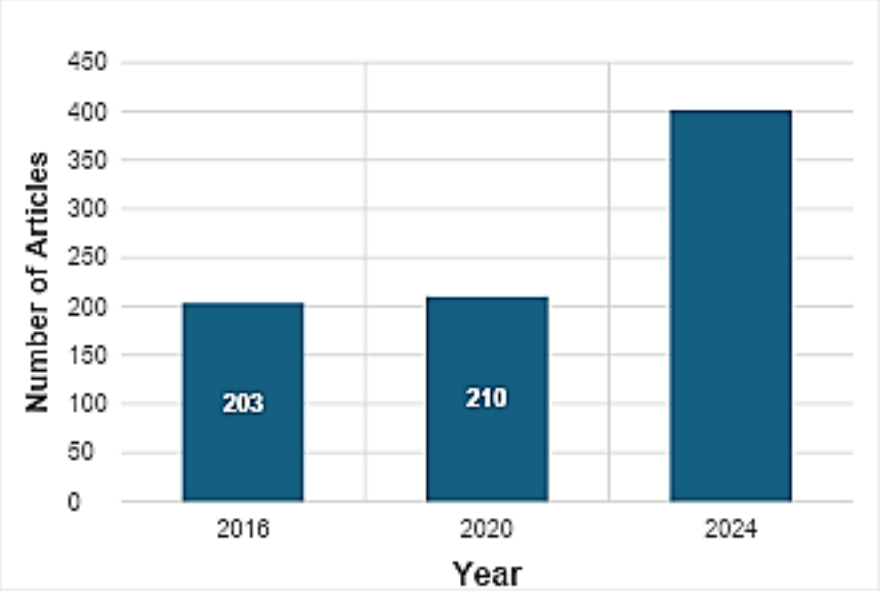

Figure 2. Number of newspaper and news-website articles about the Paralympic Games in selected Greek media outlets (2016–2024)

Framing of the Paralympic Games in Selected Greek Media

The articles were classified using the nine coding units shown in Table 4: Informative, Athlete First, National Success, Publicity, Supercrip/Superhuman, Multidimensional, Impact of the PG, Business, and Political/Legal. Because each article could receive up to two coding units, the findings are reported in two ways: (i) as percentages of all coding entries and (ii) as percentages of all articles.

For the 2016 Games, Table 7 and Figures 3 and 4 show that Athlete First and National Success were the most prevalent frames. Each accounted for 25.61% of coding entries and appeared in 36.45% of articles. These frames were followed by Informative, 22.15% of coding

entries and 31.53% of articles; Political/Legal, 8.30% and 11.82%, respectively; Impact of the PG, 5.88% and 8.37%; Supercrip/Superhuman, 5.19% and 7.39%; Business, 4.15% and 5.91%; Multidimensional, 1.73% and 2.46%; and Publicity, 1.38% and 1.97%. Coverage therefore focused primarily on athletic performance and national achievement, with comparatively limited attention to broader social or contextual perspectives.

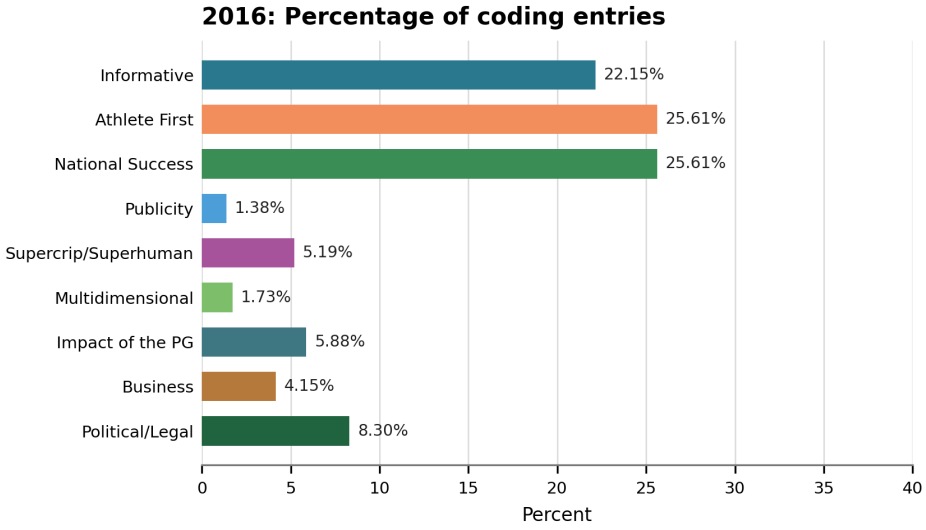

Figure 3. Distribution of frames in selected Greek media coverage of the 2016 Paralympic Games, based on coding entries

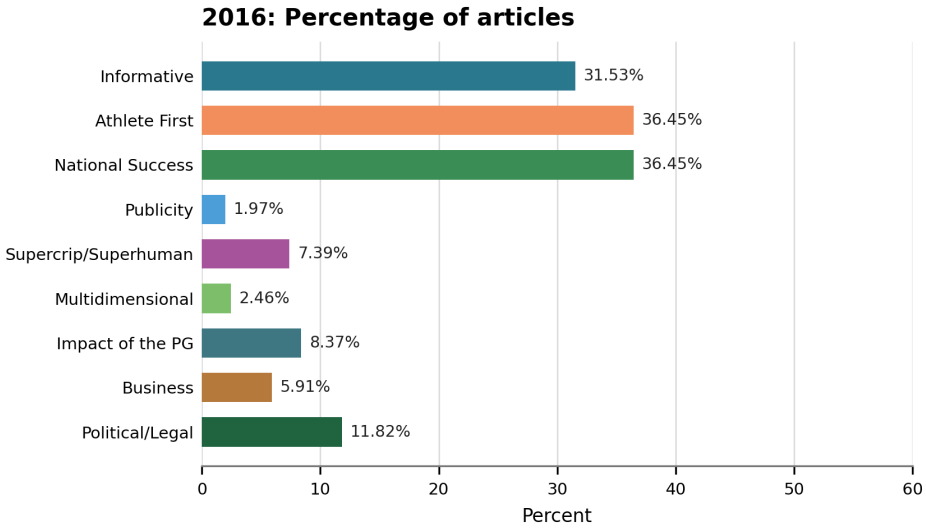

Figure 4. Distribution of frames in selected Greek media coverage of the 2016 Paralympic Games, based on articles

For the 2020 Games, Table 8 and Figures 5 and 6 show that Athlete First was the dominant frame, accounting for 33.23% of coding entries and appearing in 51.43% of articles. National Success followed at 31.08% of entries and 48.10% of articles, while Informative accounted for 15.38% and 23.81%, respectively. The less frequent frames were Political/Legal, 8.62% of entries and 13.33% of articles; Impact of the PG and Multidimensional, each 2.77% and 4.29%;

Supercrip/Superhuman, 2.46% and 3.81%; Publicity, 2.15% and 3.33%; and Business, 1.54% and 2.38%.

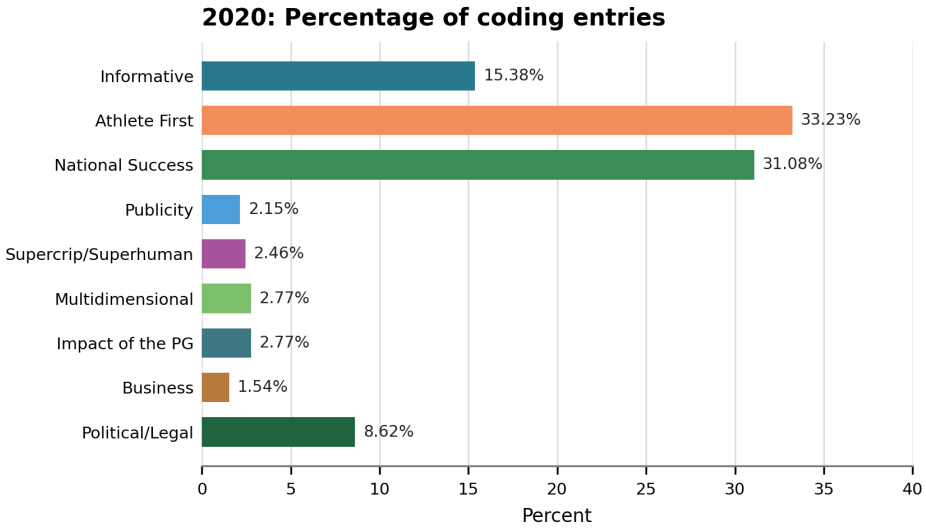

Figure 5. Distribution of frames in selected Greek media coverage of the 2020 Paralympic Games, based on coding entries

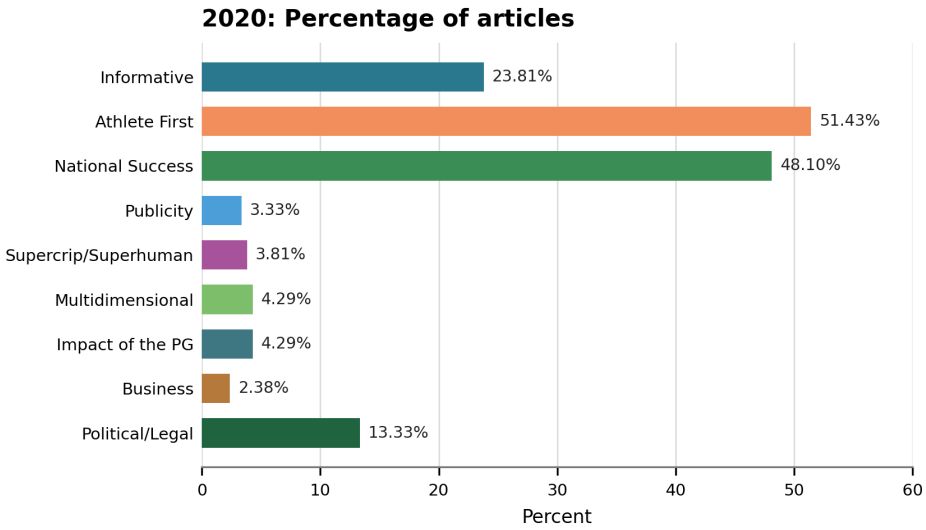

Figure 6. Distribution of frames in selected Greek media coverage of the 2020 Paralympic Games, based on articles

Compared with 2016, the 2020 findings show a stronger emphasis on the Athlete First frame and less frequent use of most secondary frames.

For the 2024 Games, Athlete First accounted for 35.93% of coding entries and appeared in 44.89% of articles, while National Success declined to 21.36% of entries and 26.68% of articles. Informative accounted for 18.56% and 23.19%, respectively; Political/Legal, 8.18% and 10.22%; Supercrip/Superhuman, 7.19% and 8.98%; Multidimensional, 2.99% and 3.74%;

Impact of the PG, 2.79% and 3.49%; Business, 2.20% and 2.74%; and Publicity, 0.80% and 1.00% (Table 9 and Figures 7 and 8).

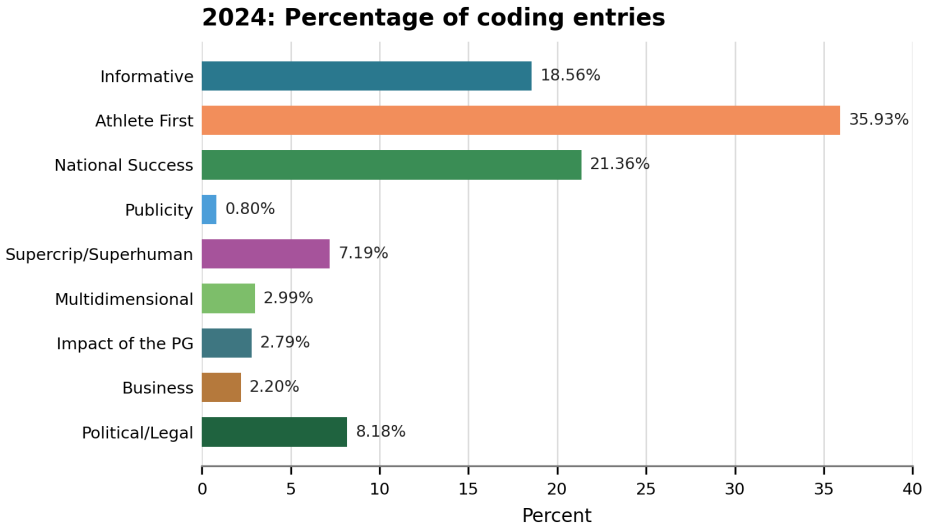

Figure 7. Distribution of frames in selected Greek media coverage of the 2024 Paralympic Games, based on coding entries

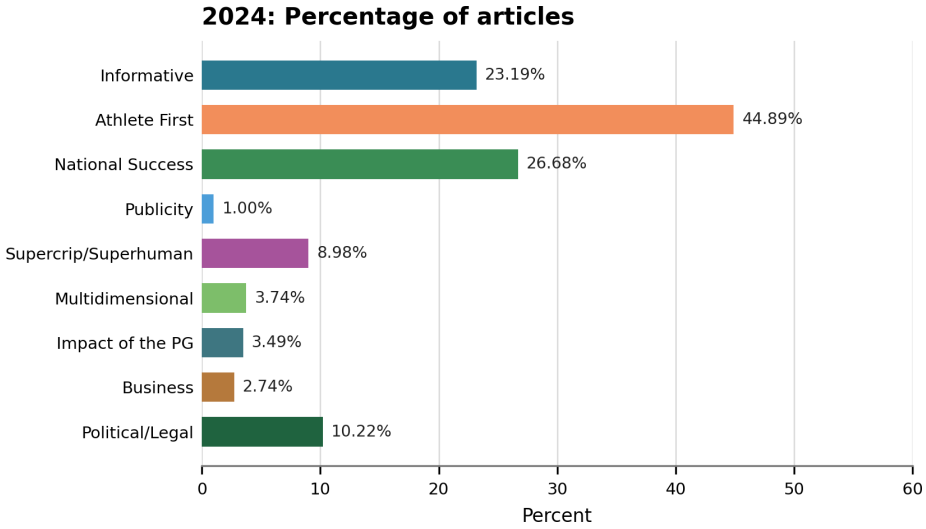

Figure 8. Distribution of frames in selected Greek media coverage of the 2024 Paralympic Games, based on articles

This distribution confirms the continued dominance of Athlete First and a notable decline in National Success relative to the two earlier editions. The increase in Supercrip/Superhuman suggests a modest shift towards inspirational narratives, while the other frames remained relatively stable. Figures 9 and 10 compare the distribution of all nine coding units across the three editions, using percentages of coding entries and percentages of articles, respectively. The figures highlight the sustained prominence of Athlete First, variation in National Success, and the relative stability or decline of the remaining frames.

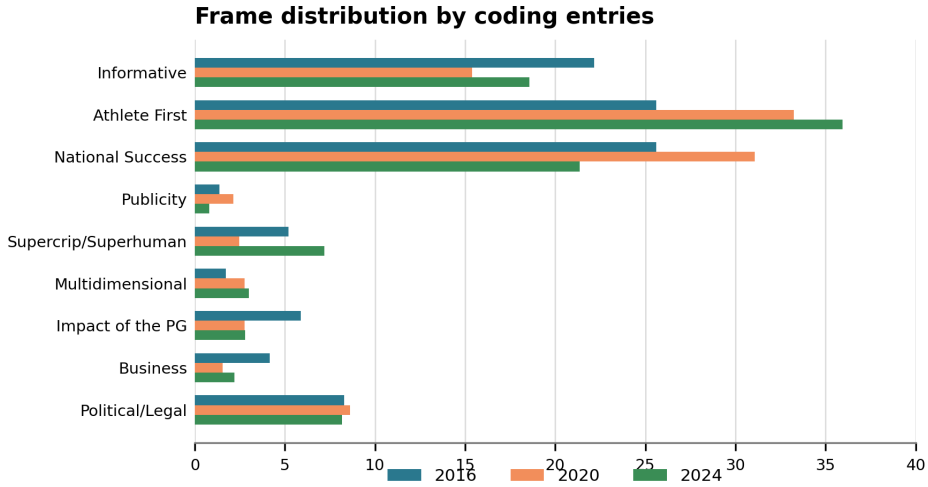

Figure 9. Distribution of frames across the 2016, 2020, and 2024 Paralympic Games in selected Greek media outlets, based on coding entries

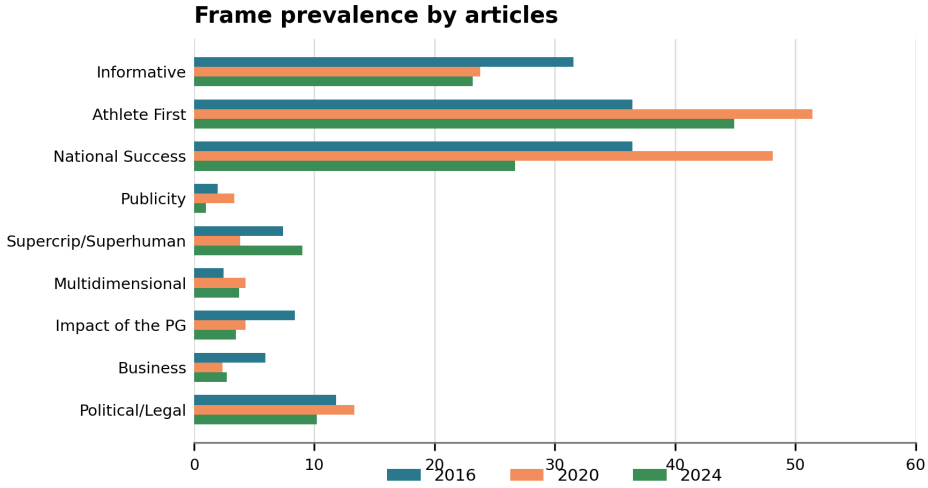

Figure 10. Distribution of frames across the 2016, 2020, and 2024 Paralympic Games in selected Greek media outlets, based on articles

Table 7. Classification of selected 2016 newspaper articles by context

Outlet / Context	Naftemporiki.gr	Tanea.gr	Kathimerini.gr	Tovima.gr	Newsit.gr	News24/7.gr	Iefimerida.gr	Newsbomb.gr	Reporter.gr	Total	Total % of coding entries	Total % of articles
Informative	4	4	3	7	19	1	14	12	0	64	22.15	31.53
Athlete First	7	17	11	5	6	2	17	7	2	74	25.61	36.45
National Success	8	16	9	7	5	2	19	6	2	74	25.61	36.45
Publicity	0	0	0	0	2	1	1	0	0	4	1.38	1.97
Supercrip/Superhuman	0	2	3	1	1	1	5	2	0	15	5.19	7.39
Multidimensional	0	1	0	0	0	1	2	1	0	5	1.73	2.46
Impact of the PG	0	1	1	1	2	3	6	3	0	17	5.88	8.37
Business	1	1	1	0	1	0	5	3	0	12	4.15	5.91
Political/Legal	4	0	3	1	6	3	3	4	0	24	8.30	11.82

Table 8. Classification of selected 2020 newspaper articles by context

Outlet / Context	Naftemporiki.gr	Tanea.gr	Kathimerini.gr	Tovima.gr	Newsit.gr	News24/7.gr	Iefimerida.gr	Newsbomb.gr	Reporter.gr	Total	Total % of coding entries	Total % of articles
Informative	7	5	0	2	14	0	9	13	0	50	15.38	23.81
Athlete First	14	10	12	8	20	9	17	17	1	108	33.23	51.43
National Success	14	12	11	9	20	5	12	18	0	101	31.08	48.10
Publicity	2	0	0	0	0	0	1	4	0	7	2.15	3.33
Supercrip/Superhuman	0	2	1	1	0	0	2	2	0	8	2.46	3.81
Multidimensional	0	1	0	1	1	0	3	3	0	9	2.77	4.29
Impact of the PG	0	0	0	0	0	1	2	6	0	9	2.77	4.29
Business	1	0	0	0	0	0	1	3	0	5	1.54	2.38
Political/Legal	5	0	0	0	3	1	11	7	1	28	8.62	13.33

Table 9. Classification of selected 2024 newspaper articles by context

Outlet / Context	Naftemporiki.gr	Tanea.gr	Kathimerini.gr	Tovima.gr	Newsit.gr	News24/7.gr	Iefimerida.gr	Newsbomb.gr	Reporter.gr	Total	Total % of coding entries	Total % of articles
Informative	4	4	3	7	36	8	16	15	0	93	18.56	23.19
Athlete First	7	17	11	5	60	19	26	31	4	180	35.93	44.89
National Success	8	16	9	7	20	14	12	19	2	107	21.36	26.68
Publicity	0	0	0	0	0	1	3	0	0	4	0.80	1.00
Supercrip/Superhuman	0	2	3	1	9	5	8	7	1	36	7.19	8.98
Multidimensional	0	1	0	0	5	0	6	3	0	15	2.99	3.74
Impact of the PG	0	1	1	1	4	3	1	3	0	14	2.79	3.49
Business	1	1	1	0	2	2	1	2	1	11	2.20	2.74
Political/Legal	4	0	3	1	4	8	16	4	1	41	8.18	10.22

Discussion and Conclusion

This study examined the media visibility and framing of the PG across three editions, 2016, 2020, and 2024, using coverage from ERT, Greece's official media rights holder, and selected newspapers and news websites. Research on Paralympic media coverage in Greece remains limited. By providing a descriptive comparison across three editions, the study complements international research, offers preliminary evidence from the Greek context, and establishes a basis for further investigation. ERT coverage declined from 115 hours in 2016 to 107 hours in 2020 and 97 hours in 2024. In contrast, the selected newspapers and news websites showed a modest increase from 203 articles in 2016 to 210 in 2020, followed by a substantial increase to 401 in 2024. This divergence may reflect editorial priorities, audience interest, or resource constraints and suggests that Greek television coverage has not kept pace with developments in other media.

Internationally, the Paris 2024 Games marked a historic development because all 22 summer sports received live coverage, compared with 19 at the Tokyo 2020 Games (IPC, 2024). A record number of media rights holders also reflected growing global interest. Better, a charitable social enterprise in the United Kingdom, reported large increases in searches for several Paralympic sports, including table tennis, athletics, wheelchair rugby, sitting volleyball, cycling, triathlon, badminton, goalball, blind football, and swimming. Across these sports, Wikipedia views increased by a combined 942% (Hellenic Paralympic Committee, 2024; McGowan, 2024). Greek broadcasting did not fully mirror this trend, as the largest increase in visibility occurred in newspapers and news websites rather than on television.

Agenda-setting theory highlights the importance of media visibility in shaping perceptions of the significance of the PG, but the framing of the Games is equally important. The theory suggests that the media may influence not what people think, but what they think about (Baran & Davis, 2003). In Greece, declining television coverage alongside increased coverage in newspapers and news websites may indicate a shift in attention towards particular media platforms, while potentially limiting overall exposure to the Games.

Mediated contact theory complements this interpretation by emphasising that media representations of social groups can shape public perceptions of those groups, including people with disabilities and Paralympic athletes (Ortiz & Harwood, 2007). Visibility determines whether the Games are noticed, while framing influences how audiences understand them. The results were reported both as percentages of coding entries and as percentages of articles, enabling interpretation of each frame's relative weight within the coding dataset and its prevalence across the selected outlets.

Across all three editions, Athlete First was the dominant frame in the selected newspapers and news websites. In 2016, it was equally prominent with National Success, but by 2024 the emphasis on National Success had declined. The strong focus on national athletes is consistent with previous research and may partly reflect the structure of the Games, in which athletes represent their countries (Cheong et al., 2025; Pullen et al., 2019). Foreign athletes and their achievements were largely absent and appeared mainly in exceptional circumstances, including the death of a Paralympic cyclist (Tovima, 2016b), an athlete's decision to postpone euthanasia (Tovima, 2016a), personal or inspirational stories (News24/7, 2024; Newsbomb, 2021), or secondary references when a Greek athlete won a medal. Even when Greek athletes medalled, headlines often prioritised national achievement over individual performance. One 2016 article, for example, used the headline 'Gold Day for Greece' and mentioned the athlete's name and performance only briefly (Reporter.gr, 2016). In other cases, the national medal count appeared only at the end of the article.

The relatively low frequency of the Supercrip/Superhuman frame in the Greek context contrasts with international studies in which it was a dominant feature of Paralympic coverage (McGillivray et al., 2021; Pearson & Misener, 2021; Tynedal & Wolbring, 2013).

Overall, the framing used by the selected Greek media outlets may be interpreted as generally positive. Paralympians were usually described as athletes or champions, with attention directed towards athletic performance and the success of the Greek Paralympic team. The relationship between Athlete First and National Success can be partly understood through Bruce's (2014) argument that nationalistic framing can position athletes with disabilities as elite athletes. In this interpretation, national identity overrides other identity characteristics, including disability, that might otherwise contribute to marginalisation. The persistence of national framing across all three editions may also indicate that Greek media use this narrative to make Paralympic sport socially recognisable. However, the limited visibility of foreign athletes, which differs from mainstream sport coverage (De Léséleuc et al., 2010), may suggest that disability sport is regarded as less significant unless national athletes are involved. The Informative frame, which included Games schedules and information about the Greek team's participation, was also present across all three editions.

From the perspective of mediated contact theory, the dominant Athlete First and nationalistic frames may support a less stereotyped view of Paralympic athletes by focusing on athletic skill rather than disability. A nationalistic focus can also strengthen national pride and engagement with the Games, but it may reinforce an understanding of the PG that is centred primarily on national achievement.

Regardless of the factors underlying this pattern, declining television coverage is a concern for future editions. Greater visibility and constructive framing of the PG could contribute to the social inclusion of people with disabilities. Conversely, reduced visibility may limit sponsorship opportunities and the growth of fan communities for Para athletes (Kolotouchkina et al., 2021).

In Greece, greater visibility of the PG could support the social acceptance and normalisation of disability and help reduce stereotypes and prejudice. These changes could contribute to improvements in rehabilitation services, education, and workforce participation for people with disabilities (Smith et al., 2017). Although the PG represent only one dimension of disability, they can promote inclusion by raising awareness, providing role models, and normalising the participation of people with disabilities in sport and physical activity (Kamberidou et al., 2019; Pullen et al., 2019).

The social impact of the Games may nevertheless be temporary. After the London 2012 Games, many athletes returned to an 'inaccessible reality' (Bush et al., 2013). Lasting change therefore requires a stronger Paralympic legacy that extends beyond the two-week duration of the Games (Pearson & Misener, 2021). Sustained and responsible media coverage could contribute to this objective.

Recommendations for Future Research

This study provides a starting point for further research on both media coverage of the Paralympic Games and the wider context of the Games in Greece. Several priorities warrant investigation.

Future research could include:

1. Comparative Analysis of PG and OG Media Coverage:
   Comparing media visibility and framing of the PG and OG would provide deeper insight into how the two events are portrayed and would identify persistent disparities or improvements in coverage.
2. Audience and Public Perception:
   Research on how Greek audiences interpret and engage with Paralympic media coverage could clarify the social effects of visibility and athlete representation. Surveys or interviews could be used to examine public attitudes towards the PG.

3. Sponsorship and Commercial Effects of Paralympic Media Coverage:
   Examining the relationship between media visibility and sponsorship opportunities for Paralympic athletes and the Games could clarify the economic implications of increased coverage and identify strategies for strengthening sponsorship engagement.
4. Athletes' Perspectives on Paralympic Media Coverage:
   Future studies could examine whether Paralympic athletes believe they are represented accurately and how media narratives affect their public image, career opportunities, and experiences as athletes.
5. Representation of International Athletes:
   The nationalistic focus identified in Greek media was accompanied by limited coverage of international athletes' achievements. Future research should investigate the causes of this pattern and its consequences for the global recognition of Paralympic sports and athletes.

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Disclosure statement
The authors declare no conflicts of interest.

Declaration of Generative AI and AI-Assisted Technologies in the Writing Process
During the preparation of this manuscript, the authors used Grammarly to assist with improving spelling, grammar, and language clarity. The authors carefully reviewed and revised the output to ensure accuracy and take full responsibility for the content of the final manuscript.

Notes on Contributors
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ORIGINAL RESEARCH ARTICLE

The Surface Electromyographic Characteristics of Different Practice Methods of Chen-Style Tai Chi *Lanzhayi* Movement

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Abstract

This study examined the surface electromyographic characteristics of the Chen-style Tai Chi Lanzhayi movement across different practice methods to clarify its neuromuscular demands and inform scientific training. Nine experienced practitioners completed slow practice, rapid power practice, practical combat practice, and a 60-s standing exercise. Surface electromyographic signals from 16 muscles and synchronised video data were collected using a MEGWIN 6000 16-channel telemetry system. Root mean square (RMS) amplitude and integrated electromyography (iEMG) were analysed. Stage 3 of the three dynamic conditions was compared using repeated-measures analysis of variance, and activation sequence was examined descriptively in one expert participant. In stages 1 and 2, the left and right tibialis anterior muscles showed the highest RMS and iEMG values. In stage 3, RMS differed significantly among conditions and increased from slow practice to rapid power practice and practical combat practice, whereas total iEMG did not differ significantly. In the expert-case analysis, activation sequence varied across practice methods and did not follow a fixed foot-leg-waist-hand order. During the standing exercise, left-leg iEMG exceeded right-leg iEMG, whereas right-arm iEMG exceeded left-arm iEMG. Practice method influenced muscle activation intensity and coordination during Lanzhayi. Training that more closely approximates practical combat may be useful for developing combat-specific performance. The traditional principle that power begins in the feet, passes through the legs, is controlled by the waist, and manifests in the hands may guide whole-body coordination, but should not be interpreted as a fixed sequence of muscle activation. The observed left-right asymmetries require confirmation in larger samples.

Introduction

Tai Chi is a traditional Chinese practice that integrates martial techniques, artistic expression, and health-related exercise (Li, 2018). It is widely practised in China, with more than 50 million practitioners (Zhang, 2019). On 17 December 2020, UNESCO inscribed Tai Chi on the Representative List of the Intangible Cultural Heritage of Humanity (Xinhua News Agency, 2020. Tai Chi originated in Chenjiagou, Wen County, Henan Province, China, and the form

associated with this region is known as Chen-style Tai Chi. As the practice evolved, it gave rise to the Yang, Wu (Hao), Wu, and Sun styles. Qi Jiguang described a movement resembling *Lanzhayi* in *Ji Xiao Xin Shu: Quan Jing* during the Ming dynasty, and the movement later became representative of Chen-style Tai Chi and other Tai Chi traditions. Tai Chi includes eight jin methods; *Lanzhayi* emphasises four primary methods: peng, lü, ji, and an.

Surface electromyography (sEMG) is widely used in sport, medicine, and exercise science to assess neuromuscular activity (Liu et al., 2022; Liang et al., 2023). It is a non-invasive technique commonly analysed in the time and frequency domains. Time-domain measures such as integrated electromyography (iEMG) and root mean square (RMS) amplitude can be used to examine muscle activation, contribution, and coordination during movement. Frequency-domain measures, including median frequency and mean power frequency, are commonly used to investigate muscle fatigue (Wang & Huang, 2019).

Electromyographic research on Tai Chi has a long history. Zhang and Huang (1989) quantitatively analysed sEMG during the first form of Chen-style Tai Chi and described general characteristics of muscle activity during practice. Wang and Yang (1996) compared the EMG of athletes practising different Tai Chi styles. Chan et al. (2003) analysed a Tai Chi master's push movement and reported that eccentric contractions of the lower-limb muscles may contribute to strengthening. Niu (2010) compared stage-specific sEMG characteristics of Tai Chi pushing-hands techniques among athletes of different skill levels. Zhu et al. (2014) combined three-dimensional motion analysis, force measurement, and telemetry sEMG to examine power generation during Chen-style Tai Chi Yanshou Hongchui. Yu et al. (2022) investigated pre-activation and co-contraction of knee and ankle muscles during brush-knee twist-step and normal walking in long-term practitioners to explore neuromuscular strategies relevant to fall prevention. More recently, Huang et al. (2024) combined three-dimensional motion capture, force-platform data, and sEMG to examine relationships among biomechanics, muscle activation, and stability during the 143D balance movement in competitive Tai Chi. Together, these studies show that sEMG can provide useful evidence about muscle recruitment and motor control in specific Tai Chi techniques.

Existing EMG studies of Tai Chi have mainly analysed muscle activity during practice, compared the same movement across skill levels, or examined health-related effects. However, little research has compared the neuromuscular characteristics of different practice methods applied to the same Tai Chi movement. Therefore, this study used a MEGWIN 6000 16-channel telemetry sEMG system and a Sony DCR-HC90 video camera to collect muscle-activation and kinematic data from nine practitioners performing Chen-style Tai Chi *Lanzhayi* under different practice conditions. The aim was to clarify how practice method influences muscle activation, strengthen the scientific basis of martial arts teaching and training, and provide practical guidance for Tai Chi training.

Methods

Study participants

Nine participants (seven men and two women) took part in the study. Their mean age was 29.44 ± 6.66 years, mean height was 170.44 ± 6.65 cm, and mean body mass was 68.77 ± 7.91 kg. The sample comprised one professor who was also a Tai Chi expert, three champions of major domestic Tai Chi tournaments, and five recreational practitioners. All participants were proficient in the selected Chen-style Tai Chi *Lanzhayi* practice methods.

Ethics, equipment, and setting

The study was reviewed by an expert panel and approved by the Ethics Committee of Sport Science at Beijing Sport University. All participants provided informed consent and were told that they could withdraw at any time without penalty. To reduce injury risk, practical combat practice was conducted under professional supervision, and participants were familiar with safe-falling techniques. Testing took place in the hall of the Sport Science Research Centre at Beijing Sport University (Figure 1). A MEGWIN 6000 16-channel telemetry sEMG system and a Sony DCR-HC90 video camera were used. Room temperature was maintained at approximately 20 °C. The same professional staff prepared the participants, operated the equipment, and recorded all trials. Video and photographic data were stored securely and accessed only by the research team; identifying features in submitted figures were masked.

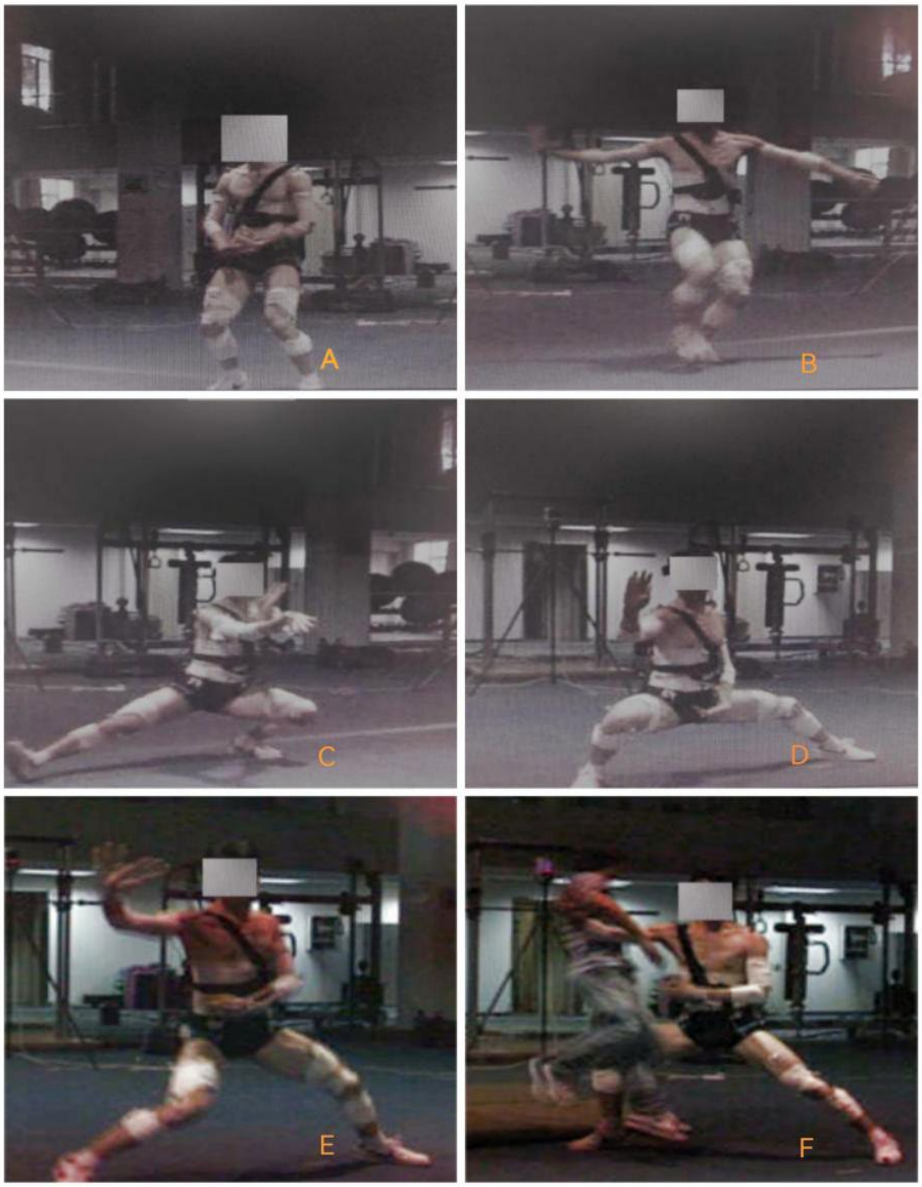

Figure 1. Experimental site layout and division of action stages

Movement definition and stage division

The *Lanzhayi* movement was divided into three stages according to the requirements and offensive and defensive meanings of the Chen-style Tai Chi competition routine. Stage 1 (A-B), 'receiving the opponent's attacking force,' extended from the end of Jingangdaozhui until the right foot began to leave the ground. Stage 2 (B-C), 'leading in the opponent and disrupting balance,' extended from right-foot lift-off until right-foot contact. Stage 3 (C-D), 'throwing the opponent,' extended from right-foot contact to completion of *Lanzhayi* (China Martial Arts Research Institute, 1999).

The four practice conditions were defined as follows:

(1) Slow practice: the movement was performed according to the standard Chen-style Tai Chi competition routine.

(2) Rapid power practice: stages 1 and 2 were performed slowly according to the competition routine, and rapid force was generated from point C during stage 3.

(3) Practical combat practice: stages 1 and 2 were performed slowly according to the competition routine. From point C, the participant prepared to throw a partner and executed the throw during stage 3. The same partner was thrown in all trials.

(4) Standing exercise: participants maintained the fixed *Lanzhayi* posture at point D for 1 min.

sEMG recording and data analysis

Tai Chi force generation depends on whole-body coordination. Based on the movement characteristics and combat applications of *Lanzhayi*, together with the recommendations of Chinese martial arts and exercise-physiology experts, 16 muscles of the lower limbs, trunk, and upper limbs were selected for testing (Table 1). Electrode locations were determined from the anatomical position of each muscle and established recommendations for surface-electrode placement (Hermens et al., 2000).

Table 1. List of selected muscles

Position	Left side muscles and number	Right side muscles and number
Lower limbs	1. Left tibialis anterior muscle	9. Right tibialis anterior muscle
	2. Left gastrocnemius muscle	10. Right gastrocnemius muscle
	3. Left rectus femoris muscle	11. Right rectus femoris muscle
Trunk	4. Left external abdominal oblique muscle	12. Right external abdominal oblique muscle
	5. Left latissimus dorsi muscle	13. Right latissimus dorsi muscle
	6. Left deltoid muscle	14. Right deltoid muscle
Upper limbs	7. Left triceps brachii muscle	15. Right triceps brachii muscle
	8. Left brachioradialis muscle	16. Right brachioradialis muscle

Before electrode placement, hair was removed with a razor, the skin was gently abraded with fine sandpaper, and the site was cleaned with 75% alcohol to remove oil. After the alcohol had evaporated, electrode paste was applied. Electrodes were positioned over the most prominent part of each muscle belly, with a centre-to-centre distance of 2 cm, and aligned with the direction of the muscle fibres.

The sEMG system sampled at 1,000 Hz. Each dynamic practice condition was performed three times, with a 5-min rest between trials. The MEGWIN 6000 16-software was used with its default settings to process the signals, segment the data using synchronised video, and export values for each movement segment. Because of resource limitations, sEMG amplitudes were not normalised to maximal voluntary contraction (MVC). Data were analysed in IBM SPSS Statistics, version 22.0. One-way repeated-measures analysis of variance was used to compare the three practice methods because all participants completed all conditions. Total RMS and total iEMG were the primary outcomes, and muscle-specific analyses were treated as exploratory. For post hoc pairwise comparisons, the least significant difference (LSD) test was used when the homogeneity-of-variance assumption was met; otherwise, Tamhane's T2 test was used. Activation sequence in participant 1, the Tai Chi expert, was examined using the percentage-peak method. An EMG amplitude greater than 20% of that muscle's maximum amplitude marked the onset of activation; values below this threshold were treated as inactive. Activation time was expressed as a percentage of total movement duration. Because the sequence analysis was based on one expert, it was interpreted as an illustrative case rather than a group-level finding.

Study hypotheses

The hypotheses were as follows:

(1) Muscle sEMG characteristics differ among slow practice, rapid power practice, and practical combat practice within the same movement stage. Specifically, RMS and iEMG values were expected to differ across the three conditions.

(2) During stage 3, muscle activation follows the traditional whole-body sequence in which power begins in the feet, passes through the legs and waist, and is expressed through the hands. Accordingly, activation was expected to proceed from lower-limb muscles to trunk muscles and then upper-limb muscles.

(3) During the standing exercise, iEMG is greater in the right, solid leg than in the left, empty leg.

Results

Stages 1 and 2 of the *Lanzhayi* movement

RMS amplitude reflects the magnitude of the sEMG signal and is commonly used as an indicator of motor-unit recruitment and muscle activation intensity. RMS generally increases as muscle force increases (Luo et al., 2017).

From an attack-and-defence perspective, stage 1 represents 'receiving the opponent's attacking force,' whereas stage 2 represents 'leading in the opponent and disrupting balance.' These stages prepare for force generation in *Lanzhayi*. RMS values for each muscle are presented in Table 2.

In stage 1, the left and right tibialis anterior muscles had the two highest RMS values, whereas the right external oblique had the lowest value. In stage 2, the left and right tibialis anterior again had the highest RMS values, and the right gastrocnemius had the lowest value (Table 2).

iEMG reflects accumulated muscle activity over a specified period and can provide an estimate of the total muscular work required for a movement (Sun et al., 2010). A muscle's contribution rate is its iEMG expressed as a percentage of the summed iEMG of all measured

muscles, indicating its relative contribution to the movement (Song et al., 2016). RMS therefore reflects activation intensity, whereas iEMG reflects accumulated activity (Xu et al., 2022). To examine the contribution of each muscle during stages 1 and 2, iEMG and contribution rates were calculated for individual muscles, body regions, and left and right sides (Tables 3 and 4).

The left and right tibialis anterior muscles had the highest iEMG values in both stages 1 and 2 (Table 3). During stage 1, body weight shifted from left to right and back to left. The high activation of both tibialis anterior muscles therefore appears to reflect their role in controlling weight transfer while the knees remained flexed.

During stage 2, the combined iEMG of the three measured muscles in the left and right legs was distributed at approximately 6:4 (Table 4). Thus, although the right leg was considered the empty leg during the step-opening phase, it continued to generate force, indicating active muscular control of the stepping limb.

Table 2. RMS (μV) for subjects in stages 1 and 2

Muscles	Stage 1	Stage 2
LTAM	149.56±60.81	272.11±104.97
LGM	58.22±3.19	94.44±21.81
LRFM	101.00±60.69	172.33±65.40
LEAOM	66.22±9.15	76.89±11.05
LLDM	75.56±18.28	83.11±9.66
LDM	86.78±27.86	123.00±59.45
LTBM	65.78±9.93	80.44±19.65
LBM	86.89±45.50	115.11±74.75
RTAM	120.67±56.38	223.33±116.92
RGM	31.56±21.44	52.78±40.62
RRFM	48.56±31.96	84.11±25.22
REAOM	22.56±11.83	82.56±45.32
RLDM	65.00±12.41	82.78±14.24
RDM	82.44±16.52	116.78±31.43
RTBM	72.89±18.15	97.33±24.53
RBM	101.33±28.62	133.44±67.26

Table 3. iEMG (μV·s) and contribution rates (%) of subjects in stages 1 and 2

Muscles	Stage 1	Contribution rate	Stage 2	Contribution rate
LTAM	470.11 ± 167.96	11.62	351.33 ± 176.63	14.78
LGM	206.11 ± 112.78	5.09	119.44 ± 50.44	5.02
LRFM	308.44 ± 117.55	7.62	210.11 ± 95.67	8.84
LEAOM	231.11 ± 117.23	5.71	94.22 ± 26.10	3.96
LLDM	252.22 ± 103.69	6.23	101.22 ± 27.70	4.26

LDM	289.78 ± 125.64	7.16	154.00 ± 91.03	6.48
LTBM	226.67 ± 107.85	5.60	100.22 ± 40.07	4.22
LBM	294.22 ± 203.99	7.27	154.89 ± 137.94	6.52
RTAM	377.44 ± 145.65	9.33	282.00 ± 168.18	11.86
RGM	97.89 ± 67.92	2.42	62.89 ± 62.10	2.65
RRFM	150.67 ± 69.41	3.72	104.11 ± 38.74	4.38
REAOM	76.22 ± 44.29	1.88	114.00 ± 90.73	4.80
RLDM	220.67 ± 99.99	5.45	99.56 ± 27.88	4.19
RDM	275.44 ± 104.41	6.81	148.33 ± 70.40	6.24
RTBM	244.56 ± 103.63	6.04	121.56 ± 45.95	5.11
RBM	325.22 ± 90.21	8.04	159.11 ± 80.06	6.69

Table 4. Comparison of the contribution rates (%) of subjects in stages 1 and 2

Stages	Position	Left side	Right side
Stage 1	Lower limbs	61.13	38.87
Stage 2		60.26	39.74
Stage 1	Trunk	61.95	38.05
Stage 2		47.78	52.22
Stage 1	Upper limbs	48.96	51.04
Stage 2		48.81	51.19
Stage 1	All muscles	56.31	43.69
Stage 2		54.08	45.92

Table 5. One-way repeated-measures ANOVA of the RMS (μV) for each muscle among the three different practice methods in stage 3

Muscles	Slow practice(a)	Rapid power practice(b)	Practical combat practice(c)	Tamhane's T2 test
LTAM	170.44 ± 89.15	186.44 ± 70.54	248.11 ± 98.57	
LGM	102.11 ± 40.06	109.67 ± 40.39	164.78 ± 93.34	F = 10.362
LRFM	115.00 ± 46.01	147.78 ± 63.62	146.89 ± 51.29	
LEAOM	75.89 ± 19.72	117.22 ± 44.95	161.00 ± 66.70	
LLDM	86.44 ± 13.12	141.44 ± 39.28	130.89 ± 31.75	pab = .034
LDM	74.67 ± 17.73	118.33 ± 37.05	198.56 ± 117.24	
LTBM	62.11 ± 7.67	86.78 ± 24.87	120.44 ± 55.91	
LBM	66.22 ± 16.98	90.11 ± 35.46	164.78 ± 156.32	pac = .005

RTAM	173.89 ± 84.16	177.11 ± 57.73	191.00 ± 81.47	
RGM	50.56 ± 33.52	60.78 ± 33.02	110.33 ± 61.33	
RRFM	114.89 ± 88.27	120.44 ± 65.60	189.44 ± 105.13	pbc = .043
REAOM	47.67 ± 21.93	106.33 ± 58.92	148.89 ± 110.81	
RLDM	66.00 ± 9.76	112.67 ± 32.56	176.67 ± 50.26	
RDM	93.44 ± 14.01	187.44 ± 40.77	582.78 ± 124.07	
RTBM	79.67 ± 15.70	135.33 ± 34.15	471.00 ± 385.45	
RBM	118.22 ± 45.19	167.00 ± 36.83	397.33 ± 295.82	
Mean value	93.58 ± 37.70	129.05 ± 36.92	225.18 ± 136.72	

Stage 3 of the *Lanzhayi* movement

Stages 1 and 2 prepared the movement, whereas stage 3 was the principal force-generating phase. RMS values from stage 3 were compared across slow practice, rapid power practice, and practical combat practice using one-way repeated-measures analysis of variance.

Stage-3 RMS increased in the order slow practice < rapid power practice < practical combat practice (Table 5). Pairwise differences were significant between slow and rapid power practice (pab = .034), rapid power and practical combat practice (pbc = .043), and slow and practical combat practice (pac = .005).

To determine whether accumulated activity also differed across practice methods, stage-3 iEMG values were compared using one-way repeated-measures analysis of variance. Contribution rates were also calculated for each muscle to describe how relative muscular involvement changed among conditions.

The analysis showed no significant difference in muscle iEMG among the three practice methods (Table 6).

In slow practice, the five largest muscle contributions were from the right tibialis anterior, left tibialis anterior, right brachioradialis, right rectus femoris, and left rectus femoris (Figure 2). In rapid power practice, the five largest contributions were from the right deltoid, left tibialis anterior, right tibialis anterior, right brachioradialis, and left latissimus dorsi. In practical combat practice, the five largest contributions were from the right deltoid, right triceps brachii, right brachioradialis, left tibialis anterior, and left deltoid. Across slow, rapid power, and practical combat practice, the relative iEMG contribution of left-side trunk and upper-limb muscles decreased, whereas the contribution of right-side muscles increased (Table 7).

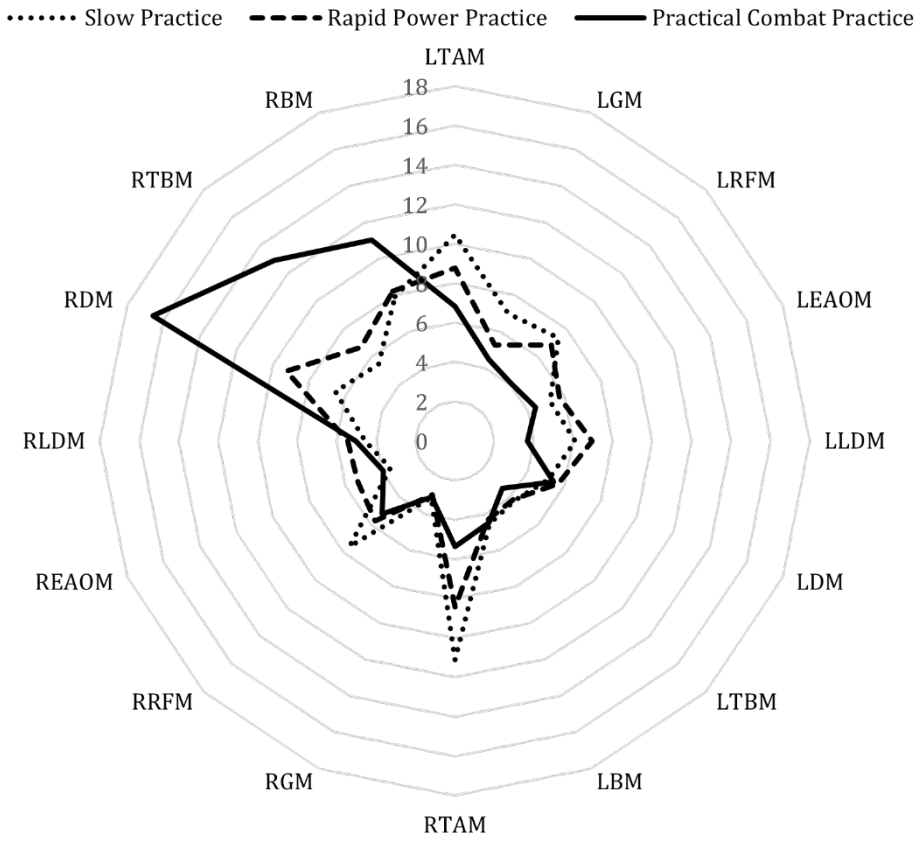

Figure 2. Stage 3 of the *Lanzhayi* movement: three practice methods' muscle contribution rate

Table 6. One-way repeated-measures ANOVA of iEMG (μV·s) for each muscle among the three different practice methods in stage 3

Muscles	Slow practice(a)	Rapid power practice(b)	Practical combat practice(c)	LSD test
LTAM	449.00 ± 151.52	462.33 ± 128.07	342.11 ± 128.64	F = 0.864
LGM	301.11 ± 137.74	278.11 ± 92.14	224.89 ± 106.76	
LRFM	317.67 ± 89.48	363.00 ± 111.54	204.33 ± 86.68	
LEAOM	224.22 ± 78.28	301.67 ± 118.71	222.78 ± 79.55	pab = .216
LLDM	261.67 ± 110.74	366.11 ± 107.92	184.22 ± 55.89	
LDM	220.22 ± 72.45	299.22 ± 67.22	272.33 ± 151.85	pac = .350
LTBM	183.44 ± 55.51	220.33 ± 47.75	170.33 ± 91.53	
LBM	195.00 ± 74.94	228.56 ± 78.33	224.89 ± 193.99	pbc = .758
RTAM	475.89 ± 169.82	444.11 ± 126.17	269.89 ± 134.49	
RGM	134.11 ± 70.13	156.22 ± 84.02	154.89 ± 76.94	
RRFM	325.11 ± 209.86	301.22 ± 131.29	263.11 ± 138.23	

REAOM	152.11 ± 121.06	281.22 ± 177.63	197.33 ± 123.19
RLDM	195.00 ± 58.97	286.33 ± 67.72	251.67 ± 73.20
RDM	281.67 ± 103.96	486.33 ± 131.55	833.00 ± 163.13
RTBM	235.56 ± 83.70	352.89 ± 106.37	651.00 ± 479.35
RBM	340.22 ± 118.35	432.67 ± 124.85	554.33 ± 379.35
Total	4292.00	5260.32	5021.10

Note. a = slow practice; b = rapid power practice; c = practical combat practice. F represents the F value of the repeated-measures ANOVA. pab, pac, and pbc represent the p values for pairwise comparisons between a and b, a and c, and b and c, respectively.

Table 7. Comparison of the contribution rates (%) of the left and right sides of the three practices in stage 3 of the *Lanzhayi* movement

Practice methods	Parts	Left side	Right side
Slow practice	Lower limbs	53.31	46.69
Rapid power practice		55.03	44.97
Practical combat practice		52.86	47.14
Slow practice	Trunk	58.33	41.67
Rapid power practice		54.06	45.94
Practical combat practice		47.55	52.45
Slow practice	Upper limbs	41.11	58.89
Rapid power practice		37.04	62.96
Practical combat practice		24.67	75.33
Slow practice	All muscles	50.15	49.85
Rapid power practice		47.89	52.11
Practical combat practice		36.76	63.24

Expert-case analysis of muscle activation sequence in stage 3

Activation order varied considerably among the nine participants and across the three practice methods. Averaging these sequences would have obscured individual timing; therefore, the sequence from participant 1, the professor with extensive theoretical and practical experience, was selected for descriptive analysis. Because EMG activation thresholds are partly subjective, previous studies have used values between 10% and 20% of peak amplitude. This study used 20% of each muscle's maximum amplitude to identify activation.

Table 8 yielded the following expert-case activation sequences:

Slow practice: the right brachioradialis and right tibialis anterior activated simultaneously, followed by the right triceps brachii; the right deltoid and right triceps brachii; the left rectus femoris, right external oblique, and left brachioradialis; the left deltoid; the left triceps brachii and right rectus femoris; the left external oblique; the left latissimus dorsi and right gastrocnemius; and the left gastrocnemius. The left tibialis anterior and right latissimus dorsi remained active throughout.

Table 8. Order of muscle activation (%) in the three practices of the expert subject for the *Lanzhayi* movement

Muscles	Slow practice	Rapid power practice	Practical combat practice
LTAM	——	36.14	——
LGM	38.18	——	——
LRFM	5.45	48.19	6.67
LEAOM	10.91	40.16	——
LLDM	14.55	44.18	——
LDM	7.27	40.16	46.67
LTBM	9.09	48.19	6.67
LBM	5.45	32.13	26.67
RTAM	0.00	24.10	——
RGM	14.55	44.18	33.33
RRFM	9.09	40.16	0.00
REAOM	5.45	44.18	——
RLDM	——	48.19	0.00
RDM	3.64	36.14	——
RTBM	3.64	44.18	——
RBM	0.00	8.03	53.33

Note. "——" indicates that the muscle remained active throughout the analysed stage.

Rapid power practice: activation began in the right brachioradialis, followed by the right tibialis anterior; the left brachioradialis; the left tibialis anterior and right deltoid; the left external oblique, left deltoid, and right rectus femoris; the left latissimus dorsi, right gastrocnemius, right external oblique, and right triceps brachii; and the left rectus femoris, left triceps brachii, and right latissimus dorsi. The left gastrocnemius remained active throughout.

Practical combat practice: activation began in the right rectus femoris, followed by the right latissimus dorsi; left triceps brachii; left brachioradialis; right gastrocnemius; left deltoid; and right brachioradialis. All other measured muscles remained active throughout.
During rapid power and practical combat practice, many muscles activated and reached peak activity almost simultaneously, indicating strong muscular synergy. This pattern is consistent with the loose, lively, elastic, and shaking force characteristics described in Tai Chi practice (Figure 3).

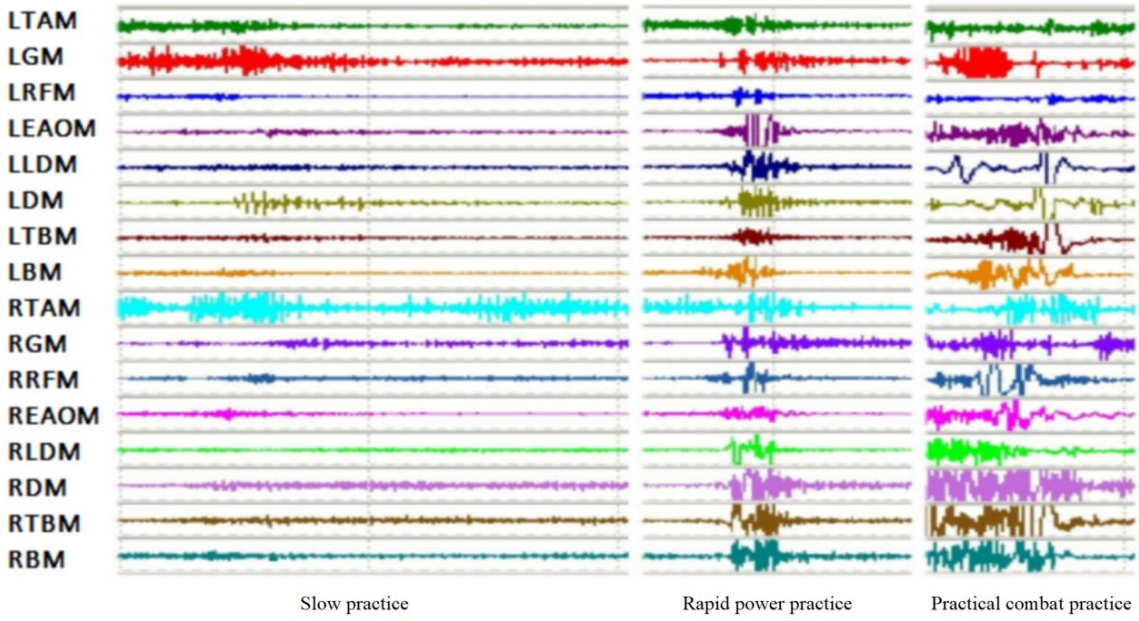

Figure 3. Electromyography of the three practices in stage 3 of the expert subject's *Lanzhayi* movement

Standing exercise of *Lanzhayi*

The standing exercise is a distinctive training method in Chinese martial arts. Although the practitioner maintains a fixed external posture, continuous internal postural adjustments are required. Previous studies suggest that standing exercises may support spinal stability, strengthen the lower-back and lower-limb muscles, and improve balance (Duan & Lin, 2019; Zhou et al., 2018). In this study, participants maintained the *Lanzhayi* standing posture for 60 s. iEMG and contribution rates were analysed, and participants' perceived responses were recorded after the exercise.
During the 60-s standing exercise, the five largest muscle contributions were from the left rectus femoris, right rectus femoris, left tibialis anterior, right brachioradialis, and right deltoid (Table 9). For the tibialis anterior, gastrocnemius, rectus femoris, external oblique, and latissimus dorsi, left-side iEMG exceeded right-side iEMG. By contrast, the deltoid, triceps brachii, and brachioradialis showed greater iEMG on the right than on the left.

The summed iEMG of the three measured lower-limb muscles was distributed between the left and right legs at approximately 6:4 (Table 10), differing from traditional estimates based on bodily perception.

Participants reported marked fatigue after approximately 30 s. Muscle shaking then became apparent, and by 60 s several participants had reached their tolerance limit and found it difficult to maintain the posture.

Table 9. iEMG (μV·s) and contribution rate (%) of each muscle of the subjects performing the standing exercise of *Lanzhayi*

Muscles	Left side	Contribution rate	Right side	Contribution rate
TAM	834.78 ± 227.17	17.14	287.56 ± 275.25	7.86
GM	504.67 ± 48.43	10.36	110.44 ± 51.34	3.02
RFM	838.44 ± 331.86	17.21	838.22 ± 333.63	22.90
EAOM	566.33 ± 41.52	11.63	83.78 ± 28.81	2.29
LDM	577.11 ± 63.49	11.85	496.22 ± 36.56	13.56
DM	573.89 ± 72.31	11.78	631.67 ± 186.76	17.26
TBM	508.44 ± 51.86	10.44	522.78 ± 59.85	14.28
BM	467.78 ± 44.25	9.60	689.89 ± 116.55	18.85

Table 10. Comparison of the muscle contribution rates (%) between the left and right sides of the subjects in the standing exercise of *Lanzhayi*

Part	Left side	Right side
Lower limbs	63.79	36.21
Trunk	66.35	33.65
Upper limbs	45.67	54.33
All muscles	57.10	42.90

Discussion

The findings show that practice method affected activation intensity, relative muscle contribution, and activation sequence during *Lanzhayi*.

Tai Chi training includes standing exercises, routine practice, pushing hands, and practical combat (Ma, 2003). These methods differ in how closely they reproduce an opponent-based task. In the present study, practical combat practice most closely approximated combat, followed by rapid power and slow practice. RMS increased significantly in the same order, indicating progressively greater activation intensity and motor-unit recruitment. In contrast, total iEMG did not differ significantly across methods. Thus, the practice methods changed the intensity and distribution of muscular activity more clearly than the total accumulated activity required to complete the movement.

Traditional Tai Chi theory describes power as beginning in the feet, passing through the legs, being controlled by the waist, and manifesting in the hands (Tang & Gu, 1996). This principle arose from holistic observation and bodily experience and has long guided practice. Zhou and Fan (2018) reported that the timing and range of motion of the ankle, knee, and hip

during *Lanzhayi* were broadly compatible with this whole-body concept. However, the expert-case sEMG data in the present study did not show a fixed lower-limb-to-trunk-to-upper-limb activation sequence in stage 3. Ma (2017) similarly reported that muscle activation during Yanshou Hongchui did not follow a single fixed order. The early activation of muscles from different body segments in slow and rapid power practice is broadly consistent with Chen's (2004) description of coordinated action among distal, middle, and proximal sections. Rapid power practice concentrated activation around the force-generating instant, whereas practical combat practice required eight muscles to remain continuously active. Overall, the activation sequence varied with practice method.

Tai Chi movement is commonly interpreted through the interdependence of yin and yang. During the *Lanzhayi* standing posture, the left leg is described as the empty leg and the right as the solid leg; the right hand is described as yin and the left as yang. In the present data, left-leg iEMG exceeded right-leg iEMG, whereas right-arm iEMG exceeded left-arm iEMG. The authors interpret these asymmetries as consistent with the principle that yin contains yang and yang contains yin (Cai et al., 2017). The greater right-arm activation also agreed with participants' perception of greater fatigue in that arm. The greater activation of the nominally empty left leg, however, differed from the traditional expectation that the right leg bears substantially more weight.

A possible biomechanical explanation is that the body's centre of mass remained between the two legs in the bow-horse stance, allowing both limbs to support the trunk and upper body. Because the right tibia was nearly vertical, the right limb may have borne axial load with less activity from the tibialis anterior and gastrocnemius. The left lower-limb muscles may therefore have required greater activation to maintain the posture. Wu and Xiong (2012) reported greater iEMG in the rear leg than in the front leg during Santi stance, apparently because the supporting leg bore more body weight. The difference between that finding and the present result may reflect the distinct weight distribution and limb geometry of the two postures. Larger comparative studies are needed to test this explanation.

Conclusions

The left and right tibialis anterior muscles were the primary force-producing muscles in stages 1 and 2 of *Lanzhayi*. During stage 3, RMS differed significantly among slow practice, rapid power practice, and practical combat practice, with activation intensity increasing in that order. Total iEMG did not differ significantly, indicating that the practice methods differed more in activation intensity than in accumulated muscular activity.

In the expert-case analysis, stage-3 activation did not follow a fixed foot-leg-waist-hand sequence, and the order differed among slow practice, rapid power practice, and practical combat practice.

During the standing exercise, left-leg iEMG exceeded right-leg iEMG, whereas right-arm iEMG exceeded left-arm iEMG. These asymmetries may be interpreted through the Tai Chi concept that yin contains yang and yang contains yin, although the physiological pattern should be confirmed in larger samples.

Recommendations and limitations

Practitioners seeking combat-specific performance may benefit from training that more closely approximates practical combat, provided that appropriate safety measures and professional supervision are used.

The traditional principle that power begins in the feet, passes through the legs, is controlled by the waist, and manifests in the hands should be treated as guidance for whole-body coordination rather than as a literal, fixed sequence of muscle activation.

This study was limited by its small sample, the analysis of a single movement, the absence of MVC normalisation, and the use of one expert participant for activation-sequence analysis. Future research should include larger samples, normalised sEMG measures, multiple representative martial arts movements, and additional biomechanical tools. Such work may help describe traditional martial arts in scientifically interpretable terms while preserving their technical and cultural context.

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Declaration of Generative AI and AI-Assisted Technologies in the Writing Process

During preparation of this manuscript, the authors used ChatGPT (OpenAI) to support translation and improve language clarity. The authors reviewed and revised the output, verified the final text, and accepted full responsibility for the manuscript content.

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ORIGINAL RESEARCH ARTICLE

Relationship between physical activity, lifestyles, and symptoms of stress, anxiety, and depression among chemical sciences students

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Abstract

Mental health problems among university students have increased and now constitute a public health concern. Unhealthy lifestyles and academic pressure may influence the emotional well-being of this population. This exploratory analytical, observational, cross-sectional study examined the relationships among physical activity (PA), lifestyle, and symptoms of anxiety, depression, and stress in 60 chemical sciences students (25 men and 35 women; mean age = 22 years, SD = 2.33). Participants completed the Depression Anxiety Stress Scales-21 (DASS-21), the FANTASTIC Lifestyle Questionnaire, and the short form of the International Physical Activity Questionnaire (IPAQ). Analyses included descriptive statistics, chi-square tests, and Spearman rank-order correlations. The results showed that 90% of participants met the World Health Organization recommendations for PA. PA was not significantly associated with emotional symptoms. In contrast, lifestyle was significantly associated with symptoms of depression (p = .003), anxiety (p = .035), and stress (p = .004). Students who reported an excellent lifestyle had higher proportions of moderate-to-severe symptoms across all three subscales. Although this finding is limited by the sample size (N = 60), it indicates a need to explore whether the lifestyle patterns and characteristics of chemical sciences students may constitute psychological risk factors in this population. Within the sample studied, lifestyle showed a stronger association with mental health outcomes than PA.

Introduction

Mental health problems among university students have increased worldwide, and students report higher levels of anxiety and stress than other populations (Barrera-Herrera & San Martín, 2021). Depression is reported to be 12.9% more prevalent at this stage of life than in the general population (Sheldon et al., 2021), representing a serious public health concern. Rapidly changing lifestyles may contribute to these conditions (Hasan et al., 2022). Ramón-Arbués et al. (2020) reported a moderate-to-high prevalence of depression, anxiety, and stress across university student samples. In Mexico, Silva-Ramos et al. (2020) found that 86.3% of the

students in their sample experienced academic stress. López Herrera et al. (2024) further noted that academic stress may trigger or intensify anxiety symptoms.

Physical activity (PA) is important for maintaining both physical and mental health (World Health Organization [WHO], 2024). However, the relationship between PA and negative emotions among university students may not be linear because other factors may influence this association (Liu et al., 2024).

Lifestyle is shaped by interactions between individual and contextual factors, which produce patterns of behaviour. These habits and behaviours can significantly influence physical and mental health (Rahimi et al., 2024). Wang et al. (2025) found a high prevalence of poor mental health among university students in association with lifestyle factors such as insufficient sleep, limited knowledge of health and exercise, inadequate breakfast consumption, and smoking.

University students are particularly vulnerable to emotional problems such as anxiety, depression, and stress because of academic pressure, lifestyle changes, and the transition to adulthood (Kamruzzaman et al., 2024).

Symptoms of depression, anxiety, and stress may vary according to sociodemographic characteristics such as sex and area of professional training (Angelucci et al., 2017). Programmes in the natural and exact sciences, including chemistry, are characterised by rigorous academic workloads that may compromise students' emotional well-being (González-Benítez et al., 2020). Medicine and dentistry have historically been associated with perfectionistic profiles (Rezaei-Gazki et al., 2024) and higher levels of stress and anxiety than other fields (Mirza et al., 2021), and recent research has extended this concern to other health and science disciplines. For example, curricular complexity, deadline pressure, and unclear teaching practices can generate substantial stress and anxiety among nursing students (Martínez Cruz et al., 2023).

Within science, technology, engineering, and mathematics (STEM), maladaptive perfectionism may be an important risk factor. Rice et al. (2013) indicated that it can contribute to disappointment with academic performance, particularly among women. Rice et al. (2015) similarly found that STEM students with maladaptive perfectionistic traits were more likely to experience moderate-to-high stress. They therefore recommended implementing prevention and intervention strategies from the beginning of university study.

Despite growing interest in university students' mental health, previous research has often examined these variables separately or within general student populations, with limited attention to academic environments involving heavy course loads, experimental rigour, and discipline-specific risks. Chemistry students face combined theoretical demands and extensive laboratory sessions that may restrict the time available for healthy lifestyles and PA. Few studies have examined how sedentary behaviour and daily habits interact with the severity of stress, anxiety, and depression symptoms in this educational context. The present study addresses this gap by evaluating these dimensions together in a specific student population and examining the potential role of PA within a demanding academic environment.

Nola Pender's Health Promotion Model explains the adoption of health-promoting behaviours through interactions among individual characteristics and experiences, behaviour-specific thoughts and feelings, commitment to action, immediate competing demands and preferences, and health-promoting behaviour. This model provides a theoretical foundation for understanding and guiding interventions that promote healthy lifestyles (Aristizábal Hoyos et al., 2011).

Bustamante Acaro et al. (2025) analysed lifestyle dimensions among university students classified as having unhealthy lifestyles according to Pender's model. Exercise was among the dimensions most frequently classified as unhealthy (86.1%). The authors identified barriers including disinterest, anxiety, academic workload, competing personal priorities, financial

limitations, and limited access to facilities. These perceived barriers may reduce self-efficacy and hinder commitment to regular exercise (Bustamante Acaro et al., 2025).

Therefore, the present study aimed to analyse the relationships among PA, lifestyle, and mental health symptoms, specifically anxiety, depression, and stress, in a sample of chemistry students.

Materials and Methods

This exploratory analytical, observational, cross-sectional study used a convenience sample of 60 chemical sciences students, comprising 25 men and 35 women (mean age = 22 years, *SD* = 2.33). Although convenience sampling was used, the sample size was considered appropriate for the exploratory nature of the study. Methodological research on pilot studies indicates that similarly sized samples may be suitable for assessing design feasibility, generating preliminary evidence, and informing future studies with larger samples and greater statistical power (Billingham et al., 2013). Participants were recruited based on availability and accessibility, which facilitated data collection during the initial phase of the study. Questionnaires were completed with interviewer guidance, and responses were anonymised after collection. Data were collected during the summer, which is a design limitation because students' routines, academic stress, and lifestyles may differ temporarily from those experienced during the regular academic year. The use of self-report instruments also introduced potential self-report and social desirability biases.

The inclusion criteria were current undergraduate enrolment, an age of 18 years or older, and provision of informed consent. Participants with incomplete questionnaires or inconsistent responses that prevented statistical analysis were excluded.

Ethical Considerations

Before data collection, participants were informed about the purpose and conditions of the study. Those who agreed to participate provided written informed consent. The study was approved by the ethics committee (C.E.I. 250826). Data confidentiality and protection were maintained throughout the study, and access to the database was restricted to the research team. No identifiable information was retained, and no identifiable individual-level data were disclosed. Data were stored securely and will be retained in accordance with the Federal Law on the Protection of Personal Data Held by Private Parties (Ley Federal de Protección de Datos Personales en Posesión de los Particulares [LFPDPPP], 2025).

Participants were recruited through a formal invitation sent to the Coordinator of the Chemical Sciences Department at the Benemérita Universidad Autónoma de Puebla (Meritorious Autonomous University of Puebla, Mexico). The coordinator distributed the invitation to students participating in the summer research programme, which receives students from institutions across Mexico. The invitation specified that participants must be currently enrolled in the Chemical Sciences Department and that participation would be anonymous.

Instruments

Mental health symptoms were assessed using the Depression Anxiety Stress Scales-21 (DASS-21), a validated and reliable instrument comprising 21 items across three seven-item subscales: depression, anxiety, and stress. Items are rated on a 4-point Likert-type scale ranging from 0, indicating the absence of symptoms, to 3, indicating high frequency (Estrada-Araoz et al., 2024; Román et al., 2016). Each subscale score is calculated by summing the seven corresponding items and multiplying the total by two. Scores are then compared with validated cut-off points to classify the severity of depression, anxiety, and stress as normal, mild, moderate, severe, or extremely severe (Salinas-Muñoz et al., 2024).

Lifestyle habits were assessed using version 3 of the FANTASTIC Lifestyle Questionnaire. The instrument, validated by Wilson et al. (1984), has been translated, adapted, and psychometrically validated in countries including Colombia, Cuba, Mexico, and Venezuela (Betancurth Loaiza et al., 2015). Its 30 items assess social relationships, PA, diet, tobacco use, alcohol consumption, sleep quality, stress management, personality traits, and health-related behaviours. Each item has three response options, and total scores range from 0 to 100. Lifestyle is classified as dangerous (<39), poor (40–59), regular (60–69), good (70–84), or excellent (≥85) (Espinosa Méndez et al., 2023).

PA levels were assessed using the Spanish short form of the International Physical Activity Questionnaire (IPAQ; Mantilla Toloza & Gómez-Conesa, 2007; Palma-Leal et al., 2022). The instrument assesses PA undertaken during the previous seven days, from walking to vigorous activity. Days and minutes of activity are used to calculate energy expenditure in MET-min/week, with standard values of 3.3 METs for walking, 4 METs for moderate activity, and 8 METs for vigorous activity. Each value is multiplied by the duration and number of days of activity per week, and the results are summed to determine PA level. Three categories are then applied: high, involving vigorous PA exceeding 1,500 MET-min/week; moderate, involving at least 600 MET-min/week; and low, involving less than 600 MET-min/week (Alarcón Meza & Hall-López, 2021).

Procedure

Data were collected over four weeks in individually scheduled, interviewer-guided sessions. Participants completed the questionnaires through Google Forms under the direct guidance of a trained interviewer. This approach enabled the immediate clarification of ambiguous items and helped prevent missing data, thereby supporting consistent and standardised administration.

Data Analysis

Data analysis was conducted in two stages. First, descriptive statistics were used to summarise and characterise the study variables. Second, inferential tests were used to explore relationships among the variables. Chi-square tests assessed significant associations, and nonparametric Spearman rank-order correlations assessed the strength and direction of relationships.

Given the exploratory nature of the study and its focus on identifying preliminary associations, the analysis primarily examined statistical significance. Cramér's V was also calculated as an effect-size measure. Analyses were performed using JASP version 0.19.3.

Results

Table 1 presents the distribution of lifestyle categories across PA levels. Table 2 provides the corresponding descriptive statistics, and Table 3 summarises PA levels by Sex. Moderate or high PA was reported by 92% of men and 77% of women. Figure 1 illustrates the relationship between PA level and perceived lifestyle. Chi-square tests showed no significant association between PA and symptoms of depression (p = .584), anxiety (p = .313), or stress (p = .629).

Table 1. Physical Activity Levels by Lifestyle Category

PA level	FANTASTIC interpretation	Frequency	Percent	Valid percent	Cumulative percent
Low	Regular	0	0.000	0.000	0.000
	Good	6	60.000	60.000	60.000
	Excellent	4	40.000	40.000	100.000
	Missing	0	0.000		
	Total	**10**	**100.000**		
Moderate	Regular	0	0.000	0.000	0.000
	Good	13	59.091	59.091	59.091
	Excellent	9	40.909	40.909	100.000
	Missing	0	0.000		
	Total	**22**	**100.000**		
High	Regular	6	21.429	21.429	21.429
	Good	17	60.714	60.714	82.143
	Excellent	5	17.857	17.857	100.000
	Missing	0	0.000		
	Total	**28**	**100.000**		

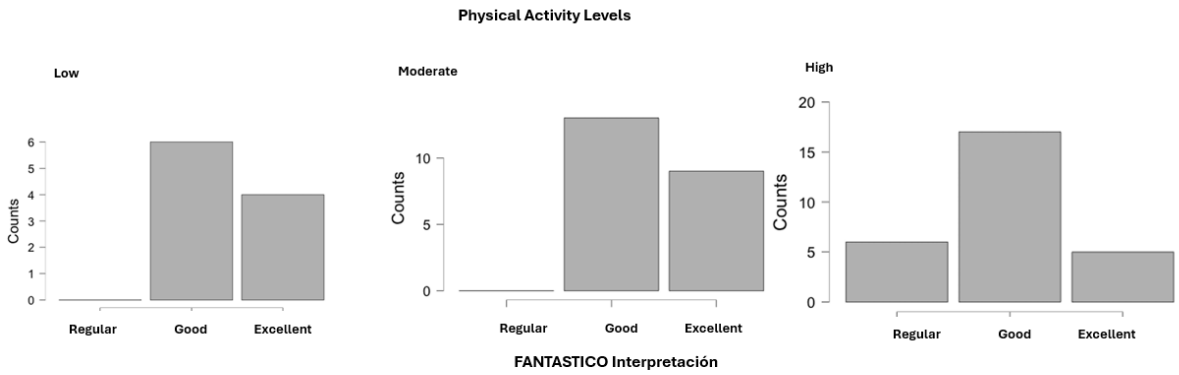
Table 2. Descriptive Statistics by Physical Activity Level

	Low	Moderate	High
Valid	10	22	28
Missing	0	0	0
Mean	1.400	1.409	0.964
Std. Deviation	0.516	0.503	0.637
Minimum	1.000	1.000	0.000
Maximum	2.000	2.000	2.000

Table 3. Physical Activity Levels by Sex

Sex	Physical activity level	Frequency	Percent	Valid percent	Cumulative percent
Men	Low	2	8.000	8.000	8.000
	Moderate	8	32.000	32.000	40.000
	High	15	60.000	60.000	100.000
	Missing	0	0.000		
	Total	**25**	**100.000**		
Women	Low	8	22.857	22.857	22.857
	Moderate	14	40.000	40.000	62.857
	High	13	37.143	37.143	100.000
	Missing	0	0.000		
	Total	**35**	**100.000**		

Figure 1. Relationship Between Physical Activity Level and Lifestyle Perception



Note. The figure comprises three panels based on PA level: low (left), moderate (middle), and high (right). The y-axis (Counts) represents the number of students in each group. The x-axis (FANTASTICO Interpretation) displays the lifestyle categories regular, good, and excellent according to the FANTASTIC Lifestyle Questionnaire scoring guidelines.

Lifestyle and Depression Symptoms

Lifestyle was significantly associated with depression symptoms (p = .003). Among participants with a regular lifestyle, 66.7% reported no symptoms of depression. Among those with a good lifestyle, 47.2% reported no symptoms, 25.0% reported mild symptoms, and 22.2% reported moderate symptoms. Among participants with an excellent lifestyle, 11.1% reported no symptoms, whereas 33.3% reported moderate symptoms and 33.3% reported severe symptoms (Table 4). Cramér's V indicated a large effect size (V = .44), suggesting a strong association between lifestyle category and depressive symptom severity in this sample.

Table 4. Relationship Between Lifestyle and Depression Levels

Lifestyle category (FANTASTIC)	No depression (%)	Mild (%)	Moderate (%)	Severe (%)	Extremely severe (%)	Total (%)
Regular	4 (66.7%)	1 (16.7%)	1 (16.7%)	0 (0.0%)	0 (0.0%)	6 (100.0%)
Good	17 (47.2%)	9 (25.0%)	8 (22.2%)	1 (2.8%)	1 (2.8%)	36 (100.0%)
Excellent	2 (11.1%)	1 (5.6%)	6 (33.3%)	6 (33.3%)	3 (16.7%)	18 (100.0%)
Total	**23 (38.3%)**	**11 (18.3%)**	**15 (25.0%)**	**7 (11.7%)**	**4 (6.7%)**	**60 (100.0%)**

Lifestyle and Anxiety Symptoms

A contingency analysis assessed the association between self-reported lifestyle categories and anxiety symptom levels. The chi-square test showed a statistically significant association (p = .035). A high proportion of participants who reported an excellent lifestyle had moderate or severe-to-extremely-severe anxiety, whereas most participants who reported a regular lifestyle had no or low anxiety (Table 5). Cramér's V indicated a large effect size (V = .37), suggesting a strong association between lifestyle category and anxiety symptoms.

Table 5. Relationship Between Lifestyle and Anxiety Levels

Lifestyle category (FANTASTIC)	No/low anxiety (%)	Moderate (%)	Severe/extremely severe (%)	Total (%)
Regular	5 (83.3%)	0 (0.0%)	1 (16.7%)	6 (100.0%)
Good	19 (52.8%)	5 (13.9%)	12 (33.3%)	36 (100.0%)
Excellent	2 (11.1%)	5 (27.8%)	11 (61.1%)	18 (100.0%)
Total	**26 (43.3%)**	**10 (16.7%)**	**24 (40.0%)**	**60 (100.0%)**

Lifestyle and Stress Symptoms

Lifestyle was significantly associated with stress level, $\chi^2(8) = 22.281$, $p = .004$. Among participants with a regular lifestyle, 83.3% had no or mild stress, 16.7% had moderate stress, and none had severe or extremely severe stress. Among those with a good lifestyle, 55.5% had no or mild stress, 33.3% had moderate stress, and 11.1% had severe or extremely severe stress. In contrast, among participants with an excellent lifestyle, 22.2% had no or mild stress, 16.7% had moderate stress, and 61.1% had severe or extremely severe stress (Table 6). Cramér's V indicated a large effect size (V = .43), suggesting a strong association between lifestyle category and stress level.

Table 6. Relationship Between Lifestyle and Stress Levels

Lifestyle category (FANTASTIC)	No/mild stress (%)	Moderate (%)	Severe/extremely severe (%)	Total (%)
Regular	5 (83.3%)	1 (16.7%)	0 (0.0%)	6 (100.0%)
Good	20 (55.5%)	12 (33.3%)	4 (11.1%)	36 (100.0%)
Excellent	4 (22.2%)	3 (16.7%)	11 (61.1%)	18 (100.0%)
Total	**29 (48.3%)**	**16 (26.7%)**	**15 (25.0%)**	**60 (100.0%)**

Physical Activity and Lifestyles

A nonparametric Spearman rank-order correlation was used to assess the relationship between PA and lifestyle. The results indicated a weak-to-moderate negative correlation that was statistically significant, $r_s = -.333$, $p < .05$, 95% CI [-.537, -.084].

Discussion

Most participants reported meeting the WHO recommendations for PA. However, this high prevalence contrasts with studies reporting low adherence in similar populations (Moral Moreno et al., 2024). The difference may reflect the use of a self-report instrument, which is susceptible to overestimation, and the summer data-collection period, when PA may increase. These factors may also help explain the absence of a significant association between PA and mental health symptoms in this sample, unlike findings reported elsewhere (Rodríguez-Romo et al., 2022; Wei et al., 2024).

In contrast, lifestyle was significantly associated with symptoms of stress, depression, and anxiety. Participants who reported an excellent lifestyle had higher proportions of moderate or severe symptoms than those who reported regular or good lifestyles. Anxiety symptoms also differed across self-reported lifestyle categories. Although research has linked PA and mental health in various populations, relatively little work has focused on chemical sciences students (Xu et al., 2024). The broader literature has documented relationships between lifestyle and psychological well-being (Zimmer-Gembeck & Skinner, 2024), consistent with the present finding that lifestyle was more strongly associated with psychological symptoms than PA. One possible explanation is that Pender's model treats lifestyle as a multidimensional construct encompassing nutrition, health responsibility, stress management, interpersonal support, self-actualisation, and exercise, all of which may influence mental health in daily life. By comparison, PA represents one component of overall behaviour and is itself influenced by other lifestyle dimensions. Lifestyle may therefore provide a broader representation of the psychosocial context of well-being (Bustamante Acaro et al., 2025).

Participants with excellent lifestyles reported higher stress levels, which may be related to self-imposed demands, perfectionism (Kealy et al., 2025), and the pressure of maintaining highly structured routines. In demanding academic contexts, healthy behaviours may coexist with perfectionistic patterns and rigid routines, particularly in fields with high performance standards (Mirza et al., 2021; Rezaei-Gazki et al., 2024). Although perfectionism was not measured in this study, maladaptive perfectionism has been identified as relevant among science and technology students and may help explain the observed association. This explanation is offered only as a hypothesis-generating interpretation: a persistent pursuit of control and achievement may increase psychological burden even when healthy habits are maintained (Kealy et al., 2025). These findings support a comprehensive approach to lifestyle that considers both physical health behaviours and the psychological processes that may influence their relationship with mental health.

A similar pattern was observed for depressive symptoms: participants who reported good or regular lifestyles had lower proportions of symptoms (Araripe et al., 2025), whereas highly structured lifestyles were associated with greater emotional vulnerability. Anxiety followed a comparable pattern, although unhealthy lifestyles may also contribute to anxiety symptoms (Kwon et al., 2024).

These trends may be understood through self-efficacy theory (Powers et al., 2024) and psychological flexibility theory (Kulandaiammal et al., 2024). A high level of organisation may enhance motivation and performance, but it may also increase pressure and reduce adaptability. Conversely, balanced, flexible, and sustainable lifestyles are associated with better indicators of well-being, consistent with positive health theory (Martín-Díaz & Fernández-Abascal, 2024) and research highlighting the benefits of positive well-being practices (Bhargava et al., 2024).

Finally, PA was inversely related to perceived lifestyle, indicating that higher PA was associated with lower perceived well-being in this dimension. Although PA is generally associated with better physical, psychological, and social well-being (Buecker et al., 2021), participants in this sample may have experienced it as an additional demand requiring time, effort, and energy or causing physical discomfort, thereby lowering their assessment of a healthy lifestyle. Bobo-Arce et al. (2024) identified lack of time, lack of energy, and insufficient resources as major barriers to PA and found that women perceived these barriers more strongly. When PA occurs alongside substantial academic, work, or family demands, it may be perceived as an additional obligation rather than solely as a health-promoting behaviour. Gómez-Mazorra et al. (2020) similarly reported greater autonomy frustration, demotivation, and external regulation among students in health and education programmes and those involved in developmental sport. When physical activities are driven by institutional, academic, or performance demands, intrinsic motivation may decline and perceptions of lifestyle habits may become less positive. Pender's Health Promotion Model explains these findings through interactions among individual experiences, behaviour-specific thoughts and feelings, and immediate competing demands, all of which affect commitment to health-promoting behaviour. Perceived barriers, limited time, and low motivation may therefore reduce the perceived benefits of PA and influence overall lifestyle assessments, even when PA remains protective for health (Bobo-Arce et al., 2024; Gómez-Mazorra et al., 2020).

Overall, lifestyle more fully reflects interactions among habits, personal demands, and psychological well-being and was therefore more strongly associated with mental health than PA alone in this sample. Future research should incorporate moderating and qualitative variables to clarify why some students reporting excellent lifestyles may nevertheless experience greater stress or emotional vulnerability.

Conclusion

This exploratory study identified a significant association between lifestyle and mental health and revealed an unexpected pattern: students who reported an excellent lifestyle had higher proportions of moderate-to-severe symptoms of stress, anxiety, and depression. Within the analysed sample, characteristics related to the students' field of study may be associated with these psychological symptoms, challenging the assumption of a simple linear relationship between healthy habits and emotional well-being. However, specific academic demands were not measured, and the sample was small and selected by convenience. The findings should therefore be interpreted cautiously and used primarily to generate hypotheses rather than generalised to the wider university population.

Limitations

This study is limited by convenience sampling, which introduces selection bias, and by the small sample size, which restricts the generalisability of the findings. Reliance on self-reported data also increases the risk of social desirability bias and response misclassification. Finally, the study design did not permit control of potentially important confounding factors, including academic workload, sleep patterns, and socioeconomic status. These limitations should be considered when interpreting the magnitude of the observed associations.

Future research should address these limitations through probability sampling and substantially larger samples to improve generalisability and reduce bias. Study designs should also measure and statistically control relevant confounding factors to strengthen internal validity and support more robust causal inference. Mediating variables such as self-efficacy, social support, and motivation towards PA should also be examined to clarify these complex relationships.

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Declaration of Generative AI and AI-Assisted Technologies in the Writing Process

During the preparation of this manuscript, the authors used Google Translate to assist with improving language clarity. The authors carefully reviewed and revised the output to ensure accuracy and take full responsibility for the content of the final manuscript.

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INTERNATIONAL SPORTS STUDIES

ORIGINAL RESEARCH ARTICLE

One Game – Two Perspectives? Insights into Team and Competition Experience in Special Olympics Unified Sports® Handball in the Context of the German National Games 2022

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Abstract

This paper analyses team and competition dynamics in Unified Sports® handball at the Special Olympics National Games 2022. Unified Sports® offers three distinct approaches that provide joint sports activities for individuals with intellectual disabilities, called athletes, and those without, referred to as partners. In this study, 25 guideline-based interviews were conducted with players pursuing the Competitive model and analysed using the coding process of Grounded Theory. An objective was to investigate the players' team and competition experience as well as interaction patterns and their underlying causes in a nuanced manner. The results show prevailing complementary interactions within the handball teams. Partners assume primary responsibility in almost all contexts, guide athletes both within and beyond the sporting context, and provide emotional and practical support. They demonstrate higher handball-specific performance and a more pronounced game understanding than athletes. These performance differences are closely connected to the category of disability. Consequently, the analysed dynamics cannot be clearly attributed to disability or sporting performance. Further interaction patterns may partly be explained by specific requirements of the Unified Sports® concept and the partners' prosocial behaviour. Because of prevailing ambivalent goals, an area of tension emerges between social inclusion and competition. The results indicate that the competition in Unified Sports® handball does not fully comply with the principles of the Competitive model postulated by Special Olympics.

Introduction

Joint sports activities and competitions involving individuals with and without disabilities are gaining in importance, which is why the Special Olympics (SO) Unified Sports® concept opens pioneering perspectives. As the world's largest sports movement for individuals with intellectual and multiple disabilities, SO presents itself as a movement for social inclusion and

regards Unified Sports® in particular as an effective example of inclusion (Special Olympics Deutschland, n.d.). In this context, Unified Sports® offers a promising opportunity to contribute to the implementation of the United Nations Convention on the Rights of Persons with Disabilities (United Nations, 2007). Within this concept, SO enables people with and without intellectual disabilities to participate together in sport through three different approaches (Special Olympics, 2024). The present paper focuses on the Unified Sports® Competitive model, whose objective is to provide an inclusive and simultaneously competitive sports offer through specific rules (Special Olympics, 2024). This aspiration appears particularly challenging in sports games, which are inherently characterised by both victory and defeat, as well as the dynamic interplay between cooperation and competition.

The state of research on Unified Sports® competitions remains rudimentary (Ollila & Haegele, 2025). Most existing studies focus on psychosocial effects of joint sports participation, particularly in relation to social-emotional learning, attitudinal change, or personality development (e.g. Accardo et al., 2023; Huber & Pochstein, 2025; McConkey et al., 2013). These studies reveal inequities between athletes with and without disabilities and indicate that partners often assume roles as leaders and helpers. However, these patterns of social interaction have not been examined within the context of sporting competition. The current direction of research may be shaped by interpretations aligned with two of the three Unified Sports® models, which prioritise community, participation, and the removal of barriers over performance-oriented aspects. However, some studies have investigated motor-skill aspects and performance levels of Unified Sports® players (e.g. Ketcheson et al., 2024; Pawlowski, 2025; Skowroński et al., 2024).

There are only a few studies explicitly examining Unified Sports® competition from the players' perspective (Greve et al., 2021; Greve et al., 2025), and these show that joint competitions of individuals with and without disabilities often fail to create an equitable competition situation. They reveal a tension between conceptual guidelines and actual competition practices (Greve et al., 2025; Skowroński et al., 2024). Greve et al. (2021) and Greve et al. (2025) reported asymmetrical structures in handball and basketball based on the category of difference in terms of disability, accompanied by in-group thinking and unequal participation. Partners, players without disabilities, primarily act as supporters of athletes, players with intellectual disabilities – both emotionally and with regard to sport-specific facets. Additionally, they concentrate on athletes' sporting and social development. Current studies reveal an area of tension between equitable participation and competition, which has been interpreted slightly differently across various studies. Pawlowski (2025) highlighted that players in Unified Sports® focus on joyful participation in joint sports activities rather than on performance and sporting ability. Greve et al. (2021) and Greve et al. (2025) identified an area of tension between social support and sporting success that is intensified by deliberate restraint of partners, aimed at enabling athletes to experience success. This tension emerges from diverse goal orientations among individual players (Greve et al., 2025). A comparable area of tension between performance-oriented competition demands and the desire for joyful participation is evident in two studies of a similar setting in which people with and without intellectual disabilities participate in joint competition in handball (Greve & Bechthold, 2019) and rugby (Corazza & Dyer, 2017).

Skowroński et al. (2024) revealed performance differences in basketball: partners possess higher technical abilities, achieve higher game performance, participate more actively in the flow of play, and adopt an overall dominant position compared with athletes. The causes of these differences are still unclear. Similarly, Pawlowski (2025) revealed higher sport-specific motor abilities in basketball among partners. Other researchers showed that Unified Sports® football players exhibited comparable values at almost all levels of physical activity and

differed only in activities of higher intensity (Ketcheson et al., 2024). However, they did not analyse participation in or contribution to the game situation.

To date, the underlying mechanisms shaping team dynamics and interactions remain unclear. In particular, the supportive role of partners requires closer examination. The question arises whether certain dynamics are triggered by the Unified Sports® concept itself, by joint sports activities of individuals with and without intellectual disabilities or rather by the complexity of the sport. Handball in particular, as a dynamic, contact-intensive sport, imposes high motor requirements owing to intense body contact and pressure of space, time, and opponents (König et al., 2022). Success is determined not only by individual performance in competition or by the players' basic performance level but, crucially, by the actions of teammates and opponents (Lames, 1998). The complexity of handball lies in fast-paced transitions, where players must make quick decisions in synchronisation with their team (Espoz-Lazo & Hinojosa-Torres, 2025). This real-time coordination and reorganisation among players require self-organisation, as coaching instructions cannot be given in time. Therefore, verbal and nonverbal communication is necessary. Overall, handball involves many cognitive and mental processes, such as listening, observing, interpreting, making decisions, and performing actions (Espoz-Lazo & Hinojosa-Torres, 2025).

The research gaps outlined above highlight the relevance of an in-depth analysis of team dynamics, interaction patterns, competition perspectives, and the area of tension between social inclusion and competition within the Unified Sports® Competitive model from the players' perspective. Therefore, the present paper reconstructs and analyses the perspectives of handball players at the SO National Games Berlin 2022 by means of guideline-based interviews. The specific objective of this study is to elucidate how athletes and partners experience and interpret the Unified Sports® competition in handball.

To establish the analytical framework for interpreting the findings, the paper delineates the SO competition rules and the Unified Sports® concept, then outlines central theoretical concepts of social interaction and social support.

Competition Rules at Special Olympics

SO competitions differ from other sporting competitions through specific rules and regulations. They take place at regional, national, and international level (Special Olympics, 2022). National Games and World Games are staged every two years, alternating between Summer and Winter Games. International SO rules apply. These are based on the regulations of international sport federations and national professional associations, and have been partially adapted (Special Olympics, 2022). Divisioning plays a central role in SO competitions: participants are grouped into the most homogeneous divisions possible by means of classification systems (Special Olympics, 2024). This grouping takes account of performance level and age in order to ensure fair competitions. In handball, divisioning follows the so-called Swiss system, with a ranking list being drawn up on the basis of wins (Special Olympics Deutschland, 2023). The Maximum Effort Violation Rule prevents disproportionate performance improvements during the tournament, thereby ensuring equal opportunities and preventing tactical restraint during divisioning (Special Olympics, 2024). At the end of the competition, placements are determined and honoured within each division (Special Olympics, 2024).

In addition, the Criteria of Advancement to Higher Level Competition regulates eligibility: athletes must have participated at previous competition levels in order to advance to the next level (Special Olympics, 2024).

The Unified Sports® Concept

Unified Sports® enables individuals with and without intellectual disabilities of all genders to take part together in team and individual sports (Special Olympics, 2024). Three approaches are distinguished, each with its own structure adapted for specific needs. The Unified Sports® Recreation model focuses on joint sports activities regardless of performance level and without competition participation. By contrast, the Unified Sports® Player Development model aims to enable peer learning and mutual support in the development of sport-specific abilities among players with different performance levels. Participation in competition is possible up to the national level. The Unified Sports® Competitive model, which this paper discusses, focuses on preparing for and taking part in national and international SO competitions. All team members should be of roughly the same age and performance level, and possess the necessary sport-specific competencies (Special Olympics, 2024). Under this approach, the sport rules closely mirror those of the relevant professional sports association – in handball, the rules of the German Handball Federation apply to the German National Games (Special Olympics Deutschland, 2021). International regulations additionally stipulate that four athletes and three partners must be on court in a Unified Sports® handball team. In Germany, athletes are required to occupy the goalkeeper position (Special Olympics Deutschland, 2021).

Fundamental is the Principle of Meaningful Involvement (POMI), which is intended to ensure that all team members are actively and meaningfully involved in the game (Special Olympics, 2012). POMI requires every player to contribute their best to the team's success by deploying their individual strengths and taking on important roles without any one player dominating, posing a safety risk, or excluding others. Team members should therefore adjust their level of ability to those of their teammates but not lower it drastically. Players and coaches are expected to internalise POMI and to observe it when forming their teams. Compliance during competition is monitored by observers (Special Olympics, 2012). Additional sport-specific guidelines exist to operationalise POMI (Special Olympics, 2024). While SO formulates these generally for all Unified Sports® players in handball, SO Germany explicitly imposes special requirements on partners: they should avoid dominating play, act as role models, and involve athletes in the flow of play (Special Olympics Deutschland, 2021). It seems problematic that these directives create differences between athletes and partners while ascribing to partners a higher performance level and a supportive role, regardless of the model being pursued.

Interaction Patterns

Against the background of the research interest, it is relevant to examine interaction patterns in the context of Unified Sports® competitions. Social interactions between individuals are described and classified differently depending on the theoretical perspective. According to Watzlawick's systems theory, they can be characterised along the dimensions of symmetry and complementarity (Willemse & von Ameln, 2018). Complementary interactions are based on the adoption of opposing roles: one party assumes a superior position, while the other submits. Symmetrical interactions, by contrast, arise either through mutual acceptance of one another's equal worth, resulting in interaction on an equal footing, or through mutual striving for superiority. Willemse and von Ameln (2018) further state that reciprocity is present when complementary interactions alternate over time so that a form of symmetry emerges in the long term. Interactions are determined not only by individual or situational factors but also by social norms (Willemse & von Ameln, 2018). For example, the social responsibility norm shapes social interactions. It is founded on a sense of responsibility and moral obligation and motivates people to engage in prosocial behaviour when others depend on their support to achieve success or well-being (Berkowitz & Daniels, 1963, as cited in Bierhoff & Rohmann, 2021). In addition, altruism – understood as a motivational state directed primarily at increasing another person's

welfare (Batson, 2014) – can shape social interaction patterns. The concept of othering likewise influences social interaction patterns. Canales (2000) defines othering as a process in which individuals are categorised as 'other' on account of perceived deviations from social norms and are consequently stigmatised. A precondition is an established norm that classifies certain groups as norm-conforming and others as deviant.
Within theories of recognition and respect, symmetry and reciprocity are regarded as central premises for equivalence and equal participation (Silter, 2019).
Interactions in team sports – which we examine in this study – are characterised by role allocation, distribution of responsibilities, and coordinated behaviours (Wegner, 2020). In handball, interactions are typically hierarchical between backcourt players and wing and pivot players (Korte & Lames, 2019). Backcourt players structure and dominate interplay as central players (Korte & Lames, 2019). Particularly, the centre is responsible for ball distribution and functions as a playmaker as well as a bridging unit between the other positions (Korte & Lames, 2018). The role of playmaker requires game intelligence and autonomous decision-making to coordinate quick adaptations during the game (Baur, 2009; Espoz-Lazo & Hinojosa-Torres, 2025). Wing and pivot players, in contrast, bear less responsibility for structuring the teamwork and are less frequently involved in offensive situations (Korte & Lames, 2019). Accordingly, a systematic analysis of interaction patterns within Unified Sports® teams is crucial for understanding team dynamics and interpreting equitable participation.

Social Support

Previous research has established that support is highly relevant in the context of Unified Sports® competition. However, a detailed differentiation of support types in Unified Sports® remains outstanding.
Social support constitutes a multidimensional construct that can be divided into emotional, practical, and informational support types (e.g. Cohen & Wills, 1985; House, 1981; Thoits, 1985). Some models additionally incorporate positive social interactions in terms of belonging or companionship (Barrera & Ainlay, 1983; Cohen & Wills, 1985; Fydrich & Sommer, 2003). The understanding underlying the present paper is based on the concept proposed by Fydrich and Sommer (2003). They define social support as the result of cognitive-emotional processing and evaluation of present and past social interactions through which individuals experience or expect assistance in order to cope with tasks, manage burdens, and achieve personal goals. The authors distinguish three interdependent support types: *emotional support* (e.g., receiving appreciation, encouragement, advice, and guidance in problem solving), *practical support* (e.g., relief from tasks, accompaniment, concrete help, receipt of tips, and information) and *social integration* (e.g., a sense of belonging, shared activities, and having trusted persons). Fydrich and Sommer (2003) emphasise that support types are helpful only if they are perceived as positive by the recipient. The helper's intention may differ from the recipient's need.

Within the object of investigation, where people with different life situations and backgrounds come together, inclusive and competitive objectives are pursued simultaneously. Consequently, analysing social interactions in Unified Sports® demands a nuanced, context-sensitive approach.

Methods and Materials

Given the rudimentary state of research to date, the present study was exploratory in nature. To reconstruct and analyse the perspectives and experiences of players in Unified Sports® handball, 25 guideline-based interviews were conducted during the National Games Berlin 2022 with 11 athletes and 14 partners. Participants were players from six different Unified Sports® handball teams who volunteered. Sample characteristics are provided in Table 1. The

study was conducted in accordance with the Ethical Principles for Medical Research Involving Human Participants of the World Medical Association Declaration of Helsinki and in compliance with applicable laws and institutional guidelines. Before each interview, voluntary and informed consent was obtained and documented after information had been provided about the research aims and the handling of data. Information was provided clearly and, for athletes, in simple language to ensure barrier-free communication (Netzwerk Leichte Sprache, n.d.). All interviewees were of legal age, legally competent, and could withdraw from the study or decline to answer individual questions at any time without reprisal. Prior to data collection, interviewers were briefed on working with sensitive topics. The interview guidelines addressed motives for participation in Unified Sports®, personal tasks and goals, perceptions of victory and defeat, and the influence of observers on the team's playing behaviour. Team cohesion, interaction between the groups of players, and individual evaluations of the Unified Sports® concept were also explored. The interview guide contained carefully considered questions and the guide for athletes was written in simple language (Netzwerk Leichte Sprache, n.d.). Open narrative prompts provided a comprehensive insight into participants' individual perspectives and subjective experiences. Interview duration varied by group and ranged from 10 to 30 minutes. All interviews were conducted in German and quoted excerpts of the transcripts were translated into English for reporting. Audio recordings and transcripts were pseudonymised.

Table 1. Demographic Characteristics of Participants (Mean and Standard Deviation)

Players of the Unified Sports® Handball Team	Athletes	Partners
Number	11	14
Gender	9 male, 2 female	7 male, 7 female
Age (years)	25.82±6.46	23.29±5.26

Interview data were analysed using the coding process of Grounded Theory methodology (Corbin & Strauss, 1990), as this approach is particularly suited to investigating and comparing social processes and phenomena in a field that has been little explored to date. This enabled an open and unbiased approach to the research field of Unified Sports® handball within the Competitive model. Key stages of the analytical procedure were coding and memo writing. Analysis was carried out in tandem by researchers with and without field access to ensure continuous communication of results and the necessary distance from the field. Coding was performed separately for athletes and partners in several steps using the MAXQDA analysis software. In this process, only open and axial coding were applied. First, all relevant themes and phenomena in the data were identified and open coded. Within each group, interviews were coded sequentially, with the coding tree being expanded continuously. Analysis continued iteratively until data saturation was reached, such that interviews no longer yielded new information relevant to the research question. During a second pass, axial coding was used to corroborate the identified categories, establish systematic relationships between them, and develop a category system. In total, 1565 codes were inductively generated (1021 codes from partner interviews; 544 from athlete interviews). These were organised under 10 main codes for partners and 8 for athletes across multiple levels before overarching categories were formed. Selective coding to develop a core category (Corbin & Strauss, 1990) was not used

because the theory generated through the applied coding steps was sufficient to answer the research question.

Results

In the course of the analytical steps, five main categories with several subcategories were extracted from the interview data, reflecting the team dynamics and competition experience of the handball players at the National Games 2022 (see Figure 1). The categories are first outlined, then illustrated by expressive quotations and finally situated within interpretations and theoretical contexts.

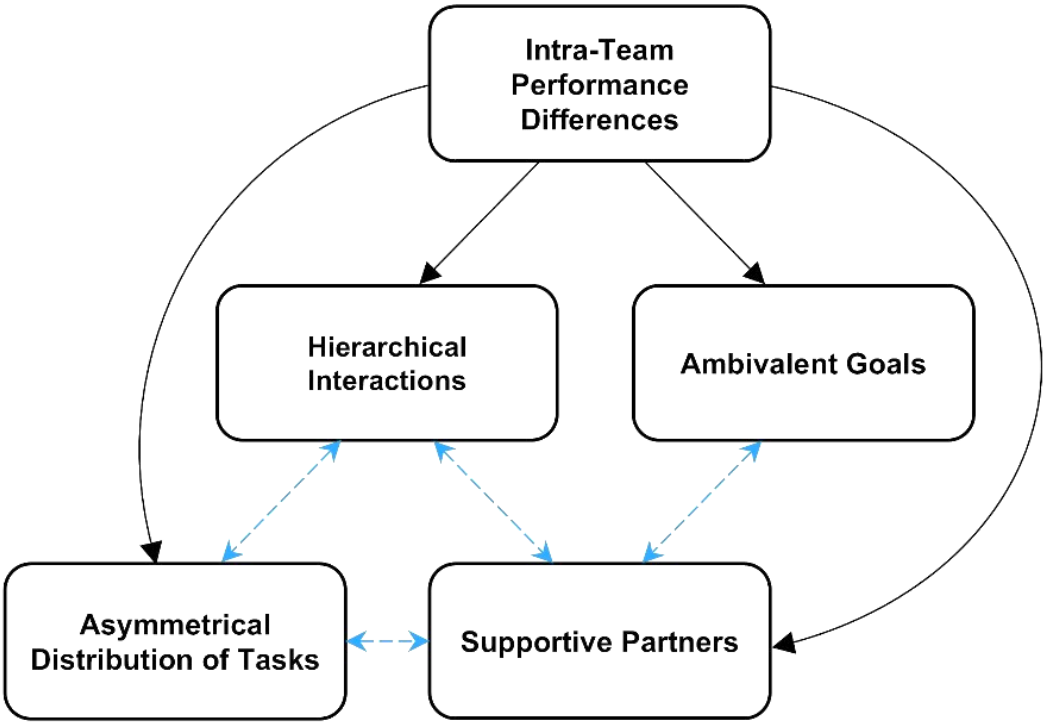

Figure 1. Overview of the Five Main Categories

Figure 1 shows the overview of the five main categories and their interrelationships in Unified Sports® handball within the Competitive model. Intra-team performance differences function as the base category and influence all other categories (black arrows). Dashed arrows indicate dynamic interactions between individual categories. Arrow directions point to assumed causal relationships.

Intra-Team Performance Differences

From the players' perspective, the interviews reveal intra-team performance differences between partners and athletes. Partners perceive themselves as stronger performers in handball because they report lower handball performance by the athletes. They describe giving athletes technical and tactical tips, implying that they attribute higher handball-specific abilities to themselves. Performance differences across teams within the group of athletes are additionally described.

> *"There are teams with really strong guys with disabilities; physically and athletically they're way ahead … they can obviously score goals. With us it's like, sure, with the Unified partners we probably have some of the strongest here, but if our athletes don't score we don't win the match. … We aren't here just for us to throw the balls into the goal while our athletes run up and down the sideline." (Unified Partner (UP) 13, pos. 20)*

The quotation shows differences in goal-scoring success between athletes and partners. Performance differences characterise both the partners' style of play and goals and those of the whole team, because victory is made contingent on the athletes' performance. Performance differences between partners and athletes have likewise been reported in earlier research (Pawlowski, 2025; Skowroński et al., 2024). One influencing factor is different training and competition opportunities: while athletes typically participate exclusively in a Unified Sports® handball team, partners often engage in an additional non-Unified handball team with regular match participation, which tends to enhance their handball-specific performance. As these differences are linked to many other phenomena analysed, they can be identified as a base category that crucially characterises Unified Sports® handball within the Competitive model. This is particularly noteworthy because the differences identified are not consistent with the approach postulated by SO (Special Olympics, 2024), a point also raised by Skowroński et al. (2024) and Ollila and Haegele (2025). The performance differences influence the interpersonal interactions within the Unified Sports® handball teams, which are described in detail in the following category.

Hierarchical Interactions

The interaction patterns between athletes and partners reveal discrepancies between subjective interpretation and objective analysis.

Perceived Symmetrical Interactions. Players portray the interactions on and off the playing field as symmetrical, even though their explanations simultaneously point to complementary interaction patterns between athletes and partners.

> *"Actually, we all try to be on equal footing, but when something doesn't run smoothly you sometimes have to lay down the law, … even though we're young, we have a high standing with them. … if anything's up, they can always come to us, … But I'd say there's no hierarchy. We're basically all on the same wavelength and on equal footing." (UP 5, pos. 108-112)*

The partner's statement exposes contradictions: contrary to her subjective interpretation, the fact that partners serve as contact persons for athletes and issue decisive commands does not constitute communication on an equal footing. Her belief that she enjoys high esteem among athletes also implies that she sees herself as being on a superior level. Overall, this deviates from symmetrical interactions described by Willemse and von Ameln (2018). It remains unclear whether partners genuinely perceive the patterns as symmetrical or respond in line with the norm of social desirability (Mummendey, 1981).

Manifested Complementary Interactions. Within the teams, complementary interactions predominate both inside and outside the handball context, with partners assuming a guiding role that athletes follow. On the playing field, partners act as playmakers, lead offence situations, give defensive instructions to athletes, and ensure that they maintain their positions. They shoulder greater responsibility for tactical decisions, sometimes consult with coaches without involving athletes and provide athletes with technical and tactical advice.

> *"Every player puts forward their opinion and it gets noticed, but we partners still have to check whether these ideas are actually feasible. You know, because we know our players, how it works." (UP 6, pos. 78)*

The quotation illustrates that partners evaluate and selectively implement athletes' suggestions. It also implies that the partner regards his heightened responsibility and decision-making authority as self-evident. Furthermore, complementarity is reinforced by partners acting as assistant coaches who, for example, lead exercises in training.

Complementary interactions are also evident off the handball court, as partners support athletes in everyday tasks and serve as contact persons. The patterns analysed correspond to the complementary interaction defined by Willemse and von Ameln (2018). Greve et al. (2021) and Greve et al. (2025) reported comparable asymmetrical structures and hierarchical relationships within Unified Sports® teams.

Differentiating Wording. Complementarity is reinforced by partners' use of differentiating language towards athletes. Partners draw a clear linguistic boundary between the groups of partners and athletes, whereas athletes do this far less and tend to refer to the team as a whole or to individual players.

> *"It's difficult, you know, dealing with them; they're different people and you have to look behind the façade first, but at some point you figure it out and then it feels normal." (UP 4, pos. 10)*

The quotation reveals not only clear differentiation and in-group thinking but also a devaluation of individuals with intellectual disabilities. This attitude is particularly noteworthy in the context of SO Unified Sports®. Such differentiation can be linked to the process of othering (Canales, 2000) and is likewise highlighted by Greve et al. (2021).

Positive Team Cohesion. Despite the differentiation, the handball teams experience positive team cohesion both on and off the playing field, with particular emphasis on mutual support and a family-like atmosphere.

> *"In my view the way we get along and the communication on the court are really good. We talk to each other, we look out for one another and, wherever help is needed, if there's a gap, we try to close it so that no one gets through." (Unified Athlete (UA) 8, pos. 62)*

The athlete describes a positive team dynamic characterised by mutual thoughtfulness and support during the game. Additional explanations, such as joint activities after training, indicate a positive dynamic off the court as well. Experiencing such positivity is intriguing considering the complementary patterns described above. The latter therefore appears to exert no negative influence on cohesion. Strong team cohesion in Unified Sports® teams has especially been reported in previous research that did not focus on competition (e.g. McConkey et al., 2013) and by Greve et al. (2021).

The analysed complementary interactions are reinforced by the partners' supportive role, described below.

Supportive Partners

From the players' perspective, the Unified Sports® Competitive model is often understood as a concept in which partners act as supporters of athletes. Both groups of players partly refer to partners as 'supporters', yet this role attribution is articulated mainly by partners themselves. In some teams, this understanding manifests in a tandem concept whereby partners deliberately support athletes to enhance their playing practice.

In line with Fydrich and Sommer (2003), three support types were identified. Emotional support is of particular relevance, as many partners emphasise motivating and encouraging the athletes, especially after defeats.

> *"We're kind of the ones who have to bring the motivation back onto the field … sometimes it's not that easy … physically getting a shot on goal … I understand that it's difficult for the athletes … and then they let their heads drop. Yet we keep trying to bring in this good atmosphere" (UP 10, pos. 117-135)*

The partner attributes the need for emotional support to the high physical demands of handball and the resulting frustration among athletes.
Off the court, partners likewise ensure that all athletes feel comfortable, particularly during the week of the National Games in Berlin.

Moreover, practical support (Fydrich & Sommer, 2003) is central, as partners give athletes technical and tactical instructions during play and debriefings and explicitly create shooting opportunities for athletes through targeted assists. Partners cite the inherent complexity of handball and performance differences as reasons. It also becomes apparent that they regard supporting individuals with intellectual disabilities as the expected norm and transfer this to the sport context.
Outside the handball context, partners assist with everyday tasks such as taking medication. According to the athletes, those with milder impairments are granted more autonomy. This shows that the support type can be attributed to the cognitive abilities of athletes and thus to the category of disability.
The supportive role meets with approval from athletes but also with criticism, particularly when it is perceived as patronising. This evaluation of support points to paternalistic traits within Unified Sports®.
That partners function as supporters both emotionally and within handball in Unified Sports® competitions has been highlighted in previous research by Greve et al. (2021) and Greve et al. (2025), but it has not been further differentiated.

Social Integration (Fydrich & Sommer, 2003) also emerges as a support type, since partners perceive themselves as trusted persons for the athletes – a perception that is, however, not evident from the athletes' viewpoint. Moreover, social integration is present because athletes and partners participate in joint activities through the weekly training, and both groups experience a sense of belonging to a handball team.

Deliberate Restraint. The supportive role is accompanied by deliberate restraint of partners in offence and defence during the handball game. In accordance with the Unified Sports® concept and POMI (Special Olympics, 2012), such restraint is viewed, on the one hand, as an attempt to avoid cautions by observers and injuries, and to maintain the flow of play. On the other hand, it stems from prosocial behaviour, as partners refrain from shots on goal in favour of athletes.

> *"What I actually find difficult sometimes is really going through and taking the shot on goal (.) because I rather feel I have to or want to pass again; maybe someone else is positioned better right now, … and I could maybe … give them a chance. I actually had two or three situations where I was free and then didn't go at all." (UP 10, pos. 67-71)*

The quotation reveals the partner's uncertainty regarding restraint when taking shots on goal. This indicates that, from the partner's perspective, the Unified Sports® concept fails to provide clear role expectations for the players involved. The statement further indicates that partners' restraint is situated in a tension between enabling participation of athletes and making their own contribution to the team's success.
Previous research has likewise identified deliberate restraint by partners in favour of athletes (Greve et al., 2021; Greve et al., 2025).

Athlete Spotlighting. Partners perceive their main function in Unified Sports® as putting athletes in the spotlight as well as enabling them to have the most positive playing experience and to gain experience of sporting competition. They realise this spotlighting by giving athletes shooting opportunities through targeted assists, thereby assigning responsibility to them in match-deciding situations. It is worth noting that athletes themselves do not articulate this

spotlighting. Partners push their own development in Unified Sports® into the background and prioritise that of athletes.

> *"My focus is really somehow to give people the opportunity; so rather this role in which I basically put the others in the spotlight; … so not to develop myself further in sporting terms." (UP 11, pos. 48)*

The quotation implies the view that, without the partners' actions, the athletes would not have the opportunity to show their handball skills and take shots on goal. Most partners do not perceive the game as a shared handball match. Instead, they focus on spotlighting athletes, which can be explained by the social responsibility norm (Berkowitz & Daniels, 1963, as cited in Bierhoff & Rohmann, 2021) as well as by altruistic behaviour (Batson, 2014). Ultimately, this attitude leads some partners to interpret the National Games 2022 explicitly as an event for athletes rather than as a shared competition, an outcome that is contrary to the inclusive ethos of the Unified Sports® Competitive model.

Asymmetrical Distribution of Tasks

Understanding Unified Sports® as a supportive concept characterises the style of play and distribution of tasks within the handball teams. Whereas partners assume numerous tasks during the game, they assign athletes almost exclusively the act of shooting on goal. Athletes, in contrast, describe a variety of self-ascribed tasks, such as acting as a motivator or promoting fair play, indicating divergent attributions of responsibility. Overall, this exposes an imbalance in the distribution of tasks between the two groups of players within Unified Sports®.

Established Differences in Positions. Teams also exhibit positional differences: partners predominantly occupy strategic, central backcourt positions or are deployed flexibly, whereas athletes are usually placed on the wing or in the pivot position.

> *"I tend to play right-back or left-back, depending on where the team needs me. … normally left wing. But in Unified it doesn't really make sense for me to stand out on the left wing if I'm supposed to, well, build the others up, build the play." (UP 6, pos. 26)*

The positional difference between Unified Sports® and the partner's other handball team contrasts the partner's functions in playing with individuals with intellectual disabilities and with those without. This indicates that the distribution of tasks within the Unified Sports® team is mirrored in the positional allocation.

Exclusive Playmaker Role. In almost all teams, partners assume the playmaker role: they coordinate offence and defence, initiate set plays, and ensure that all players keep their positions. Only in one team does an athlete undertake this function.

> *"As a Unified partner I have done a lot of game management. That's comparable to the playmaker in, let's say, a regular handball team. There's also one person who calls the plays, coordinates who should stand where, basically acting alongside the coach on the court; … that was clearly my role." (UP1, pos. 24)*

The fact that the centre back player acts as a steering and coordinating playmaker is inherent in handball (Baur, 2009), and therefore not attributable to joint play between individuals with and without intellectual disabilities. However, the finding that this position is filled almost exclusively by partners demonstrates that the distribution of responsibilities in Unified Sports® handball is not equitable. The assumption of the playmaker role by individuals without intellectual disabilities has also been documented in a comparable setting to Unified Sports® by Greve and Bechthold (2019).

Ambivalent Goals

From the players' viewpoint, the National Games are characterised by an area of tension between two competing goals: the aspiration for sporting success on the one hand and the wish for joyful participation on the other. No preference for either goal is linked to membership of the group of athletes or partners. Interestingly, the players keep the two aims separate instead of integrating them.

> *"The main goal was to have fun, we're not here to be winners, but simply to enjoy playing handball and playing together," (UP3, pos. 42)*

Despite this separation, the two goals are often mentioned one after the other, which makes many players' statements appear contradictory. This ambivalence reflects the area of tension identified by Greve et al. (2025), Corazza and Dyer (2017) and Greve and Bechthold (2019) between performance-oriented competitive demands and the wish for enjoyable joint sporting activity of individuals with and without intellectual disabilities. However, Pawlowski (2025) noted that Unified Sports® players prioritise the joyful participation over performance orientation.

A shift of focus from success to joyful participation can be observed during the tournament, caused by comparisons with stronger teams.

Focused Sporting Success. Players express performance-oriented goals such as winning individual matches or a medal, and securing qualification for the World Games. Several partners explicitly state that they want to win on behalf of the athletes or strive to improve the athletes' performance, whereas athletes emphasise improving their own performance during the competition. This indicates that partners orient the Unified Sports® competition at the National Games around the athletes, whereas athletes perceive it as a joint competition.

Focused Joyful Participation. The aim of joyful participation for all includes 'having fun', which many players highlight as an essential component of the National Games. While athletes emphasise the enjoyment of playing handball together, partners additionally locate enjoyment in enabling playing experience and success for the athletes, particularly for those with lower performance levels.

> *"My coach doesn't want us to win by too much … We want to win by four goals or so, but no more. … He also says slow down, let the (.) weaker ones, or those who don't play as well as we do, score some goals; … that they also gain game experience … I think that's really good because the weaker ones always need more experience." (UA 2, pos. 165-173)*

By advocating restraint towards opposing teams to allow lower-performing players opportunities to score, the athlete signals an absence of a competitive mindset at the National Games. This underscores the aim of enabling everyone to experience a joyful competition. The athlete's goals appear to be strongly influenced by the coach's perspective.

Inconsistent Team Goals. Overall, these results indicate that within the handball teams there are neither collective goals nor a shared competitive mindset at the National Games. Players from the same team pursue only individual priorities. Although variation in individual goals within teams is common and thus not specific to Unified Sports® handball, it is unusual for teams to lack common team goals and motives (Wegner, 2020).

Discussion

Many phenomena analysed in Unified Sports® mirror fundamental features of team sports, where role allocation, the associated distribution of responsibilities, and coordinated behaviours are typically present (Wegner, 2020). The establishment of a leadership structure in which players act as playmakers and with a defined role for each teammate is a well-documented phenomenon in handball (Korte & Lames, 2018). The same pattern has already been reported in joint handball games of individuals with and without intellectual disabilities (Greve & Bechthold, 2019). Since the centre's role as playmaker demands game intelligence and autonomous decision-making to coordinate quick adaptations during the game (Baur, 2009; Espoz-Lazo & Hinojosa-Torres, 2025), and the data reveal limited game understanding among athletes, the assumption of the playmaker role by partners seems a logical consequence for building and maintaining the flow of the game, as well as for structuring the interplay between tactical formations. This reveals that the complexity of handball itself reinforces the complementary interaction between players in Unified Sports® handball. As complementary interactions between backcourt players and other players represent a typical dynamic in handball (Korte & Lames, 2019), the complementary interactions identified within Unified Sports® teams may initially be interpreted as regular dynamics in handball. Moreover, both partners and athletes perceive these interactions positively and raise no criticism of the observed complementary patterns.

Nevertheless, the findings highlight the need for critical reflection on the underlying unequal distribution of the roles and responsibilities described between players with and without disabilities – a necessity also emphasised by Ollila and Haegele (2025) as essential for deconstructing prevailing relationship dynamics. Primarily, partners take over responsibility-bearing roles, such as that of playmaker, to facilitate successful handball play. Thus, athletes often occupy roles that largely mirror those they assume outside the sporting context. Whether the complementary interaction patterns and other phenomena identified are primarily driven by the category of disability or rather determined by differences in sporting performance remains unclear. In the data collected, these two aspects are closely interconnected. The question arises as to what extent the basic categorisation into 'athlete' and 'partner' in the Unified Sports® concept (Special Olympics, 2024) – which already implies a complementary structure based on disability – reinforces these phenomena, and whether it is necessary or potentially obstructive to the success of the Unified Sports® Competitive model. The principles of this model, which require players to have similar sport-specific performance levels, suggest that performance should be the only relevant dimension of difference, while disability should not play an important role in the handball match itself – at least in theory. Consequently, the Competitive model holds the potential to enable players with intellectual disabilities to disengage from socially entrenched role ascriptions. A question that arises is whether the positive team cohesion and joint sports activities within a concept labelled inclusive (Special Olympics Deutschland, n.d.) masked this unequal distribution of responsibilities and entrenched structural injustice in Unified Sports® competitions. The interaction patterns observed are shaped by the individual understanding of the Unified Sports® concept – an understanding based on the principle of support, widely accepted by partners and strongly influenced by coaches' views. Therefore, an in-depth analysis of the coaches' perspective and their influence on Unified Sports® appears necessary.

Overall, the analysed Unified Sports® competition does not fully comply with the principles of the Unified Sports® Competitive model posited by SO. The monodirectional supportive role of partners results in partners perceiving the National Games not as a joint competition, but as an event for athletes. Accordingly, the reality aligns more closely with the Unified Sports® Player Development model (Special Olympics, 2024). Although the support types identified are seldom caused by sport-specific factors, the question arises as to whether

handball, given its high complexity (König et al., 2022), is an appropriate sport for a successful Unified Sports® Competitive model. Team sports with lower technical and tactical demands might be better suited to meet the model's requirements. Additionally, partners' restraint is not in line with the Competitive model. On the one hand, it leads to Unified Sports® being interpreted as a competition for athletes. On the other hand, in attempts to comply with POMI (Special Olympics, 2012), partners sometimes drastically lower their own performance and thereby, paradoxically, infringe the principle itself. Consequently, they do not contribute their best to the team's success, do not fully deploy their strengths, and foreground the athletes. As a result, equitable participation in the sense of POMI is not achieved. It must be noted that SO does not define the meaning of 'contributing one's best to the team's success'. In this regard, there may be a difference between Unified Sports® and classic team sports, such that equal participation may be interpreted in different ways. The successful implementation and understanding of POMI from the players' perspective should be investigated in further studies.

Unified Sports® handball is characterised by a central tension between the wish for joyful participation by all and the aspiration of sporting success. Although this should be problematised within the Competitive model, it appears understandable given the real dynamics – Could a competition be regarded as successful if higher-performing players largely dominate play in order to win, while lower-performing players occupy passive roles? Might the distancing from performance-orientation and the focus on joyful participation operate as a coping strategy for partners to avoid disappointment of defeat? Would this tension dissolve if the players on Unified Sports® teams possessed roughly similar performance levels, or would it nonetheless persist owing to social norms surrounding disability?
It remains open how the two aspects of social inclusion and competition can be reconciled considering the prevailing dynamics.

As a critical limitation, the interview timing and setting during the National Games – an event characterised by an experiential character and a competitive environment – may have influenced players' goals and their perceptions of dynamics.

The findings underscore the need for further research on competition within the Unified Sports® Competitive model, particularly studies including match analyses. Such work would allow researchers to examine the extent to which perceived interaction patterns correspond to actual game actions.

Conclusion

The present study provides grounded insights into team dynamics and perspectives on competition in Unified Sports® handball during the National Games Berlin 2022. Although players perceive interactions during competition as symmetrical and emphasise very positive dynamics within their Unified Sports® teams, the analysis reveals predominating complementary interactions between partners and athletes. Within the Competitive model of Unified Sports® handball, partners almost continuously assume strategic, coordinating, and supportive functions, whereas athletes are largely restricted to finishing shots on goal. Ultimately, this results in partners regarding the National Games 2022 as an event for athletes and a venue for enabling participation, rather than as a joint competition. Consequently, complementarity can be interpreted as problematic in relation to the fundamental idea of equitable participation within the Competitive model. Hence, the National Games in handball do not fully conform to the principles of the Unified Sports® Competitive model promoted by SO. This underscores the necessity for partners to engage in critical reflection on their role and interaction patterns – particularly concerning the influence of social norms on the playing field.

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Declaration of Generative AI and AI-Assisted Technologies in the Writing Process
During the preparation of this manuscript, the authors used Chat AI (GWDG-hosted) in order to optimise the German-to-English translation and improve grammar and phrasing. The authors carefully reviewed and revised the output to ensure accuracy and take full responsibility for the content of the final manuscript.

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INTERNATIONAL SPORTS STUDIES

REVIEW

A Thematic Review of Motivation and Self-Regulation in Physical Education and the Effects on Students' Psychological Well-being

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Abstract

There is increasing interest in the association between psychological well-being, motivation, physical literacy, self-regulation, and physical education. While the impact of each of these variables on students' health is well established, a comprehensive review of their interconnections has been limited. A thematic literature review was conducted using Web of Science, ScienceDirect, PubMed, and Google Scholar, searching for English-language studies published from 2020 to 2024. The keywords were "self-regulation", "motivation", "physical education", and "psychological well-being". After selection, 82 peer-reviewed articles and relevant books were included from different cultural contexts, using longitudinal, cross-sectional, and survey-based designs. The findings were integrated using a thematic synthesis approach. The review highlights the significance of self-regulation in enhancing physical performance, stress management, attention control, and positive attitudes towards exercise, which are related to psychological well-being and academic success. Motivation, particularly students' motivation, has been identified as a key factor in the development of physical literacy and long-term physical activity engagement. These constructs co-occurred and mutually reinforced one another across studies, with self-regulation and motivation jointly predicting both physical and psychological performance outcomes and indicators of psychological well-being. Improving self-regulation and motivation in physical education could contribute to better psychological well-being and physical literacy among students. These findings have important implications for the development of evidence-based educational programs, educational strategies, and educational policies to promote resilience, lifelong physical activity, and balanced student development.

Introduction

The complex interplay among psychological well-being and physical education in the university student experience is a notable, yet insufficiently synthesised, field of study. A comprehensive understanding of this interaction is essential for enhancing holistic health approaches. Psychological well-being, which includes subjective happiness, life satisfaction,

and strong mental and emotional health, is essential for both individual and community prosperity (Abdullahi et al., 2021; Dhanabhakyam & Sarath, 2023). Although therapies aimed at enhancing well-being, including stress reduction methods and the development of self-awareness, creativity, and emotional intelligence, are gaining traction (Coventry, 2023; Kumar, 2021), a thorough comprehension of the fundamental processes is still lacking. This requires a transdisciplinary approach, acknowledging the crucial role of psychological well-being in enhancing individual resilience and social advancement (Mead et al., 2021).

Despite its complexity, the connection between self-regulation, psychological well-being, and physical education is becoming clearer. According to numerous studies, self-regulation plays a mediating role in the relationship between physical activity and enhanced cognitive and physical fitness. This means that people who are good at controlling their behaviour are more likely to reap the benefits of exercise (Bai et al., 2021; Gea-García et al., 2020). Physical literacy has additionally been identified as a moderating variable in the association between physical activity and self-esteem in participants (She et al., 2023), specifying that physical and cognitive competencies interact in shaping physical activity engagement. Erturan et al. (2020) and Blain et al. (2020) are two studies that highlight the importance of self-efficacy and self-regulation in encouraging physical education and leisure-time physical activity. Taken together, these findings suggest that self-efficacy and emotional intelligence mediate the relationship between physical exercise and subjective well-being, such that individuals with higher regulatory and appraisal capacities report greater psychological benefits from exercise.

A significant gap remains in comprehending the mediating functions of self-regulation and motivation within this intricate interaction. While recent reviews have explored physical activity and well-being in general (Lubans et al., 2016; Mead et al., 2021), they have not specifically investigated the collaborative mediating roles of self-regulation and motivation within the context of physical education, nor have they concentrated on university-aged individuals across varied cultural environments. This study is characterised by its simultaneous integrative focus on these two mechanisms, its limitation to the 2020–2024 timeframe to represent post-pandemic educational reality, and its incorporation of works from many national contexts. Although the impact of self-regulation on the correlation between physical exercise and cognitive/physical fitness is well-documented (Rodríguez et al., 2022), and its extensive effects on well-being and academic engagement are acknowledged, the intricate processes of its influence necessitate more clarification. Likewise, the significant influence of motivation on behaviour and performance, especially in physical education, is an issue that warrants more investigation (Moroz & Shtepa, 2021). Although the individual importance of these characteristics is recognised, their interactive mediating roles within the broader context of psychological well-being and physical education have not been fully integrated in prior reviews.

This review synthesises evidence from 82 peer-reviewed studies published between 2020 and 2024 to construct an integrative thematic framework elucidating how self-regulation and motivation jointly mediate the relationship between psychological well-being and physical education among university students. Rather than offering a formal conceptual model in the conventional sense, this framework aims to organise existing findings thematically around two central mediating pathways —self-regulatory and motivational orientations and map their combined influence on psychological and physical outcomes. It emphasises how motivation and self-regulation mediate the relationship between physical education and psychological well-being by critically analysing 99 studies published between 2020 and 2024.

In contrast to prior thematic reviews that examine these constructs in isolation (Živanović et al., 2021), the current study adopts a holistic lens to demonstrate their interdependence and combined explanatory value. This is specifically relevant considering the known influence of the educational environment on student physical activity engagement (Leo et al., 2022; Wang

et al., 2022), and the significant deficiency of studies investigating the mediating roles of self-regulation and motivation in this context. The study intends to address a significant research gap, providing essential insights for the development of tailored treatments and educational practices that enhance overall well-being and physical performance among China's expanding student demographic.

Methods and Materials

This review adopted a structured narrative and thematic approach to identify and synthesise relevant literature on physical education, motivation, self-regulation and psychological well-being among university students. It does not make any claim to the standards of a systematic review and does not follow PRISMA guidelines, instead prioritising breadth of conceptual coverage and theoretical coherence over exhaustive search completeness.

Search Strategy

A literature search was performed in four databases (Web of Science (WOS), ScienceDirect, PubMed and Google Scholar) from January to May 2024. The Boolean search string used was: (“self-regulation” OR “self-regulation”) AND (“motivation”) AND (“physical education”) AND (“psychological well-being” OR “psychological wellbeing”). In Google Scholar, there is no limit on exportable results, so the searches were limited to the first 200 records, according to relevance, evaluated with the same criteria used in the other databases.

Inclusion and Exclusion Criteria

Sources were included if they (1) were published between 2020 and 2024; (2) were written in English and published in peer-reviewed journals; (3) investigated the role of motivation and/or self-regulation in physical education contexts; and (4) presented findings on the psychological well-being of university students as the target population. Sources were excluded if they were not published in English, were conference abstracts or failed to include physical education and psychological well-being as central constructs. Book chapters or encyclopaedia entries that offered a fundamental theoretical grounding to the key constructs considered in this review were selectively included.

Selection and Evaluation

The selection process was conducted in two stages. The first phase consisted of screening the titles and abstracts of all 317 retrieved records against the inclusion and exclusion criteria. In the second phase, full texts of potentially relevant sources were read and appraised for relevance and methodological clarity. Sources were evaluated based on clarity of research design, adequacy of sample description, and relevance of reported outcomes to review questions. At this stage, sources that did not sufficiently address the relevant constructs or that did not report transparently were excluded.

Following this process, 82 references were identified and cited in this review; 76 peer-reviewed journal articles, four books or book chapters, one dissertation retained for its theoretical contribution, and one encyclopaedia chapter. Of these, 73 references (89.0%) were published between 2020 and 2024, indicating a contemporary and current literature base.

Review Questions for Guidance

The thematic analysis of the included literature was guided by three questions: (1) What is the effect of physical education and physical literacy on students’ psychological well-being? (2) How does motivation influence the impact of physical education on psychological well-being? (3) How does self-regulation influence the impact of physical education and psychological well-being?

Thematic Analysis

Findings were synthesised using a thematic approach following the framework developed by Thomas and Harden (2008) including three phases: (1) coding of key findings from each included source; (2) grouping of initial codes into descriptive themes based on conceptual similarity and recurrence across sources; and (3) development of analytical themes that addressed the review questions beyond the content of individual studies. Initial coding was carried out by the first author and then reviewed by a second reviewer. Themes were discussed and refined until a consensus was reached, guided by their frequency in the literature and their theoretical fit with self-regulation, motivation, physical literacy, and psychological well-being.

Discussion

Physical education and students' psychological well-being

Psychological well-being among university students

Psychological well-being is a multifaceted concept that includes happiness, life satisfaction, and mental and emotional health (Dhanabhakyam & Sarath, 2023). It is regulated by physiological and socio-psychological features and is vital for individual and community health (Abdullahi et al., 2021). Strategies to enhance psychological well-being, including stress reduction, emotional intelligence, and self-awareness development, are gaining traction (Kumar, 2021; Shyu, 2019), although the specific mechanisms by which physical education facilitates these results are not well comprehended. This gap prompts the current review to concentrate on the mediating functions of self-regulation and motivation.

Among university students specifically, research identifies several predictors of psychological well-being, including spiritual well-being and stress (Leung & Pong, 2021; Motevalli et al., 2022; Yusof et al., 2019), mindfulness-based interventions (Seppälä et al., 2020), personality traits such as agreeableness and conscientiousness (Osamika et al., 2021), as well as factors like learning styles and perceived social isolation (Liu et al., 2021; Morales-Rodríguez et al., 2020). These findings collectively highlight the multifaceted nature of student well-being and justify the examination of physical education in conjunction with motivational and self-regulatory processes.

A significant number of the studies featured in this review were carried out in Chinese university contexts, highlighting both the extensive recent research output from China and the specific challenges encountered by Chinese university students, such as elevated academic expectations, competitive atmospheres, and swift societal transformations. The contextual circumstances render the Chinese university population significant for analysing the relationship among physical education, self-regulation, motivation, and psychological well-being. Recent research conducted at Chinese institutions has underscored this significance: Yang et al. (2024) discovered a correlation between physical literacy and health-related quality of life among medical students at Shanxi Medical University, with physical exercise and subjective well-being acting as mediators. Kan et al. (2024) similarly established a favourable correlation between physical literacy, physical exercise, and psychological well-being among Chinese university students, highlighting the significance of physical education in fostering psychological resilience. These findings support the broader argument that structured physical education programs can effectively enhance student mental health, especially in high-stress academic settings.

Physical Literacy and Well-being

Physical literacy includes the movement skills, confidence, motivation, and knowledge essential for promoting lifelong engagement in physical activity (Dudley et al., 2019; Killough

et al., 2020; Roetert et al., 2018). Although health promotion policy emphasises its significance, the lack of a universally accepted definition hinders the creation of integrated programs (Bailey, 2020). Nevertheless, standardised assessment instruments, including the Physical Literacy Knowledge Questionnaire, are being formulated to bridge this gap (Longmuir et al., 2018).

A recent study has highlighted the importance of physical literacy in improving overall well-being, particularly among children and adolescents. Britton et al. (2023) and Blain et al. (2020) reported positive associations between physical literacy and well-being. In addition, Blain et al. (2020) found that higher levels of physical literacy were associated with greater participation in physical education and leisure-time physical activity. Urbano-Mairena et al.'s (2023) bibliometric study supports these findings by indicating a substantial relationship between physical literacy and health outcomes. Yi et al. (2020) dives into the complexities of physical literacy, discovering gender discrepancies and mitigating factors that influence children's physical literacy skills. Furthermore, Ahmad et al. (2020) and Roetert et al. (2019) emphasises the need for a multifaceted approach to literacy, including health literacy, in promoting overall well-being and physical exercise. Their findings highlight the significance of communicating a consistent message to improve health outcomes and build a culture of physical activity among people of all ages. These findings highlight the importance of physical literacy in promoting overall well-being and the need for coordinated efforts to include physical literacy in educational and health promotion strategies.

Although the beneficial correlation between physical literacy and student well-being is widely acknowledged, a significant gap remains in our comprehension of the fundamental causative mechanisms. A multitude of research utilises correlational designs, complicating the differentiation of causation and effect, while neglecting the impact of confounding variables. The specific elements of physical literacy—movement skills, knowledge, or confidence—that most profoundly influence well-being are ambiguous, obstructing the creation of successful tailored treatments. The absence of longitudinal research constrains our comprehension of the enduring impacts of physical literacy on well-being. A more sophisticated strategy is required, integrating varied approaches and improved measurement instruments to address these significant constraints. The reciprocal link between physical literacy and other well-being criteria requires more research to identify the most effective techniques for promoting positive and lasting effects.

Physical Education and psychological well-being

Physical education is a multifaceted educational domain that promotes physical activity, sports, and exercise and is central to holistic individuals' development (Živanović et al., 2021). Its benefits encompass not just physical health but also cognitive function, academic performance, and psychological well-being (Bailey et al., 2013; Salian & Kumar, 2022). Moreover, physical education significantly contributes to alleviating mental strain and stress (Burlui & Moisescu, 2021), and there is an increasing acknowledgement of the necessity to modernise curricula to maintain student involvement (Liu, 2020; Tison et al., 2020).

Numerous studies have looked at the relationship between physical education and psychological well-being, with consistent favourable results. According to Piñeiro-Cossio et al. (2021) and Sun et al. (2024), physical education can improve psychological well-being, especially through health education and sports participation. Du and Liu (2022) emphasises the importance of physical activity in improving psychological well-being, especially during the transition to college. Furthermore, Erturan-Ilker (2014) and Nopiyanto et al. (2022) provide a more nuanced viewpoint, emphasising the importance of meeting fundamental psychological requirements and motivating rules within the context of physical education in developing psychological well-being. Physical education and psychological well-being lay the

groundwork for understanding motivation and its critical role in increasing physical activity, improving physical literacy, and determining educational results (see Figure 1).

Despite the frequent reporting of a positive link between physical education (PE) and psychological well-being, the current literature has numerous significant limitations. A multitude of research utilises cross-sectional designs, which exclude conclusive findings regarding causation and insufficiently address the role of confounding variables. The precise components of physical education—activity types, intensity, duration, or social context—that most successfully enhance psychological well-being are generally unspecified, hindering the development of evidence-based, focused programs. Moreover, the long-term implications of physical education engagement on psychological well-being are frequently underexplored, constraining our comprehension of enduring repercussions. A more comprehensive research agenda is necessary, integrating longitudinal studies, varied techniques, and improved assessment instruments to address these critical gaps and fully harness the promise of physical education to increase student mental health. The intricate relationship between physical education, other elements of school life, and wider societal surroundings requires additional examination to comprehensively understand its varied impact on psychological well-being.

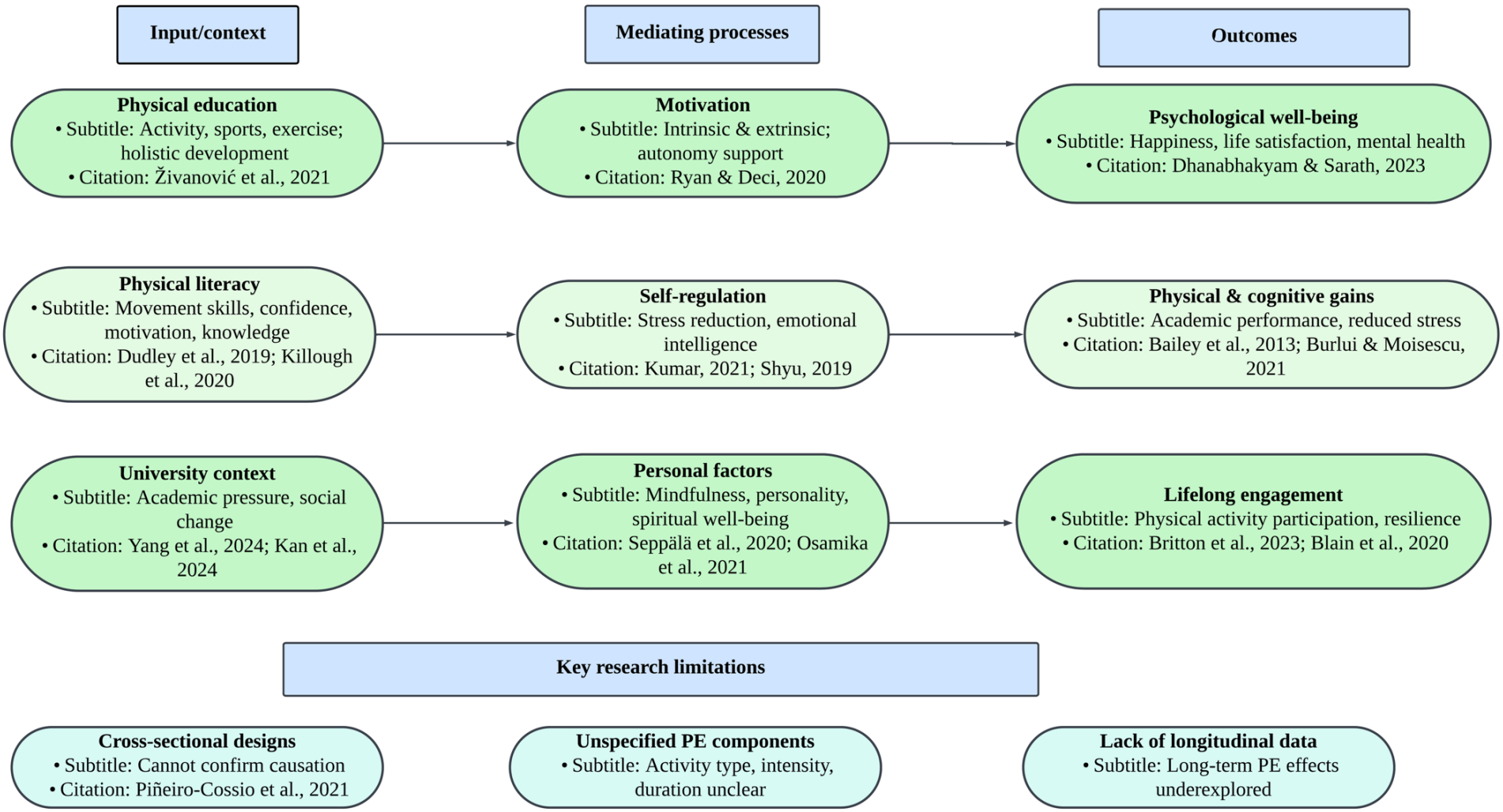

Figure 1. Physical education and psychological well-being.

Note: Adapted from Živanović et al. (2021); Dhanabhakyam & Sarath (2023); Bailey et al. (2013); Ryan & Deci (2020); Kumar (2021); Britton et al. (2023); Yang et al. (2024).

Role of motivation in physical education and psychological well-being

Motivation refers to the initiation, direction, intensity, and persistence of behaviour (Dörnyei, 2018; Ryan & Deci, 2000; Sulaiman et al., 2021), a construct recognised as dynamic and multifaceted, varying across developmental stages, environments, and tasks (Wright et al., 2019). According to Self-Determination Theory (Ryan & Deci, 2020), motivation encompasses both the intrinsic forms driven by internal goals and satisfaction and extrinsic forms, driven by external incentives or demands. In the context of education, motivation is essential for sustained learning and can be influenced by factors such as self-efficacy, goal orientation, and task difficulty (Salajegheh & Hoseinyshavoun, 2018). In physical education, motivation is a crucial factor influencing students' engagement, physical activity levels, and long-term well-being, rendering it a significant theme in this analysis.

Several studies have underlined the importance of motivation in physical activity, physical literacy, and education. Van Doren et al. (2021) and Leo et al. (2022) discovered that students' opinions of their physical education instructors' motivational style significantly impacted their motivation and physical activity levels. Hutmacher et al. (2020) and Kalajas-Tilga et al. (2020) emphasised the importance of autonomy support and intrinsic motivation in physical education, with the former demonstrating a positive impact on out-of-school physical activity and the latter identifying intrinsic motivation as a significant predictor of daily physical activity. Choi et al. (2021) and Rojo-Ramos et al. (2022) both highlighted the beneficial impacts of certain educational interventions, such as sport education, on physical literacy, motivation, and physical activity levels. These studies collectively indicate that when physical education programs emphasise skill development and collaborative learning, student motivation rises, hence enhancing both in-school engagement and physical activity outside of school environments. Motivation is crucial for the advancement of physical literacy; increased motivation cultivates a more favourable attitude towards physical activity, prompting students to develop skills that facilitate lifetime engagement in exercise (Choi et al., 2021). It is essential to recognise that motivational effects are contingent upon context and may be influenced by teaching methods, social dynamics inside the classroom, and cultural influences. Pereira et al. (2021) and Baena-Extremera et al. (2021) presented practical applications and insights from self-determination theory and neuroeducation, respectively, to improve motivation and physical activity in physical education. These findings pave the way for understanding how self-regulation, as a complementary construct, interacts with desire to influence behaviour and accomplishment in a variety of circumstances.

Motivation has a significant role in psychological outcomes, especially in educational contexts, where it profoundly affects students' mental health and academic achievement. Perez-Ordas et al. (2022) assert that intrinsic motivation, derived from personal interest and enjoyment in activities, correlates with improved psychological well-being. Their study suggests that genuinely driven students are more inclined to engage profoundly in learning experiences, resulting in enhanced emotional regulation and resilience. This inherent motivation not only cultivates a constructive learning atmosphere but also enhances life satisfaction and general mental well-being. Within the realm of physical education, this differentiation is notably pertinent: intrinsic motivation forecasts enduring participation in physical activities and psychological wellness, whereas extrinsic motivation, though effective in the short term, is less consistently linked to long-term results (Perez-Ordas et al., 2022).

Evidence from Chinese educational settings further corroborates these tendencies. Zheng et al. (2023) discovered that motivation significantly impacts both physical activity levels and reported well-being among Chinese adolescents during physical education. Specifically, higher motivation was linked to increased enjoyment of physical activities, which was positively correlated with adolescents' overall well-being, indicating that motivationally enriched

physical education environments can significantly improve both physical engagement and psychological outcomes (see Figure 2).

While motivation clearly influences the association between physical education and well-being (Papaioannou & Krommidas, 2021; Perez-Ordas et al., 2022), the unique and interactive effects of intrinsic and extrinsic motivation on psychological well-being require further research. Innovative pedagogical methods, including cross-disciplinary integration in physical education (Gobbi et al., 2020), show potential but need to be assessed in broader and more varied contexts. Qualitative methodologies, for example, could provide deeper insights into students' motivated experiences, enhancing the mostly quantitative database.

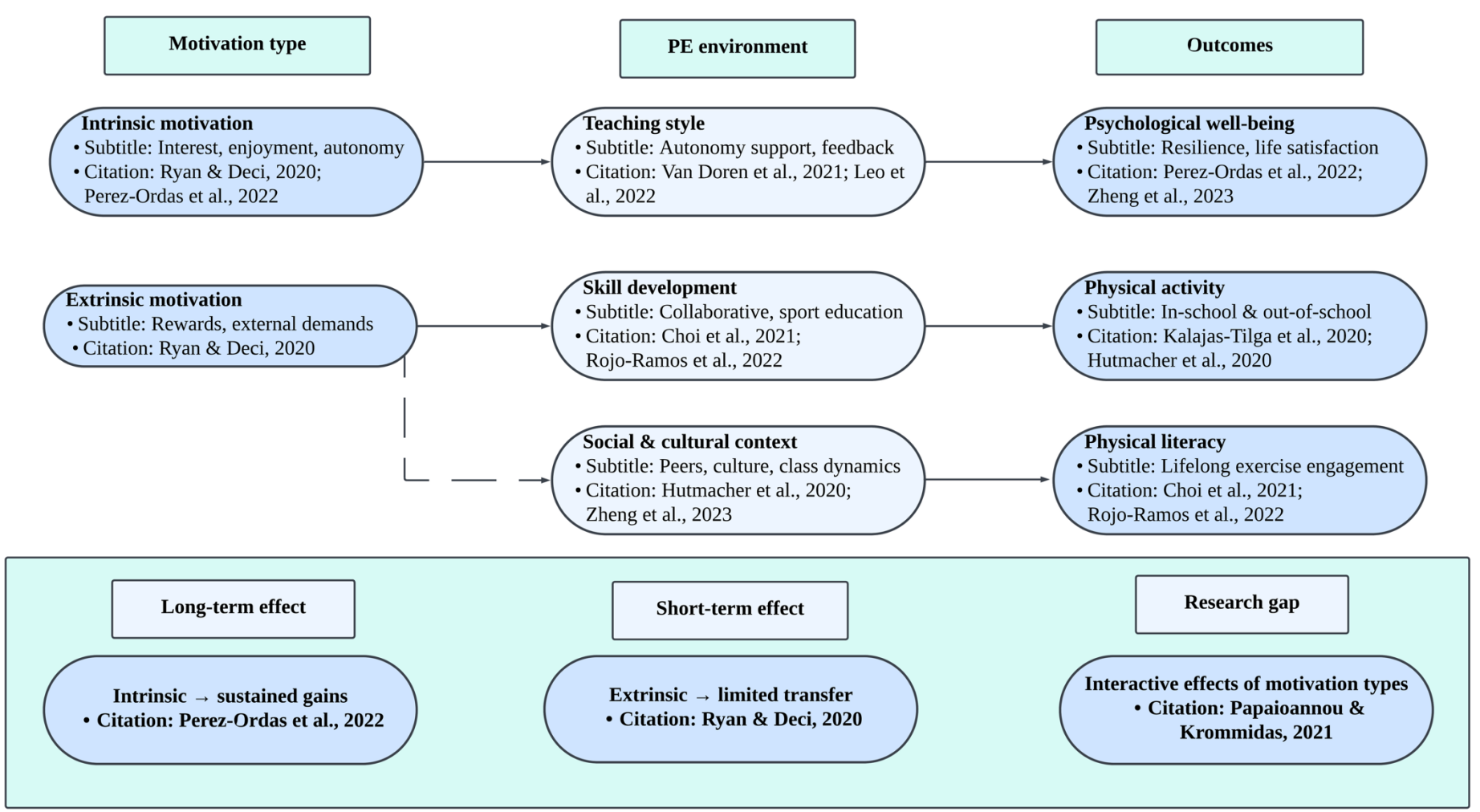

Figure 2. The role of motivation in physical education and psychological well-being.

Note: Adapted from Ryan & Deci (2020); Perez-Ordas et al. (2022); Zheng et al. (2023); Choi et al. (2021); Kalajas-Tilga et al. (2020); Van Doren et al. (2021); Leo et al. (2022).

The role of self-regulation in physical education and psychological well-being

Self-regulation is the process by which individuals actively monitor, control, and regulate their thoughts, emotions, and behaviours to achieve desired goals and outcomes (Boekaerts et al., 1999; Zimmerman, 2000, 2008). This process encompasses cognitive, emotional, and behavioural strategies including goal-setting, planning, progress monitoring, self-reflection, and adaptive adjustment as well as avoiding distractions, deferring gratification, and persevering in the face of obstacles or disappointments. Generally, these capacities make self-regulation an important predictor of adaptive functioning across academic, social, and psychological domains (Boekaerts et al., 1999; Zimmerman, 2008).

Self-regulation is a multidimensional construct that is essential to human functioning across a range of domains. In educational contexts, promoting self-regulation enhances children's academic performance and psychological health (Merritt et al., 2022), with its theoretical underpinnings derived from the synthesis of social psychology, personality psychology, and cognitive neuroscience (Inzlicht et al., 2021). In physical and athletic contexts, self-regulation influences training, competition, and recovery: effective recovery self-regulation necessitates individuals to recognise the disparity between their current and desired states and to implement cognitive, emotional, and behavioural strategies to bridge this gap, thereby improving long-term health and athletic performance (Balk & Englert, 2020). Kermarrec et al. (2022) discovered that self-regulation significantly enhances learning processes in physical education, augmenting students' abilities to establish goals, track progress, and modify strategies, which results in improved performance and increased engagement in physical activities. These findings establish self-regulation as not only an academic skill but also a fundamental competency for physical and psychological well-being across various contexts.

Evidence consistently associates self-regulation with favourable academic performance and well-being results throughout various educational levels. In early childhood, self-regulation correlates with academic preparedness and prosocial behaviour (Savina, 2021). In teenagers, psychological and academic subjective well-being are intricately linked to self-regulatory abilities, with educators significantly influencing the development of students' self-efficacy and self-regulation skills (Gökteke & Ocak, 2024). Rodríguez et al. (2022) correlated self-regulation with student happiness and school engagement at the university level, whereas Šteh and Šarić (2020) evidenced that fostering self-regulated learning processes enhances meaningful and effective learning in higher education. Nieva and Prudente (2022) discovered that academic achievement did not moderate the association between online self-regulated learning and well-being, indicating that self-regulation provides a direct psychological advantage irrespective of performance results. These findings collectively highlight the necessity of further investigation into the function of self-regulation in physical education and physical literacy.

In the context of physical education, self-regulation is shaped by multiple factors, including teacher learning support and the motivational climate of the classroom (Laxdal, 2020), as well as the cognitive and metacognitive strategies employed by physical education instructors (Liu et al., 2020). Structured interventions targeting self-regulated learning, such as dedicated self-regulation teaching units, have demonstrated improvements in students' physical performance calibration, goal accomplishment, and attributions patterns (Kolovelonis et al., 2022). Beyond the classroom, research indicates that self-regulation plays a crucial mediating role in the association between physical activity and cognitive school readiness in preschool-age children (Bai et al., 2021). Specifically, moderate-to-vigorous physical activity (MVPA) was positively correlated with self-regulation and cognitive school readiness scores, with self-regulation partially mediating the association between MVPA and cognitive school readiness -

indicating both direct and indirect pathways through which physical activity supports early cognitive development. Collectively, these findings underscore the imperative of developing physical education treatments that specifically aim to enhance self-regulatory abilities to improve both physical and cognitive outcomes.

A converging body of studies has indicated significant links between self-regulation, physical literacy, and psychological well-being. Bai et al. (2021) and Gea-García et al. (2020) found that self-regulation mediates the association between physical exercise and cognitive school readiness, while also improving students' time management and goal-setting capabilities. Furthermore, effective self-regulation boosts fitness levels by promoting regular participation in physical activities, so creating a positive feedback loop that supports both physical and cognitive achievement. She et al. (2023) elucidated that physical literacy mediates the correlation between self-esteem and participation in physical activity: by enhancing individuals' confidence and competence in movement, physical literacy fosters continued engagement in exercise, subsequently improving self-esteem and overall well-being. These findings underscore the importance of including physical literacy development into educational curriculum as a means to enhance both self-regulatory capacity and psychological well-being.

Erturan et al. (2020) and Blain et al. (2020) underscored the complementary roles of self-efficacy and self-regulation in enhancing leisure-time physical activity and engagement in physical education. Enhanced self-efficacy cultivates individuals' confidence in their capacity to participate in physical activities, whereas proficient self-regulation allows them to establish objectives, track advancement, and surmount challenges. Collectively, these constructs significantly improve participation rates and motivation in both recreational and formal educational contexts, supporting the case of targeted interventions that develop both capacities in students. Building on this, Vasilopoulos and Ellefson (2021) and Wang et al. (2022) demonstrated positive associations between physical activity, self-regulation, and emotional regulation, as well as the mediating role of self-efficacy and emotional intelligence in the relationship between physical exercise and subjective well-being. These findings collectively highlight the complex, mutually reinforcing links among self-regulation, physical education, and psychological well-being.

Several recent studies have investigated these linkages among Chinese university students, a demographic marked by unique academic constraints and an increasing state focus on physical education reform. Yang et al. (2024) discovered at Shanxi Medical University that physical literacy had a positive correlation with health-related quality of life among medical students, with physical exercise and subjective well-being acting as mediators.

In a separate study of 798 university students in Chongqing, Zhang et al. (2022) found that higher physical fitness was correlated with higher physical activity and physical literacy, which in turn predicted improved psychological well-being. Furthermore, Zhong (2024) found that students intrinsically motivated to participate in physical activities reported higher levels of personal development and general well-being, suggesting that physical education programs which cultivate intrinsic motivation may yield substantial psychological benefits. Collectively, these studies illustrate that the pathway from physical education and psychological well-being in Chinese university students functions through various mechanisms—physical literacy, fitness, and intrinsic motivation—reinforcing the need for comprehensive program design that addresses all three.

Additional evidence substantiates the mediating function of self-regulation in this area. Leo et al. (2022) identified that a need-supportive teaching environment in physical education correlated with enhanced student intentions for physical activity, whereas Aleksovska-Velickovska et al. (2019) established that self-determined regulation of exercise behaviour forecasted elevated physical activity levels. Wang et al. (2022) and Shang and Xie (2021) further confirmed positive correlations between physical exercise and subjective well-being,

with the latter identifying body image and self-esteem as mediating variables. Despite this increasing evidence, the mediating roles of self-regulation and motivation in the association between physical education and well-being remain inadequately comprehended. In particular, existing research rarely distinguishes between the independent and interactive effects of these two dimensions, resulting in an inadequate specification of the mechanisms by which they influence psychological consequences. Further research utilising robust methodologies — such as mediation and moderation analyses — is essential to elucidate how self-regulation and various forms of motivation (intrinsic versus extrinsic) collectively impact the association between physical education participation and psychological well-being. This paper proposes a conceptual framework that incorporates the suggested variables in physical education and psychological well-being, while also considering the mediating roles of self-regulation and motivation (see Figure 3).

Conclusion

This study examined the intricate relationship between physical literacy, physical education, and psychological well-being, focusing on three primary research issues. The results illuminate the beneficial impacts of physical literacy and physical education on students' psychological well-being (RQ1), elucidating the crucial influence of motivation in fostering participation in physical education and improving psychological well-being (RQ2). The study investigated the mediating effects of self-regulation and motivation on the link between physical education and psychological well-being (RQ3), highlighting the significant interaction of these elements in fostering beneficial results. The research offers a refined comprehension of the interrelation between physical exercise, psychological aspects, and well-being, guiding the creation of more effective treatments for holistic student development.

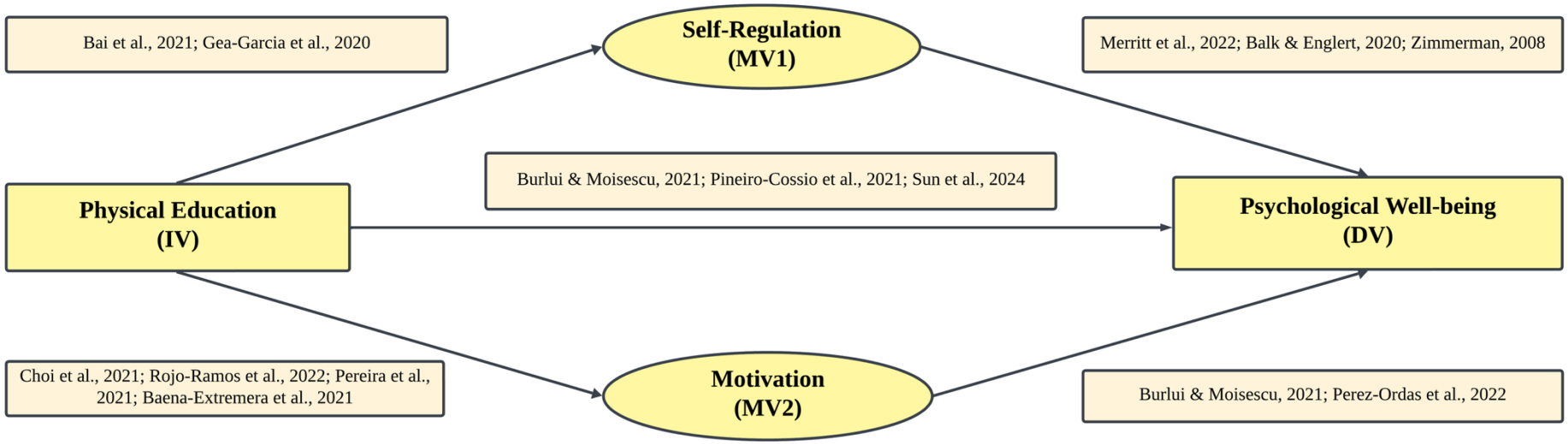

Figure 3. Proposed conceptual mediating roles of self-regulation and motivation in physical education and psychological well-being

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During the preparation of this manuscript, the author(s) used ChatGPT to assist with improving language clarity, grammar, and phrasing. The author(s) carefully reviewed and revised the output to ensure accuracy and take(s) full responsibility for the content of the final manuscript.

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Table S1. Thomas and Harden (2008) Thematic Coding — Motivation, Self-Regulation, Physical Education, and Psychological Well-Being

Theme 1: Physical Education, Physical Literacy, and Psychological Well-Being			
1a. Psychological well-being among university students			
Happiness, life satisfaction, and mental health as core components of well-being	Multidimensional nature of psychological well-being	Physical education supports holistic well-being through multiple psychological pathways	Dhanabhakyam & Sarath (2023); Abdullahi et al. (2021)
Stress, spiritual well-being, and personality traits predict student well-being	Individual predictors of university student well-being	Physical education supports holistic well-being through multiple psychological pathways	Leung & Pong (2021); Osamika et al. (2021); Seppälä et al. (2020)
Chinese university students face elevated academic pressure and social change	Contextual constraints on student well-being in China	Physical education supports holistic well-being through multiple psychological pathways	Yang et al. (2024); Kan et al. (2024)
Physical literacy correlates with health-related quality of life in medical students	Physical literacy as a mediator of well-being in high-stress contexts	Physical education supports holistic well-being through multiple psychological pathways	Yang et al. (2024); Kan et al. (2024)
1b. Physical literacy and well-being			
Movement skills, confidence, motivation, and knowledge define physical literacy	Physical literacy as a multidimensional construct	Physical literacy is a foundational pathway linking PE participation to long-term well-being	Dudley et al. (2019); Killough et al. (2020); Roetert et al. (2018)
Physical literacy positively linked to well-being and leisure-time activity participation	Physical literacy predicts well-being and activity engagement	Physical literacy is a foundational pathway linking PE participation to long-term well-being	Britton et al. (2023); Blain et al. (2020)
Gender differences and mitigating factors shape physical literacy development	Variability in physical literacy acquisition	Physical literacy is a foundational pathway linking PE participation to long-term well-being	Yi et al. (2020)
Lack of universal definition hinders integrated program development	Definitional and methodological gaps in physical literacy research	Physical literacy is a foundational pathway linking PE participation to long-term well-being	Bailey (2020); Longmuir et al. (2018)
Correlational designs limit causal conclusions about physical literacy and well-being	Research design limitations in physical literacy studies	Physical literacy is a foundational pathway linking PE participation to long-term well-being	Urbano-Mairena et al. (2023)
1c. Physical education and psychological well-being			
PE improves psychological well-being through sports participation and health education	Direct positive effects of PE on psychological outcomes	Structured PE programs produce consistent psychological benefits, though mechanisms remain underspecified	Piñeiro-Cossio et al. (2021); Sun et al. (2024)
PE alleviates mental strain and contributes to stress reduction	PE as a stress-reduction tool	Structured PE programs produce consistent psychological benefits, though mechanisms remain underspecified	Burlui & Moisescu (2021); Du & Liu (2022)

Meeting basic psychological needs in PE fosters well-being	Psychological need satisfaction as a PE mechanism	Structured PE programs produce consistent psychological benefits, though mechanisms remain underspecified	Erturan-Ilker (2014); Nopiyanto et al. (2022)
Cross-sectional designs dominate; causal conclusions are limited	Methodological limitations of PE and well-being research	Structured PE programs produce consistent psychological benefits, though mechanisms remain underspecified	Piñeiro-Cossio et al. (2021)
Specific PE components (intensity, duration, context) remain underspecified	Lack of specificity about effective PE components	Structured PE programs produce consistent psychological benefits, though mechanisms remain underspecified	Liu (2020); Tison et al. (2020)
Theme 2: Motivation as a Mediating Mechanism in Physical Education and Well-Being			
2a. Nature and types of motivation in PE			
Motivation is dynamic, multifaceted, and varies across contexts and developmental stages	Motivation as a context-dependent construct	Motivation mediates the relationship between PE and psychological well-being, with intrinsic motivation producing the most sustained effects	Ryan & Deci (2020); Dörnyei (2018)
Intrinsic motivation driven by internal goals; extrinsic by external incentives	Intrinsic vs. extrinsic motivation in PE (SDT)	Motivation mediates the relationship between PE and psychological well-being, with intrinsic motivation producing the most sustained effects	Ryan & Deci (2020); Ryan & Deci (2000)
Self-efficacy, goal orientation, and task difficulty influence motivation in education	Cognitive antecedents of motivation	Motivation mediates the relationship between PE and psychological well-being, with intrinsic motivation producing the most sustained effects	Salajegheh & Hoseinyshavoun (2018)
2b. Motivational influences on physical activity and physical literacy			
Teacher motivational style significantly impacts student motivation and PA levels	Teacher behaviour as a motivational determinant	Motivation mediates the relationship between PE and psychological well-being, with intrinsic motivation producing the most sustained effects	Van Doren et al. (2021); Leo et al. (2022)
Autonomy support and intrinsic motivation predict out-of-school physical activity	Autonomy support as a driver of PA beyond school	Motivation mediates the relationship between PE and psychological well-being, with intrinsic motivation producing the most sustained effects	Hutmacher et al. (2020); Kalajas-Tilga et al. (2020)
Sport education and collaborative PE interventions increase motivation and physical literacy	Pedagogical interventions that enhance motivation	Motivation mediates the relationship between PE and psychological well-being, with intrinsic motivation producing the most sustained effects	Choi et al. (2021); Rojo-Ramos et al. (2022)
SDT and neuroeducation-based approaches improve motivation and PA in PE	Theory-based motivational interventions in PE	Motivation mediates the relationship between PE and psychological well-being, with intrinsic motivation producing the most sustained effects	Pereira et al. (2021); Baena-Extremera et al. (2021)

2c. Motivation and psychological outcomes			
Intrinsic motivation correlates with emotional regulation, resilience, and life satisfaction	Intrinsic motivation predicts psychological well-being	Motivation mediates the relationship between PE and psychological well-being, with intrinsic motivation producing the most sustained effects	Perez-Ordas et al. (2022)
Higher motivation linked to enjoyment of PA and overall well-being in Chinese adolescents	Motivation, enjoyment, and well-being in Chinese PE contexts	Motivation mediates the relationship between PE and psychological well-being, with intrinsic motivation producing the most sustained effects	Zheng et al. (2023)
Intrinsic motivation predicts long-term PA and well-being; extrinsic is effective short-term only	Differential long-term effects of intrinsic vs. extrinsic motivation	Motivation mediates the relationship between PE and psychological well-being, with intrinsic motivation producing the most sustained effects	Perez-Ordas et al. (2022); Papaioannou & Krommidas (2021)
Interactive effects of intrinsic and extrinsic motivation on well-being remain underexplored	Research gap: interactive motivational effects	Motivation mediates the relationship between PE and psychological well-being, with intrinsic motivation producing the most sustained effects	Gobbi et al. (2020)
Theme 3: Self-Regulation as a Mediating Mechanism Between Physical Education and Well-Being			
3a. Nature and dimensions of self-regulation			
Self-regulation involves monitoring and controlling thoughts, emotions, and behaviours towards goals	Self-regulation as a goal-directed, multi-strategy process	Self-regulation bridges PE participation and psychological well-being through cognitive, emotional, and behavioural pathways	Zimmerman (2000, 2008); Boekaerts et al. (1999)
Self-regulation draws on social psychology, personality psychology, and cognitive neuroscience	Multidisciplinary theoretical foundations of self-regulation	Self-regulation bridges PE participation and psychological well-being through cognitive, emotional, and behavioural pathways	Inzlicht et al. (2021)
Self-regulation influences training, competition, and recovery in athletic contexts	Self-regulation in sport and physical performance	Self-regulation bridges PE participation and psychological well-being through cognitive, emotional, and behavioural pathways	Balk & Englert (2020)
3b. Self-regulation across educational levels			
Self-regulation correlates with academic readiness and prosocial behaviour in early childhood	Developmental role of self-regulation in early education	Self-regulation bridges PE participation and psychological well-being through cognitive, emotional, and behavioural pathways	Savina (2021)
Self-regulatory abilities linked to academic and psychological well-being in adolescents	Self-regulation predicts adolescent academic and psychological outcomes	Self-regulation bridges PE participation and psychological well-being through cognitive, emotional, and behavioural pathways	Gökteke & Ocak (2024)

Self-regulation correlates with university student happiness and school engagement	Self-regulation as a predictor of university student well-being	Self-regulation bridges PE participation and psychological well-being through cognitive, emotional, and behavioural pathways	Rodríguez et al. (2022); Šteh & Šarić (2020)
Self-regulation provides direct psychological benefit regardless of academic performance	Self-regulation's independent effect on well-being	Self-regulation bridges PE participation and psychological well-being through cognitive, emotional, and behavioural pathways	Nieva & Prudente (2022)
3c. Self-regulation in the PE context			
Teacher support and motivational climate shape self-regulation in PE	PE environment as an antecedent of self-regulation	Self-regulation bridges PE participation and psychological well-being through cognitive, emotional, and behavioural pathways	Laxdal (2020); Liu et al. (2020)
Self-regulation teaching units improve PE performance calibration and goal attainment	Structured SR interventions improve PE outcomes	Self-regulation bridges PE participation and psychological well-being through cognitive, emotional, and behavioural pathways	Kolovelonis et al. (2022)
Kermarrec et al. found SR enhances goal-setting, progress tracking, and strategy use in PE	SR as an active learning tool in PE	Self-regulation bridges PE participation and psychological well-being through cognitive, emotional, and behavioural pathways	Kermarrec et al. (2022)
MVPA positively correlated with self-regulation and cognitive school readiness in preschoolers	Physical activity → self-regulation → cognitive readiness pathway	Self-regulation bridges PE participation and psychological well-being through cognitive, emotional, and behavioural pathways	Bai et al. (2021)
3d. Self-regulation, physical literacy, and well-being interactions			
Self-regulation mediates the link between physical exercise and cognitive school readiness	SR as mediator: PA → cognitive outcomes	Self-regulation and physical literacy jointly mediate the pathway from PE to psychological well-being, creating a positive feedback loop	Bai et al. (2021); Gea-García et al. (2020)
Physical literacy mediates the relationship between self-esteem and PA participation	Physical literacy as mediator: self-esteem → PA engagement	Self-regulation and physical literacy jointly mediate the pathway from PE to psychological well-being, creating a positive feedback loop	She et al. (2023)
Self-efficacy and SR jointly enhance leisure-time PA and PE engagement	Self-efficacy and SR as complementary regulatory mechanisms	Self-regulation and physical literacy jointly mediate the pathway from PE to psychological well-being, creating a positive feedback loop	Erturan et al. (2020); Blain et al. (2020)
Physical exercise → self-efficacy/emotional intelligence →	Emotional intelligence as mediator between PE and well-being	Self-regulation and physical literacy jointly mediate the pathway from PE to psychological well-being,	Vasilopoulos & Ellefson (2021); Wang et al. (2022)

subjective well-being pathway confirmed		creating a positive feedback loop	
Body image and self-esteem mediate physical exercise and well-being in Chinese students	Body image and self-esteem as mediating variables	Self-regulation and physical literacy jointly mediate the pathway from PE to psychological well-being, creating a positive feedback loop	Shang & Xie (2021); Zhang et al. (2022)
Physical literacy, fitness, and intrinsic motivation all mediate PE and well-being in Chinese universities	Multiple mediating pathways in Chinese university PE research	Self-regulation and physical literacy jointly mediate the pathway from PE to psychological well-being, creating a positive feedback loop	Yang et al. (2024); Zhong (2024)
Independent and interactive effects of SR and motivation on well-being remain underspecified	Critical research gap: SR and motivation interaction	Self-regulation and physical literacy jointly mediate the pathway from PE to psychological well-being, creating a positive feedback loop	Leo et al. (2022); Aleksovska-Velickovska et al. (2019)

Note. Coding follows the three-phase Thomas and Harden (2008) framework: (1) initial codes derived from individual source findings; (2) descriptive themes grouped by conceptual similarity; (3) analytical themes addressing the review's guiding questions. Sources cited reflect those discussed within each coded finding.

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REVIEW

Holistic Education in Physical Education: A Systematic Review of Conceptualisations, Practices, Outcomes, and Challenges

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Abstract

Physical education (PE) can contribute to whole-person development, yet its potential is often constrained by mind–body dualism, narrow performance priorities, and limited teacher preparation. This systematic review examined how holistic PE has been conceptualised, enacted, evaluated, and challenged in research published from 2015 to 2025. Following PRISMA guidance, six databases were searched for peer-reviewed studies. After title, abstract, and full-text screening, 35 studies addressing holistic PE in formal educational settings were included. An inductive, domain-based thematic synthesis combined open coding with thematic clustering across four predefined domains: conceptualisations, practices, outcomes, and challenges. The analysis generated 152 codes, 189 subthemes, and 15 meta-themes. Across the literature, holistic PE was commonly framed through physical and health literacy, embodiment, whole-person health, and the development of personal and social resources. Reported practices included embodied, reflective, culturally responsive, and interdisciplinary approaches. Outcomes extended beyond physical competence to cognitive development, social and emotional learning, values, agency, and health literacy. Persistent barriers included standardised assessment, mind–body dualism, weak cultural integration, and insufficient teacher preparation. Based on these findings, the review proposes the Holistic Physical Education Ripple Framework (HPERF), informed by the Tai Chi symbol and systems thinking. HPERF represents holistic PE as an evolving ecosystem in which concepts, practices, outcomes, and challenges interact dynamically. It provides a flexible structure for curriculum design, reflective teaching, evidence mapping, and future longitudinal research.

Introduction

The World Health Organization's (WHO, 2024a) slogan "Health for All and All for Health", adopted at the Ninth Global Conference on Health Promotion, emphasises the interdependence of health promotion and sustainable development. Education is central to this agenda because contemporary health challenges extend beyond disease prevention to include physical inactivity, mental ill health, and social inequity (WHO, 2025). The United Nations Sustainable Development Goals (SDGs), particularly Goal 3, Good Health and Well-being, and Goal 4,

Quality Education, similarly position education as a means of promoting population health and human development (United Nations, 2015). Consistent with SDG 4, the United Nations Educational, Scientific and Cultural Organization's International Bureau of Education (UNESCO-IBE) promotes a holistic and systemic view of curriculum development and learning (UNESCO, 2023).

In this review, holistic education refers to an approach that develops learners' physical, psychological, social, cognitive, ethical, and, where relevant, spiritual capacities in an integrated manner. This orientation aligns with physical literacy and with global initiatives that view health as multidimensional rather than solely biomedical (WHO, 2023). Holistic education challenges narrow, subject-centred models by combining interdisciplinary learning, lived experience, social interaction, and reflection to support critical thinking, empathy, responsibility, and lifelong learning (Mahmoudi et al., 2012). Although holistic ideas have longstanding philosophical roots, holistic education emerged as a distinct educational movement during the late twentieth century. Miller's (1991) work helped articulate the field, while J. P. Miller (2019) developed a curriculum framework organised around relationships among modes of thinking, mind and body, domains of knowledge, individuals and communities, humanity and the Earth, and the inner life. Miller described this relational focus as follows:

> *The focus of holistic education is on relationship: the relationship between linear thinking and intuition, the relationship between mind and body, the relationships among various domains of knowledge, the relationship between the individual and community, the relationship to the earth, and the relationship to our souls. In the holistic curriculum the student examines this relationship so that he or she gains both awareness of them and the skills necessary to transform the relationship where appropriate. (Miller, 2019, p. 89)*

Miller's relational account provides the philosophical foundation for this review. It is especially relevant to physical education (PE) because movement places bodily experience, cognition, emotion, social interaction, and engagement with the environment within the same learning context. PE can connect mind and body through purposeful movement, translate social responsibility into cooperation and shared decision-making, and develop ecological awareness through activity in natural environments. Viewed in this way, holistic PE is not simply an expanded list of learning outcomes; it is an effort to reconnect dimensions of experience that conventional curricula often separate. The comparatively limited attention given to spiritual or existential dimensions in contemporary PE scholarship also indicates an area for further conceptual development.

Holistic education encompasses diverse philosophical orientations and pedagogical practices, but they share an emphasis on wholeness and on avoiding the exclusion of significant dimensions of human experience (Mahmoudi et al., 2012). PE is particularly well placed to integrate these dimensions because it can foster physical competence, emotional regulation, social learning, cognitive engagement, and a sense of purpose through movement (Bailey et al., 2009; Hellison et al., 2025). In practical terms, holistic PE intentionally develops the learner as a whole person rather than treating physical fitness and motor skill as isolated ends. Evidence linking physical activity with mental health, cognitive function, self-esteem, and social connection further supports this broader orientation (Bailey, 2017; Ennis, 2017; Haerens et al., 2011; WHO, 2024b). A holistic approach therefore extends traditional PE by integrating physical, cognitive, social, emotional, and ethical learning (Lynch & Soukup, 2016). Such an approach can contribute to health and well-being across the life course and is consistent with preventive and inclusive public-health priorities (WHO, 2022).

Holistic conceptions of education and PE also have historical precedents. Classical Greek ideals connected bodily cultivation with moral and intellectual development, a relationship later captured in the Latin maxim mens sana in corpore sano, "a sound mind in a sound body"

(Demirel & Yıldıran, 2013; Gültekin et al., 2013; Young, 2005). Contemporary traditions extend these ideas in different cultural forms. For example, Japanese taiiku links physical education with lifelong moral and physical well-being (Hayashi, 2025), while Chinese and Daoist perspectives emphasise balance, embodied knowledge, and harmony with the natural world (Xu & He, 2025; Yu & Ilundáin-Agurruza, 2016). International policy has likewise framed physical education and sport as contributors to whole-person development and social participation (Habyarimana et al., 2022; UNESCO, 2015). Curricula in countries including Canada, the United States, and New Zealand increasingly incorporate physical literacy, well-being, inclusion, and interdisciplinary learning (Lynch, 2024). Realising holistic education through PE, however, requires more than adding innovative activities. It depends on culturally responsive curriculum design, supportive policy, appropriate assessment, and sustained teacher development (Long & Bianchini, 2018).

Against this background, the review examines how PE can move beyond disciplinary and mind–body divisions to support human flourishing in contemporary education. It synthesises literature published between 2015 and 2025 on conceptual frameworks, pedagogical practices, multidimensional outcomes, and implementation challenges, and uses the findings to develop an adaptable framework for holistic PE (Kirk, 2013; Tannehill & Lund, 2015). The review had five objectives: (1) to identify and synthesise the principal conceptualisations of holistic education in PE scholarship; (2) to categorise pedagogical approaches and curriculum designs that translate holistic principles into practice; (3) to examine reported physical, cognitive, affective, social, ethical, and behavioural outcomes; (4) to analyse structural, professional, and sociocultural barriers to implementation; and (5) to construct a flexible conceptual framework that can be refined through future research and practice.

Methods and Materials

Search Strategy

Six electronic databases were searched: Education Research Complete, ERIC, SPORTDiscus, Scopus, Web of Science, and Google Scholar. The search combined terms relating to holistic education and PE using the Boolean operators AND and OR. The core search string was (“holistic” OR “whole” OR “integrated education”) AND (“physical education” OR “PE” OR “sport education” OR “movement education” OR “school sport*” OR “sport*”). Search syntax was adapted to the requirements of each database. Apart from the publication period, language, and document-type criteria described below, no additional concept filters were applied at the search stage. This deliberately broad strategy increased the screening burden but reduced the likelihood of excluding studies that used related terminology rather than explicitly naming “holistic education” (Table 1).

Table 1. Key Concepts and Search Terms

Key Concepts	Search Terms
Holistic Education	"holistic", "whole", "integrated education",
Physical Education	physical education", "PE", "sport education", "movement education", "school sport*".

Inclusion and Exclusion Criteria

Peer-reviewed journal articles published in English between 2015 and 2025 were eligible. Screening proceeded in three stages: title screening, abstract screening, and full-text review (Figure 1). Empirical studies using quantitative, qualitative, or mixed methods were included, as were conceptual papers that directly examined holistic education in PE. To be eligible, a study had to focus on PE, health and physical education (HPE), sport education, or movement education in a formal educational setting and address whole-person development through at least two interrelated dimensions, such as physical and social-emotional development, cognition and embodiment, or health and ecological awareness. Studies were also eligible when they critically examined the meaning of the "whole person", interdisciplinary integration, or the relationship among physical, mental, social, moral, and cultural dimensions in PE.

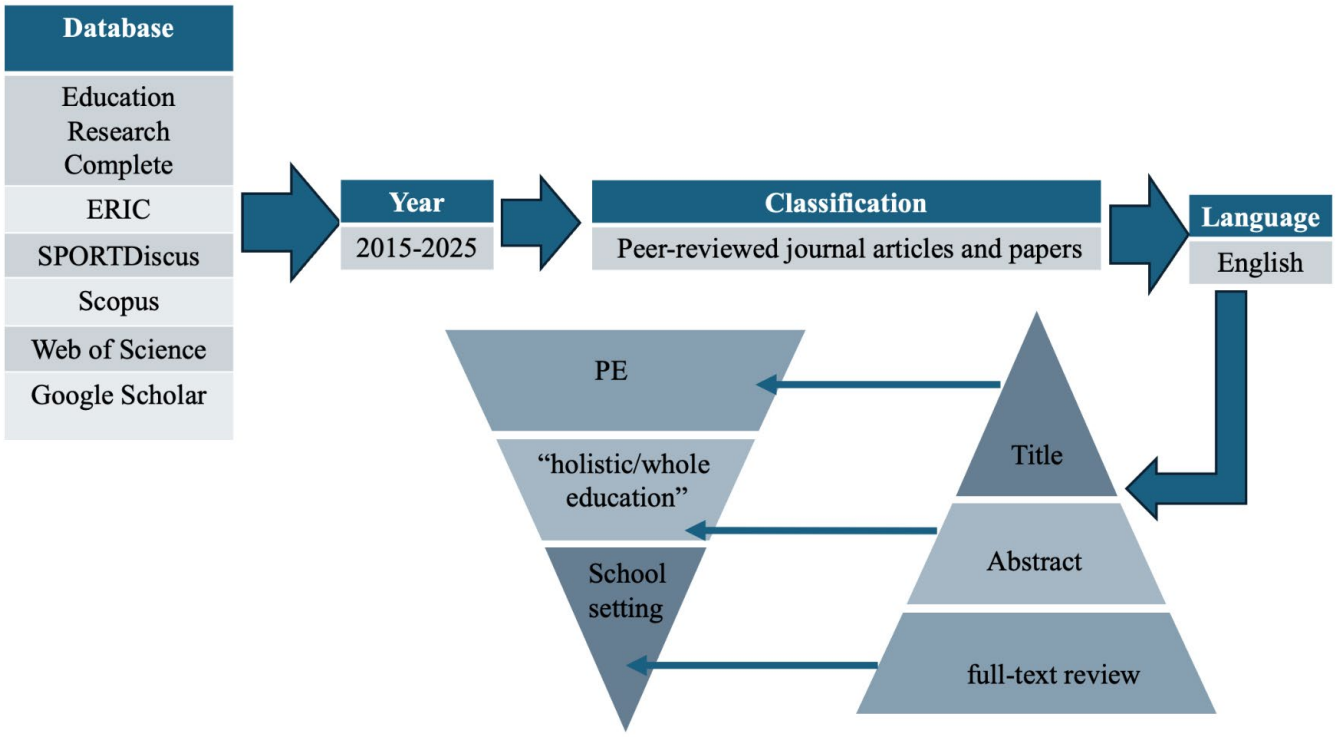

Figure 1. Screening Process for Articles Selection

Studies were excluded if they were published outside the specified period, were not available in English, or were not peer-reviewed journal articles. Conference papers, reviews, meta-analyses, books, book chapters, editorials, opinion pieces, grey literature, and records for which the full text could not be obtained were excluded. Duplicate reports were removed, and when multiple publications used the same data, the most comprehensive or relevant report was retained. Studies conducted solely in community sport, professional sport, clinical exercise, or other non-educational settings were excluded. The review also excluded studies limited to technical skill instruction or competitive performance without an explicit whole-person component, as well as exercise physiology, biomechanics, and medical studies that did not address educational theory, pedagogy, or curriculum. The selection process was documented using the PRISMA 2020 framework to enhance transparency and reproducibility (Page et al., 2021; Figure 2).

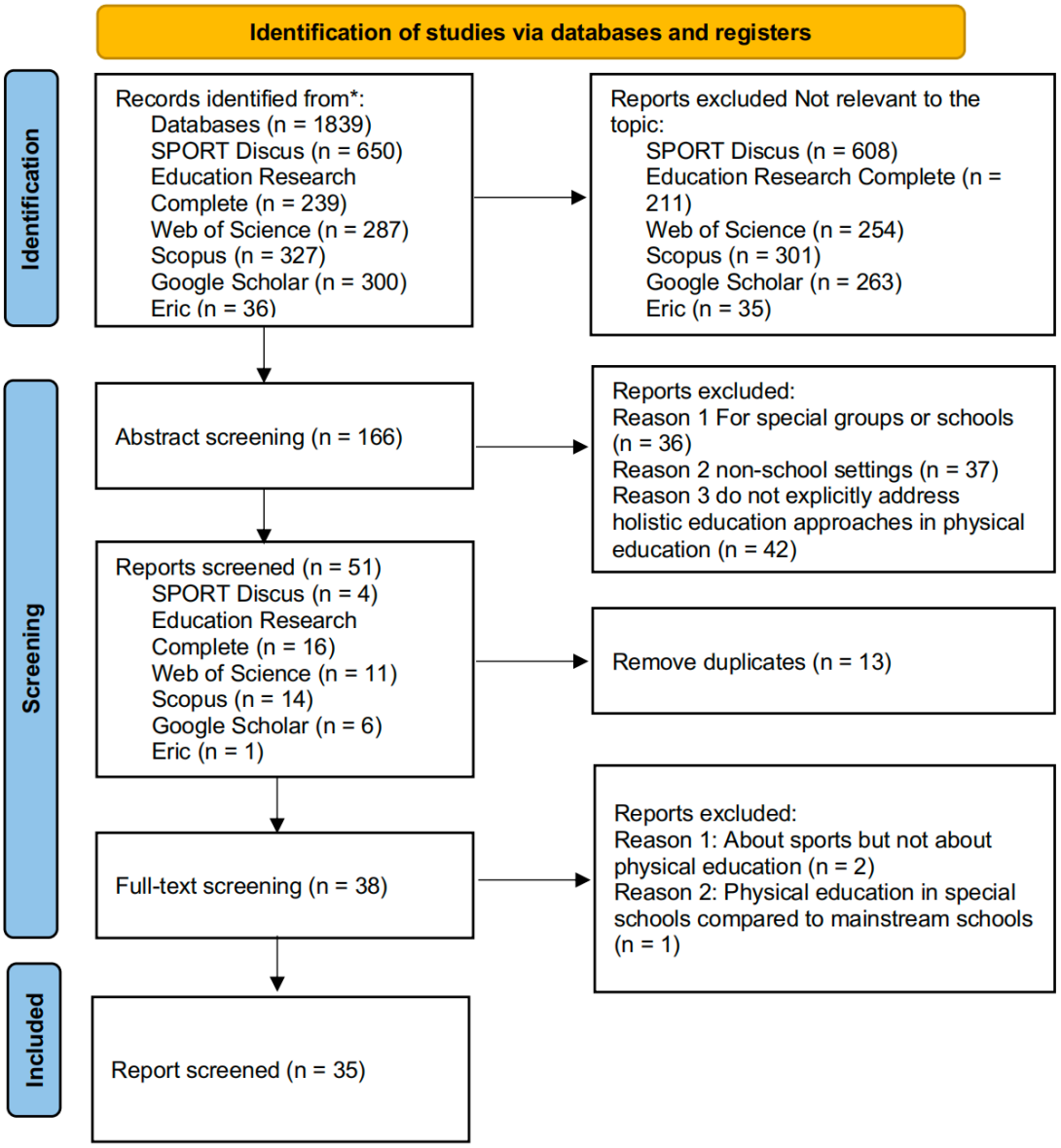

Figure 2. PRISMA flowchart of in/exclusions through the stages of the review

Data Extraction and Analysis

Data were extracted from each included study using a structured framework that recorded publication details, country and educational context, participants, study design, conceptual framing, pedagogical practices, reported outcomes, and implementation challenges. These characteristics were summarised in Table 2. The extraction framework was designed to capture both empirical evidence and conceptual contributions, recognising that some papers did not involve participants directly.

The review used an inductive, domain-based thematic synthesis informed by Thomas and Harden (2008) and conventional content analysis (Hsieh & Shannon, 2005). Findings were initially organised under four predefined domains, conceptualisations, practices, outcomes, and challenges, after which open coding was used to identify patterns within each domain. The analysis involved repeated reading, line-by-line coding of relevant findings and arguments, development of descriptive subthemes, and iterative clustering into higher-order meta-themes. Braun and Clarke's (2019, 2022) guidance on reflexive thematic analysis informed the processes of familiarisation, interpretation, and theme refinement. Key statements and conclusions were extracted from each article and coded as closely as possible to the source meaning. Codes were then compared across studies, grouped into subthemes, and synthesised into meta-themes. Table 3 presents a condensed coding framework. For clarity, each article appears once in the table with a representative coding entry, although individual articles could contribute to more than one domain or theme. Tables 4 to 7 present the subthemes within each of the four domains.

Because the analysis was conducted by one researcher, inter-coder reliability was not calculated. To strengthen rigour, the coding framework was reviewed repeatedly and discussed through external peer feedback. Interpretations were checked against the source studies throughout the process, and claims were kept within the limits of the reported evidence. The four domains were treated as interconnected rather than sequential: conceptualisations shape pedagogical practices, practices generate outcomes, and outcomes and implementation challenges inform subsequent conceptual and pedagogical refinement (Figure 4). The review protocol was registered with the International Prospective Register of Systematic Reviews (PROSPERO; CRD42024516532).

Table 2. Characteristics of the Reviewed Studies

Source	Geographical Distribution	Research Subjects	Methodological Orientations
Shelley & McCuaig, 2019	Australia (Queensland)	Pre-service teachers, six students from 19 to 27 years old	Qualitative case study
Wibowo et al., 2023	Germany	5th-grade physical education class	Conceptual and descriptive
Gleddie & Morgan, 2020	Canada	School-aged students and teachers Mix of theoretical, empirical, and policy-oriented sources	Theoretical and narrative review
Xu & He, 2025	China (Beijing)	University students and faculty members	A qualitative inquiry centred on an intervention-based case study
Polsgrove & Lockyer, 2018	US	Proposal of a new theoretical model-The Holistic Approach to Developmental Movement Education (HADME)	A conceptual paper
Coulter et al., 2015	Australia	A hypothetical case study of a male elite athlete	Theoretical and narrative review
Kennedy et al., 2019	Ireland	Junior high school students	A qualitative, ethnographic research design
Papaioannou, 2017	Greece	Ancient Greek philosophy, modern positive psychology, and motivational theories, Students, Children, Overweight students, Athletes	Theoretical, philosophical, and position paper
Yu & Ilundáin-Agurruza, 2016	Taiwan, China	The Chinese martial art of “Taijiquan” and its principle of ‘inside-outside’ connectivity, Philosophical concept of the 'Body without Organs'	A qualitative, comparative, and interpretive rooted in the humanities
Thorburn, 2020	UK, Australia, Ireland	School-aged children and adolescents aged 5-16, Students aged 16-18 who are undertaking examination awards in physical education, Teachers and policy stakeholders	Philosophical and conceptual analysis
Hayashi, 2025	Japan	Japanese scholarly work on ‘Taiiku’, Official Japanese documents from the Ministry of Education, Culture, Sports, Science and Technology, the Japan Sports Agency, and the Science Council of Japan, Western philosophical works on well-being, moral perfectionism, and spiritual exercise	Conceptual and philosophical analysis
Haga et al., 2024	Norway	10th grade students	Primary qualitative research study
Fernández-Bustos et al., 2024	Spain (Albacete)	Schoolchildren	Quasi-experimental design
Liu et al., 2024	Malaysia	Student-athletes, elite athletes, children, coaches, and administrators	Mixed-methods approach

Baena-Morales et al., 2024	Spain	School-aged children and adolescents	Theoretical proposition for a new intervention model
Cardina & James, 2018	US	American national frameworks, standards, and guidance documents	Theoretical and descriptive
Dalziell et al., 2019	UK (Scotland)	Primary 6 aged between 10 and 11 years	Pre-post quasi-experimental design
Linker & Deutsch, 2020	US	University students	A programme implementation case study
Sprake & Walker, 2015	UK (England)	Pupils/school children, pe teachers, adults	A conceptual paper
Weight et al., 2016	US	Undergraduate students	A cross-sectional study
Etkin, 2024	Canada (Manitoba)	Policy documents from Statistics Canada	Narrative review
Jenny & Rhodes, 2017	US (South Carolina)	Second-grade class students	Professional and conceptual review
Papaioannou et al., 2019	Greece	First year of secondary school	Professional and conceptual review
Brunsdon & Walker, 2021	US	British and American education practice cases	A conceptual paper
Nopembri & Sugiyama, 2022	Indonesia (Yogyakarta)	10 to 12 years old elementary school students	Quantitative research
Kreider, 2018	US	1 physical education teacher, 10 current students, and 3 graduates	Qualitative case study design
Green et al., 2018	Canada	Educational systems, assessment tools, and policy frameworks of Canada, Wales, the United Kingdom, the United States, and Australia	Narrative review and conceptual analysis
Purnomo et al., 2024	Indonesia (Padang, West Sumatra)	High school students	Associative research and quantitative descriptive research
Schenker, 2017	Sweden (Malmö)	Two prime movers and leaders of the KIOSK programme, middle-level classes (ages 10–12)	A qualitative case study
Ruin & Stibbe, 2021	Germany	Documentary artefacts, curriculum documents from the selected German states	Hermeneutically oriented qualitative text analysis
Neto & Joao, 2022	Brazil	philosophical paradigms (e.g., Cartesianism, complexity thinking) theoretical proposals (e.g., Science of Human Motricity, Transdisciplinarity)	Theoretical and conceptual paper
Baena-Morales & González-Víllora, 2022	US	High school students	Qualitative case-study design
Pang, 2020	Hong Kong Special Administrative Region	Based on a sociological and discursive analysis of the HPE field in Hong Kong, using Pierre Bourdieu's concepts of habitus, field, and capital as its primary theoretical framework	A theoretical and conceptual paper

Thorburn & Stolz, 2015	UK, Australia	Philosophical (Merleau-Ponty, MacIntyre, Dewey), theoretical (physical education and phenomenology), and curriculum-based sources (Australian Curriculum)	Conceptual and theoretical paper
Escalié et al., 2017	French	One Physical Education teacher and thirty-two high school students	A qualitative longitudinal case study

Table 3. The process of extracting codes and themes from the four aspects of holistic PE: Source, Country, Codes, themes, Meta-themes

Source	Country	Example Codes	Themes	Meta-themes
Shelley & McCuaig, 2019	Australia	Sociocultural perspective seeks to highlight how health is multi-dimensional in nature.	multi-dimensional health	
Wibowo et al., 2023	Germany	Bildung is a holistic development of cognitive, physical, emotional, social, and aesthetic capacities.	cognitive, physical, emotional, social, aesthetic capacities	1-Meta-theme 1 Health and physical Literacy (38)
Gleddie & Morgan, 2020	Canada	Critical attributes from physical literacy theory are seamlessly integrated and nurtured in all four domains: physical, cognitive, behavioural, and affective.	physical, cognitive, behavioural, affective	
Xu & He, 2025	China	A holistic approach to embodiment education that values the unity of body and mind.	unity of body and mind	1-Meta-theme 2 Embodiment (14)
Polsgrove & Lockyer, 2018	US	Considering the human body as a dynamic system.	dynamic system	
Coulter et al., 2015	Australia	People can be defined through three layers of understanding, incorporating (a) dispositional traits, (b) characteristic adaptations, and (c) narrative identities. Together these layers provide a vision of the whole person.	dispositional traits, characteristic adaptations, narrative identities	1-Meta-theme 3 Holistic HPE (16)
Kennedy et al., 2019	UK	This paper lays bare the central role the managed body plays in the 'production of cultural and economic capital'	cultural/economic capital production	1-Meta-theme 4 Capital (3)
Papaioannou, 2017	Greece	If it is mixed with some exercise and rivalry which ends in pleasure, it promotes health in the body and intelligence in the mind.	promotes health in body promotes intelligence	2-Meta-theme 1 Physical Literacy learning (2)
Yu & Ilundáin-Agurruza, 2016	Taiwan, China	The concept of inside-outside connectivity is Chinese philosophical traditions.	inside-outside connectivity	2-Meta-theme 2 Embodied Learning (25)
Thorburn, 2020	UK	Embodied subjectivity is capable of providing the foundational cornerstone for sustaining child and adolescent engagement in physical education	embodied subjectivity	
Hayashi, 2025	Japan	The philosophies of moral perfectionism and spiritual exercise aligning with the core principles of Taiiku.	perfectionism spiritual exercise	
Haga et al., 2024	Norway	Students can adopt a holistic and comprehensive understanding of health, provided they have the time and opportunities for experience, and reflect on the connection between movement, exercise, health, and the body.	reflection capacity	
Fernández-Bustos et al., 2024	Spain	The Health-based Physical Education framework (HbPE) is one of the most interesting frameworks for health development	Health-based Physical Education framework (HbPE)	2-Meta-theme 3 Interdisciplinary teaching (Education framework / theory) (20)
Liu et al., 2024	Malaysia	The Integrated Holistic Development Programme for College Athletes (IHDP-CA) on the holistic development outcomes of student-athletes	IHDP-CA	
Baena-Morales et al., 2024	Spain	The Intervention Framework for Sustainable Development in Physical Education (PESDIM), which combines psychological theories with specific educational strategies, is presented.	'PESDIM', psychological theories	
Cardina & James, 2018	US	The national framework for the physical education and physical activity component of the WSCC framework is a comprehensive school physical activity program	WSCC framework	
Dalziell et al., 2019	Scotland	Better Movers and Thinkers (BMT) was designed as a novel approach to PE that directly targets the development of physical	Better Movers and Thinkers (BMT)	

		competence, cognitive skills and personal qualities.		
Linker & Deutsch, 2020	US	SHAPE America has responded to the call to address children's SEL skills with its user-friendly health.moves.minds.® service learning program.	health.moves.minds.® service learning program	
Sprake & Walker, 2015	UK	The main strength of Physical Education lies in its ability to develop the child holistically, through a focus on the promotion of physical literacy,	develop holistically	3-Meta-theme 1 Health and Physical Literacy skill (3)
Weight et al., 2016	US	Athletes demonstrating significantly greater nutrition, health, injury knowledge, and body awareness than non-athletes.	nutrition, health, injury knowledge, body awareness	
Etkin, 2024	Canada	Explores the integration of holistic methods for PE by promoting student-centred practices and diverse activities, cultivating physical literacy while embracing self-esteem, resilience, and ecological awareness.	ecological awareness	3-Meta-theme 2 Cognitive Development (10)
Jenny & Rhodes, 2017	US	Life skill development in PE may lead to positive affective learning that may pay dividends that last a lifetime.	life skill	
Papaioannou et al., 2019	US	Interdisciplinary programs facilitate students' learning of new motor skills, as well as physics concepts and concurrently increase motivation to learn both in PE and physics.	increase motivation	3-Meta-theme 3 Social-Emotional Competencies (13)
Brunsdon & Walker, 2021	US	To develop virtuous states of character which incorporate capacities of perception, motivation, cognition and affection.	capacities of perception, motivation, cognition	
Nopembri & Sugiyama, 2022	Indonesia	The forms and types of physical activities can be a driving variable that improves psychosocial and spiritual aspects and reduces the negative psychological aspect.	improves psychosocial and spiritual aspects, reduces the negative psychological aspect	
Kreider, 2018	US	This PE program was developed to not only increase the physical capabilities of students, but also assist them in taking a lead role in their own development, both physically and academically	academically	3-Meta-theme 4 Values and Personal Growth (5)
Green et al., 2018	Canada	Rejects the notion of normative standards for ipsative judgements, thus reflecting the nature of physical literacy as it was intended.	normative standards	4-Meta-theme 1 Standardised evaluation (12)
Purnomo et al., 2024	Indonesia	Thus, investing in teacher development and adapting the education system is the key to creating a generation that is skilled, creative and ready to face future challenges.	adapting the education system	
Schenker, 2017	Sweden	An unconscious use of some of the didactic tools can support the logic of competitive sport, which is common in PEH and which contradicts teaching PA for social health.	logic of competitive sport	
Ruin & Stibbe, 2021	Germany	The specific content of the learning outcome statements focuses on a narrow, biomedical interpretation of health as preventive training and promoting conditional abilities	narrow biomedical interpretation of health	
Neto & Joao, 2022	Brazil	The dichotomy between body and mind is consequently established in this same area.	dichotomy between body and mind in this same area	4-Meta-theme 2 Mind-body dualism (5)
Baena-Morales & González-Víllora, 2022	Spain	PE has traditionally been approached from two philosophies, one focused exclusively on body development and the other on the vision of the whole person (in addition to body, mind, spirit and well-being)	body, mind, spirit and well-being	
Pang, 2020	China Hong Kong	The intersections of Eastern and Western ideologies, regimes and practices left by the British legacy continue to haunt its complex cultural and social practices.	complex cultural intersections	4-Meta-theme 3 Cultural integration (2)

Thorburn & Stolz, 2015	UK	This makes it vital that a commitment towards embodied learning and school-based physical culture is matched by the pedagogical capacity for teachers	matched by the pedagogical capacity	4-Meta-theme 4 Training Teachers (11)
Escalié et al., 2017	French	A grounding in experience seems to offer heuristic possibilities for the holistic examination of teaching and learning practices that contribute to the development of the key competences, particularly when a competence is read as an experience that integrates multiple dimensions	grounding in experience	

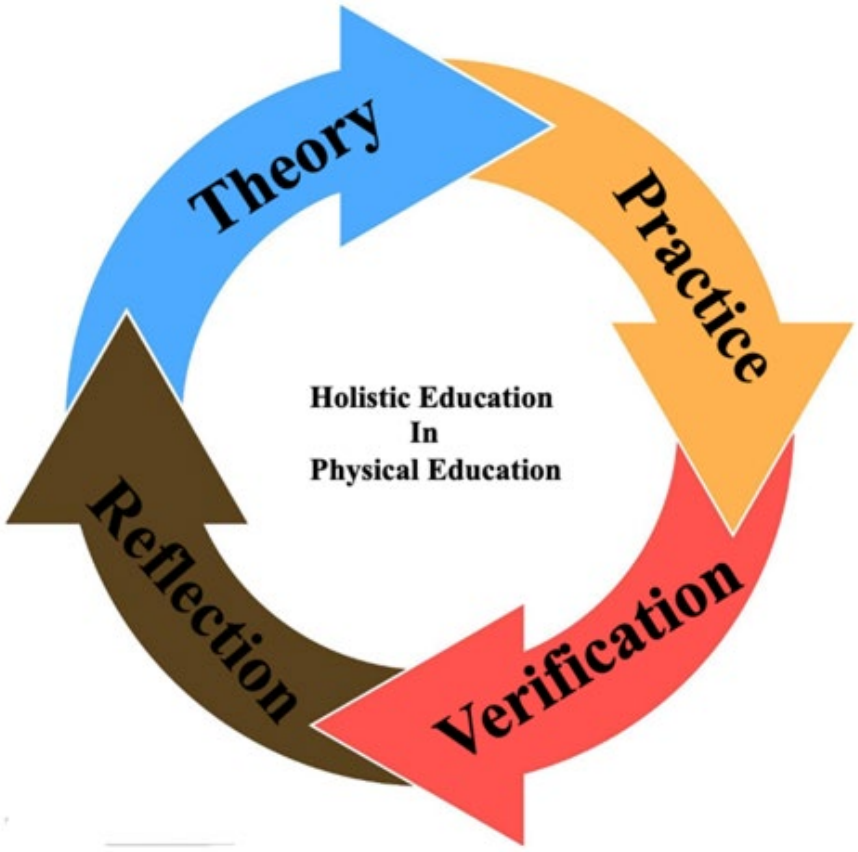

Figure 3. The Logical Closed Loop

Results

Thirty-five peer-reviewed studies were included in the final synthesis. The largest numbers were conducted in the United States, the United Kingdom, and Australia, followed by Canada, Germany, and Spain. Individual studies were also located in Greece, Norway, Sweden, Brazil, Malaysia, Japan, Indonesia, and China, indicating representation across Western and Asian settings (Figure 3). Participants included school and university students, pre-service and in-service teachers, athletes, coaches, and policy stakeholders. Conceptual and theoretical papers drew on philosophical and cultural traditions including phenomenology, Bildung, Tai Chi, Daoism, and Japanese taiiku. Qualitative designs, including case studies, ethnographies, and interpretive inquiries, accounted for approximately 57% of the studies; conceptual or theoretical analyses accounted for 23%; and quantitative or mixed-method studies accounted for 20%. The characteristics of the included studies are summarised in Table 2.

The synthesis generated 152 codes, 189 subthemes, and 15 meta-themes across four domains. The conceptualisation domain comprised three meta-themes: physical and health literacy

within holistic HPE, embodiment, and capital. The practice domain comprised physical-literacy learning, embodied learning, and interdisciplinary teaching. The outcome domain comprised physical-literacy skills, cognitive development, social and emotional competencies, values and personal growth, and health-literacy skills. The challenge domain comprised standardised assessment, mind–body dualism, disciplinary and cultural integration, and teacher preparation. Tables 4 to 7 present the full thematic classification. The following sections integrate the principal findings within each domain.

Conceptualisations of Holistic PE

The literature presents holistic PE less as a single, universally agreed definition than as a family of related educational purposes. Across cultural and educational contexts, holistic PE is framed as an integration of body, mind, emotion, relationships, values, culture, and environment. This marks a shift away from reductionist models centred primarily on fitness or technical performance towards approaches concerned with agency, identity, meaning, participation, and lifelong well-being. The relative emphasis placed on each dimension varies by context, creating multiple pathways for practice and evaluation (Miseliunaite et al., 2022). Three conceptual meta-themes were identified: physical and health literacy within holistic HPE, embodiment, and capital (Table 4). Together, they move from relatively concrete capabilities and curriculum goals to broader philosophical and social accounts of human development.

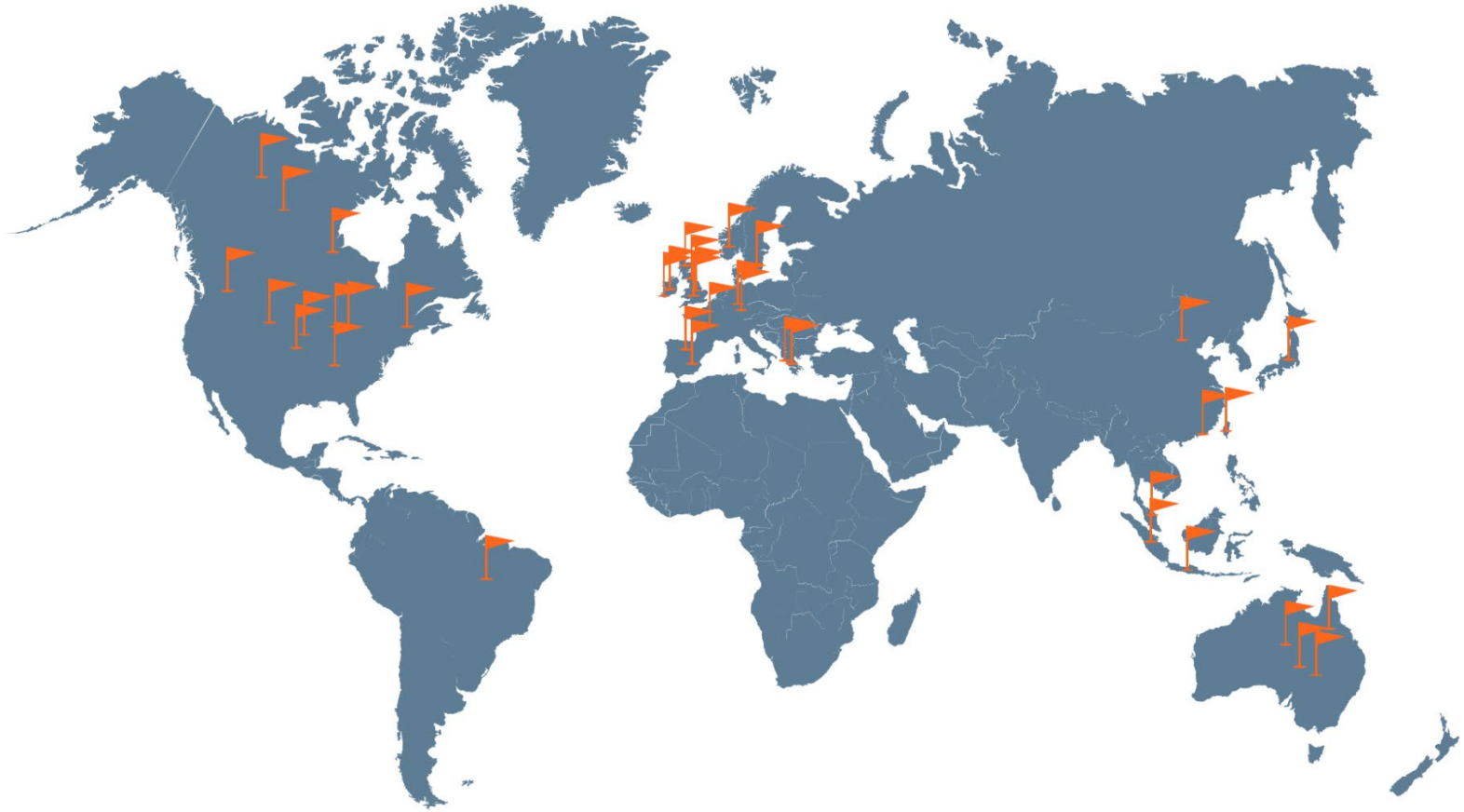

Figure 4. Geographical Distribution of the Reviewed Studies

Table 4. Thematic Classification of Holistic Education in PE - Conceptualizations (71)

1-Meta-theme 1 (38) Physical and health Literacy		**1-Meta-theme (16) 2 Embodiment**	**1-Meta-theme 3 (14) Holistic HPE**	**1-Meta-theme 4 (3) "Capital"**
Physical	Physical fitness	Body	Quality education	Human agency
Psychosocial	The capacity to act fairly	Mind	Health and well-being	Cultural/economic capital production
Cognitive	Take defeat well	Spirit/ Spiritual	Physical outcomes	Status attainment through bodily capital
Competence	Aesthetic capacities	Excellence	Emotional well-being	
Behavioural	Motivation/ intrinsically motivated	Friendship	Creativity	
Loyalty	Sportsmanship	Respect	Cultural expression	
Courage	Teamwork	Balance	Harmonious development of human body	
Emotional	Physical strength	Olympic ideals	Dispositional traits	
Intelligence	Physical abilities	Unity of body and mind	Balance between physical psychology	
Social	Knowledge and understanding	'Usefulness of uselessness'	Characteristic adaptations	
Affective	Multi-dimensional health	Yin-Yang philosophy	Individual social integration	
Skills	Access information	Unity of Heaven and Humanity	Narrative identities	
Determination	Health	Unity of body and mind	Self-awareness	
Mental	Emotional well-being	Taoist philosophy	Lifelong physical activity	
Passion	Cultural expression	'Usefulness of uselessness'		
Confidence	Physical outcomes	Cultural dimensions		
Integrated	Lifelong physical activity			
Physical competence	Creativity			
Spiritual	Moral/ moral dimensions of self-development			

Table 5. Thematic Classification of Holistic Education in PE - Practices (47)

2-Meta-theme 1 (2) Physical Literacy learning	**2-Meta-theme 2 (25) Embodied Learning**		**2-Meta-theme 3 (20) Interdisciplinary teaching (Education framework / theory)**	
Promotes health	Reflection capacity	Unification internal awareness and external postures	Interdisciplinary	physical education for sustainable development (PESD)
Promotes intelligence	Integrates philosophies	Inside-outside connectivity	Intellectual dialogue	health.moves.minds.®
	Integrating cultural	Bildung theory	WSCC framework	servicelearning program.
	Embodied workshop	Body experience concept	Holistic PE pedagogy	perspectivation and cooperative learning
	Criticism capacity	Phenomenology merging with reflective awareness	Human-centred	the Intervention Framework for Sustainable Development in Physical Education (PESDIM)
	Combining learning	Embodied subjectivity	Partnership-based SDG	
	Immersion	Perfectionism	IHDP-CA	
	Felt meaningful	Spiritual exercise	Culturally responsive	Problem-based learning paradigm/ framework
	Emotionally enriching	Primacy of consciousness	Psychological theories	memetic, progressive and transformative frameworks-based pedagogies
	Cultural expression tools	Learn to become flexible and sensitive to various contexts	Student-centred approach	
	Empathy	Ongoing interactions with the environment	Student-centred approach	Better Movers and Thinkers (BMT)
	Versatility			McAdams' actor-agent-author framework

	Experiential learning	Interactive relationship between humanity and nature	McAdams' three-tiered personality framework

Table 6. Thematic Classification of Holistic Education in PE - Outcomes (41)

3-Meta-theme 1 (8) Physical and Health Literacy skill	**3-Meta-theme 2 (10) Cognitive Development**	**3-Meta-theme 3 (13) Social-Emotional Competencies**	**3-Meta-theme 4 (10) Values and Personal Growth**
Ability, confidence and desire to be physically active for life	Engagement	Achieve a sense of belonging	Character development
Physical-social-mental tools	Creativity throughout	Emotional well-being	Academically
Develop holistically	Articulate	Manage stress	Disposition
Ability to access information, resources and services necessary to maintain and promote health	Movement competencies	Resilience	Confidence
Nutrition	Aesthetic experiences	Balanced lifestyle	Capacity to express gratitude
Health	Personal development	Psycho-physical resilience	Self-awareness
Injury knowledge	Life skill	Intrinsic motivation	Self-management
Body awareness	Cognition	Socio-emotional self-esteem	Social awareness
	Coordination	Intention to be physically active	Relationship skills
	Ecological awareness	Capacities of perception	Responsible decision-making
		Motivation	
		Cognition	
		Virtues	

Table 7. Thematic Classification of Holistic Education in PE - Challenges (30)

4-Meta-theme 1 (12) Standardised evaluation	**4-Meta-theme 2 (5) Mind-body dualism**	**4-Meta-theme 3 (2) Cultural/ discipline integration**	**4-Meta-theme 4 (11) Training teachers**
Overly general descriptions of health	Neglecting the integration of body and mind	Sociocultural courses	Sustained
Narrow view of health in PE	Philosophical conflict	Reconceptualisation of personality in sport and exercise psychology	Development of excellence and well-being
Logic of competitive sport	Dualistic approach		Matched by the pedagogical capacity
Vague comprehension	Dichotomy between body and mind in this same area		Harness
Centred on competitive	Body, mind, spirit and well-being		Nurture
Create a personalised teaching environment			Generate
Normative comparisons			Interdisciplinary collaboration
Narrow biomedical interpretation of health			grounding in experience
Measurement			Investing in teacher development
Absolute standards			Gauge the interest level of the class
Normative standards			Instill a growth mind-set
Metrics-driven			

Physical and Health Literacy within Holistic HPE

Physical and health literacy are among the most prominent concepts used to express holistic aims in HPE. Physical literacy provides a foundation for participation across the life course by integrating motivation, confidence, physical competence, knowledge, and understanding (Whitehead, 2010). Within PE, it is associated with experiences that enable learners to engage

meaningfully in movement and develop the capability and disposition to remain active (Bailey et al., 2023; Gleddie & Morgan, 2020; Green et al., 2018; Papaioannou, 2017; Purnomo et al., 2024; Sprake & Walker, 2015). Research on motor competence also supports the importance of developing movement capabilities early, although competence alone does not constitute holistic development (Barnett et al., 2016; Cohen et al., 2014). Health literacy, by contrast, concerns the capacity to access, understand, evaluate, and apply health information when making decisions (Kennedy et al., 2020; Shelley & McCuaig, 2019). The two constructs overlap but are not interchangeable. In PE, physical literacy can support health literacy by connecting embodied experience with knowledge, reflection, and informed choice, while health literacy broadens attention to nutrition, mental health, social conditions, and health-related decision-making (Cairney et al., 2019; Weight et al., 2016). Holistic HPE curricula therefore seek to develop both active participation and health agency. Policy frameworks increasingly position these capacities as core educational goals rather than short-term fitness outcomes (Lynch, 2024). This integration reflects the classical ideal of *kalokagathia*, the harmonious cultivation of bodily capability and sound judgement, while remaining focused on contemporary aims of lifelong health and well-being.

Embodiment

Embodiment is a central conceptual theme because it treats the body not as a passive object to be trained, but as a basis of perception, cognition, emotion, identity, and meaning (Thorburn & Stolz, 2015). It challenges mind–body dualism and emphasises that human experience is grounded in sensory-motor processes and in dynamic interaction with social and physical environments (Neto & Joao, 2022; Pang, 2020). In PE, movement can therefore function as a way of knowing, communicating, and reflecting rather than merely as a means of improving performance. Phenomenological accounts of embodied subjectivity, the concept of movingness, and research integrating physical, psychosocial, and spiritual development all extend this view (Nopembri & Sugiyama, 2022; Souza, 2023; Thorburn, 2020). Eastern philosophical traditions contribute additional perspectives on balance, non-instrumental experience, self-cultivation, and human relationships with nature. Tai Chi and Daoist thought, for example, provide frameworks for understanding bodily practice as simultaneously physical, ethical, reflective, and ecological (Xu & He, 2025; Yu & Ilundáin-Agurruza, 2016). Rather than treating Eastern and Western traditions as opposites, the reviewed literature suggests that dialogue among them can counter the utilitarian narrowing of PE and support more culturally responsive forms of holistic education.

The Potential of a Capital Perspective

The language of capital offers a further way to explain the multidimensional value of PE. From this perspective, PE is not only a setting for physical training but also a site where physical, cultural, social, and human resources can be developed (Kennedy et al., 2020). Investment in physical activity may generate long-term benefits in health, confidence, relationships, adaptability, and participation, which is why physical activity has been described as an under-recognised investment in human capital (Bailey et al., 2013). Studies of health and health literacy among student athletes similarly illustrate how educational sport can contribute to resources that extend beyond performance (Weight et al., 2016). The capital metaphor is useful because it makes the cumulative and socially situated value of PE visible. However, it also carries the risk of reducing learners to productive assets. A holistic interpretation should therefore emphasise human flourishing and relational well-being rather than economic utility alone. The idea of ecological capital may offer a complementary extension by drawing attention to the dynamic balance among physical, psychological, social, cultural, and

environmental relationships. This remains a conceptual proposition that requires further empirical development.

Practices of Holistic PE

Across the reviewed literature, practice has shifted from a predominantly skill-centred model towards the coordinated development of physical, cognitive, social, emotional, ethical, and ecological dimensions. Figure 5 illustrates this movement from isolated physical outcomes towards multidimensional integration. Three practice meta-themes were identified: physical-literacy learning, embodied pedagogy, and interdisciplinary teaching (Table 5). Although analytically distinct, these approaches frequently overlap in curriculum design and classroom practice.

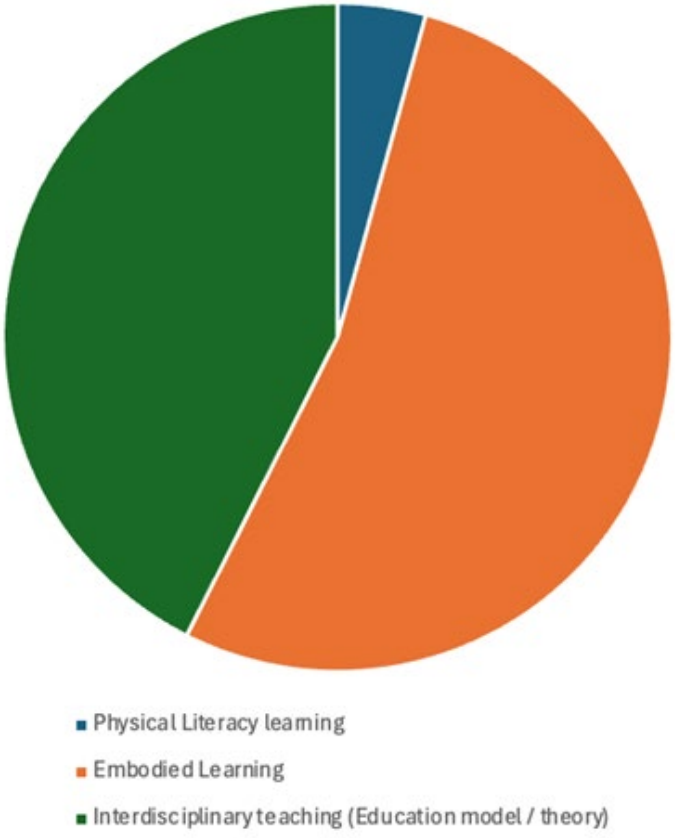

Figure 5. Comparison of the three meta-themes in practice

Embodied Pedagogy

Embodied pedagogy has become increasingly prominent in holistic PE (Thorburn & Stolz, 2015; Xu & He, 2025). It prioritises meaningful movement experiences through which learners develop confidence, bodily awareness, agency, and the capacity to sustain an active life (Sprake & Walker, 2015). Drawing on Merleau-Ponty's account of bodily subjectivity and Dewey's emphasis on experience and reflection, Thorburn (2020) argues that PE should help learners interpret and articulate what movement means, thereby deepening both self-understanding and social learning. Language, dialogue, and reflection can make bodily experience shareable and position movement as a medium of communication. Practical approaches include mindfulness, creative movement, outdoor learning, culturally meaningful activities, and reflective portfolios (Etkin, 2024; Kreider, 2018). The German concept of Bildung similarly emphasises self-

formation through embodied experience, reflection, and engagement with others rather than the passive receipt of knowledge (Ruin & Stibbe, 2021; Wibowo et al., 2023). In China, culturally grounded approaches draw on Yin–Yang and Daoist ideas to connect holistic education with local philosophical traditions (Xu & He, 2025). Across contexts, effective embodied pedagogy requires adaptation to learners' cultures, developmental needs, identities, and prior experiences rather than the uniform application of a single method.

Interdisciplinary Teaching Frameworks

Interdisciplinary teaching broadens holistic PE by connecting movement with health science, psychology, ethics, sustainability, culture, and other curriculum areas. This approach counters models that treat the body primarily as a measurable machine defined by fitness indicators (Fernández-Bustos et al., 2024). The Whole School, Whole Community, Whole Child (WSCC) framework, for example, links classroom teaching with school systems, family and community relationships, health services, and student well-being (Cardina & James, 2018). Reflective health records or portfolios can support this integration by enabling students to document activity, nutrition, goals, stress management, recovery, and learning over time (Kreider, 2018). The holistic developmental movement education framework combines philosophical principles with dynamic systems theory and emphasises individual differences, bodily experience, and the coordination of multiple movement subsystems (Polsgrove & Lockyer, 2018). Coulter et al.'s (2015) three-level personality framework, which considers the person as a social actor, motivated agent, and autobiographical author, likewise encourages sport and exercise psychology to move beyond isolated traits. Sustainability-oriented models further connect PE with environmental responsibility and the Sustainable Development Goals (Baena-Morales & González-Víllora, 2022; Baena-Morales et al., 2024). Embodied and interdisciplinary teaching are mutually reinforcing: embodied experience grounds abstract knowledge, while interdisciplinary connections expand the meaning of movement.

Outcomes of Holistic PE

The reported outcomes of holistic PE form an interconnected pattern rather than a set of isolated effects (Deng & Legge, 2022). Physical practice can support bodily competence and health agency, stimulate cognitive engagement, and provide contexts in which learners negotiate emotion, identity, relationships, and values (Table 6). Studies reported improvements in physical competence, coordination, activity participation, bodily awareness, and motivation for lifelong movement (Barnett et al., 2016; Cohen et al., 2014; Etkin, 2024; Papaioannou et al., 2019). Approaches that deliberately combined movement with cognitive tasks were also associated with attention, strategic thinking, coordination, and executive functioning (Dalziell et al., 2019). Health-based PE and programmes integrating social and emotional learning supported self-regulation, health-related decision-making, physical self-concept, and the application of embodied strategies to everyday well-being (Fernández-Bustos et al., 2024; Linker & Deutsch, 2020).

Holistic PE also created opportunities for social, emotional, moral, and personal development. Meaningful participation, cooperation, and responsibility-oriented pedagogy were associated with fairness, respect, empathy, prosocial behaviour, gratitude, life skills, and a stronger sense of self (Brunsdon & Walker, 2021; Jenny & Rhodes, 2017; Liu et al., 2024; Papaioannou, 2017). Studies that incorporated psychosocial and spiritual dimensions further suggested that PE can contribute to emotional balance and an integrated sense of well-being (Nopembri & Sugiyama, 2022). Critical approaches enabled students to examine relationships among health, the body, media, policy, and social inequality, thereby strengthening evaluative health literacy and moral reasoning (Ruin & Stibbe, 2021; Shelley & McCuaig, 2019). These outcomes should nevertheless be interpreted cautiously because much of the evidence was

qualitative, context-specific, or based on short-term and self-reported measures. Longitudinal and comparative research is needed to determine whether reported benefits are sustained and transferable beyond particular programmes.

Challenges of Holistic PE

Despite their multidimensional potential, holistic PE initiatives encounter structural, cultural, and professional barriers. Four challenge meta-themes were identified: standardised assessment, mind–body dualism, disciplinary and cultural integration, and teacher preparation (Table 7). These barriers interact. For example, narrow assessment systems can reinforce dualistic curriculum priorities, while limited teacher preparation can reduce interdisciplinary and culturally responsive practices.

Standardised Assessment

Holistic education is oriented towards development across time, whereas school assessment frequently privileges short-term, easily quantified indicators such as fitness scores or technical performance (Beni et al., 2021; Green et al., 2018; Ruin & Stibbe, 2021). This creates difficulties when educators attempt to evaluate less tangible outcomes, including agency, identity, reflection, values, relationships, and ecological awareness (Baena-Morales & González-Víllora, 2022; Papaioannou, 2017). The problem is intensified by broad or ambiguous definitions of health and by students' tendency to equate health with fitness alone (Haga et al., 2024; Shelley & McCuaig, 2019). Holistic outcomes may require observation across months or years, yet accountability systems often demand annual, standardised evidence (Pang, 2020; Xu & He, 2025). Competitive and didactic practices may also reproduce performance-oriented norms that conflict with aims related to social health, inclusion, and meaningful participation (Schenker, 2017; Wibowo et al., 2023). Addressing this tension requires assessment systems that combine quantitative indicators with student reflection, portfolios, observation, dialogue, and evidence of learning over time. The gap between policy aspirations and school realities therefore calls for collaborative redesign rather than isolated assessment reforms (MacPhail & Lawson, 2020).

Mind–Body Dualism

Mind–body dualism remains a conceptual and institutional barrier. When physical training is separated from intellectual, emotional, and moral development, holistic elements are easily treated as optional additions rather than as organising principles of PE (Neto & Joao, 2022; Xu & He, 2025). Research in England suggests that students may experience PE primarily as recreation, performance, or relief from academic pressure rather than as a coherent context for learning, reflection, and personal development (Hemingway et al., 2023; Sprake & Walker, 2015). Such perceptions can marginalise the subject and obscure its cognitive and social value. A holistic approach requires curriculum language, pedagogy, and assessment that recognise movement as simultaneously bodily, cognitive, affective, relational, and cultural.

Disciplinary and Cultural Integration

Curriculum reform must balance global principles with local meanings. Cultural content can become superficial when traditions are reduced to visible symbols or isolated activities without attention to their ethical, historical, and philosophical foundations. For example, teaching a martial-arts sequence without engaging with concepts such as martial virtue, balance, or human relationships with nature risks cultural tokenism. Similarly, interdisciplinary work can remain a loose collection of themes unless connections among movement, health, society, ethics, and environment are made explicit. Concepts such as the unity of humanity and nature and the "usefulness of uselessness" require interpretation and dialogue rather than simple

transplantation into a lesson (Xu & He, 2025). Sociocultural perspectives can help students develop critical corporeality, understand how bodies and health are shaped by social conditions, and reflect on the experiences of others (Coulter et al., 2015; Shelley & McCuaig, 2019). A balanced curriculum should expose learners to multiple meanings of movement and sport while allowing them to examine how these meanings vary across activities and cultures (Wibowo et al., 2023).

Teacher Education and Professional Development

Holistic PE places substantial demands on teachers. Educators need knowledge of movement and sport alongside competence in health education, psychology, inclusive pedagogy, cultural studies, reflection, and interdisciplinary curriculum design. However, teacher preparation often remains organised around isolated sport techniques and short-term performance outcomes. Frameworks such as WSCC depend on collaboration across subjects, services, families, and communities, capacities for which many teachers have limited preparation (Cardina & James, 2018). Teachers must also create time and psychological safety for students to reflect, make choices, and interpret their experiences (Escalié et al., 2017; Haga et al., 2024). Professional learning should therefore help teachers examine how existing programmes cultivate moral, civic, intellectual, and performance-related virtues, and how these aims are expressed in everyday practice (Brunsdon & Walker, 2021; Fenstermacher et al., 2009). Sustained development, mentoring, collaborative planning, and context-sensitive resources are essential if teachers are to adapt holistic principles within real constraints (Beni et al., 2021; Purnomo et al., 2024). The preparation of holistic educators is consequently not a peripheral issue but a central condition for implementation.

These challenges are not merely technical problems. They reflect broader assumptions inherited from industrial models of education, including instrumental views of the body, fragmented knowledge, and short-term accountability. Progress therefore requires coordinated reform in curriculum, assessment, teacher education, school organisation, and policy. Repositioning PE as a context for learning through the body, rather than simply training the body, is central to that reform.

Discussion

The review indicates that holistic PE is best understood as a dynamic system in which conceptualisations, practices, outcomes, and challenges continually influence one another. To integrate these dimensions and provide a structure for future research and practice, this study proposes the Holistic Physical Education Ripple Framework (HPERF; Figure 6). HPERF combines systems thinking with insights from Eastern and Western philosophies and represents whole-person development as an open, developmental process rather than a fixed programme.

The framework draws visual inspiration from the Tai Chi symbol, which represents interdependence, movement, and the complementarity of apparently opposing forces. At its centre, “Holistic Education” is linked to “PE”, indicating the application of holistic educational principles within the subject. This symbolism challenges Cartesian mind–body dualism and resonates with transdisciplinary accounts that regard body and consciousness as inseparable (Neto & Joao, 2022). It also connects with Merleau-Ponty’s account of embodied meaning and with Chinese philosophical ideas such as Wang Yangming’s unity of knowledge and action and Fan Zhen’s inseparability of form and spirit (Wang et al., 2025; Wong, 2025). Around the centre, four ripple-like quadrants represent conceptualisations, practices, outcomes, and challenges. Bidirectional arrows indicate that the domains are mutually influential rather than linear. The open boundaries allow meta-themes to be revised, expanded, or reorganised as evidence develops (Popper, 2005). Similar ripple-based frameworks have been used to

represent relational and co-produced value in health and care contexts, supporting the use of this form for a flexible and collaborative model (Soares & Kettley, 2024).

HPERF is intended to be both analytical and generative. For researchers, it offers a taxonomy for mapping the 15 meta-themes, identifying conceptual gaps, and comparing evidence across settings. For educators, it can support a cyclical process of curriculum development: clarify a holistic learning aim, design an embodied or interdisciplinary learning experience, examine multidimensional outcomes, identify constraints, and refine the next iteration. The framework can also be used to evaluate whether a programme addresses the whole learner or merely adds isolated well-being activities to a conventional performance model. Its incomplete ripple structure is deliberate, inviting future studies and practitioners to add, revise, or challenge themes. HPERF should therefore be treated as a provisional organising framework rather than a validated causal model. Future research should test its clarity, usefulness, and transferability across age groups, cultures, educational systems, and forms of physical activity. Such work should proceed through critical dialogue, empirical testing, and iterative revision (Mabovula, 2010).

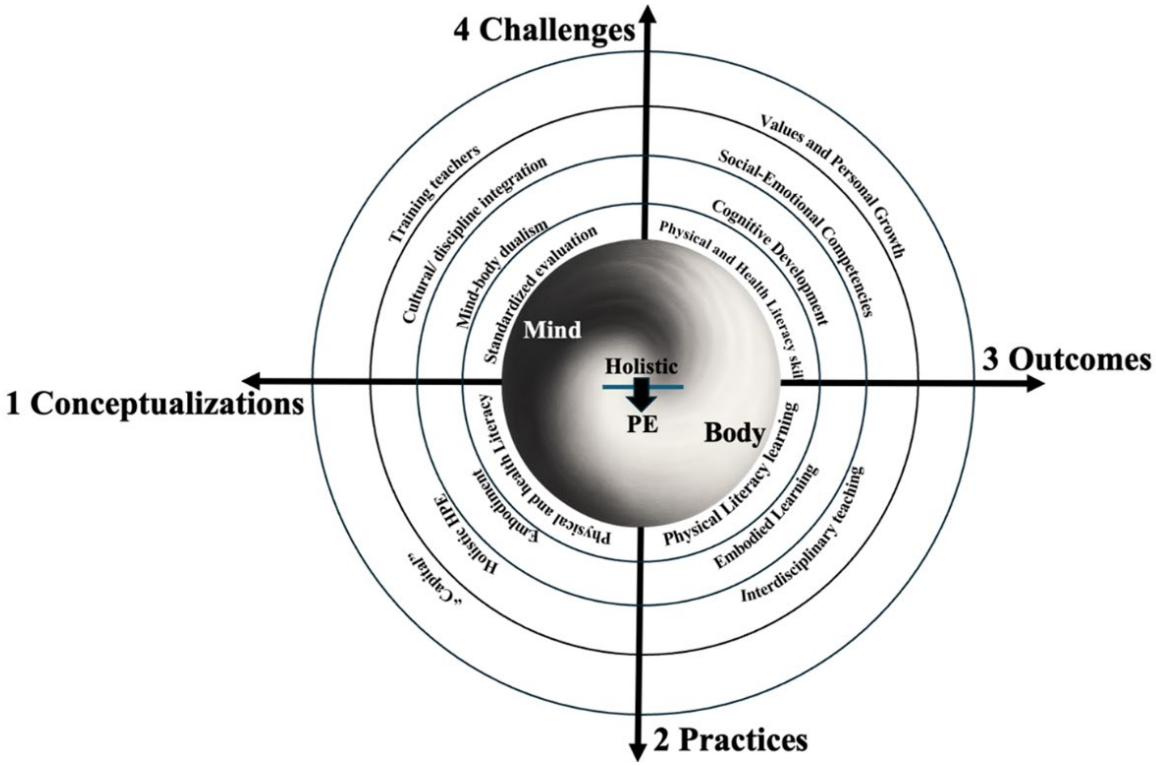

Figure 6. Holistic Physical Education Ripple Framework (HPERF)

Limitations

Several limitations should be considered when interpreting this review. First, the database selection and exclusion of grey literature may have omitted relevant studies in specialist, regional, or practice-oriented sources. Second, the English-language restriction and the use of predominantly Anglophone search terms may have overlooked culturally specific accounts of mind–body integration and holistic education. Third, the 2015–2025 publication window prioritised contemporary practice but excluded earlier empirical and conceptual work from the formal synthesis, creating a risk of recency bias. Fourth, the review focused on formal educational contexts and did not examine teacher development, community sport, or professional sport as separate bodies of evidence. Fifth, screening, data extraction, and coding

were conducted by a single researcher. Repeated review and external feedback strengthened transparency but did not substitute for independent duplicate screening and coding. The review also did not provide a formal appraisal of methodological quality across the heterogeneous empirical and conceptual studies, which limits the certainty with which outcome claims can be interpreted. Finally, the proposed HPERF is a conceptual synthesis derived from the included literature and has not yet been empirically validated. Future reviews should use multilingual search strategies, broader database coverage, duplicate review procedures, and explicit quality appraisal, while future empirical work should examine the framework's reliability and practical value.

Conclusion

This review shows that holistic PE is not defined by a single method but by a commitment to integrating physical, cognitive, emotional, social, ethical, cultural, and ecological development through movement (Kirk, 2009). Across the literature, physical and health literacy, embodiment, and the development of personal and social resources provided the principal conceptual foundations. Embodied, reflective, culturally responsive, and interdisciplinary pedagogies translated these ideas into practice, while reported outcomes extended beyond physical competence to cognition, self-regulation, relationships, values, and health agency.

The findings also demonstrate that implementation depends on the systems surrounding teaching. Standardised assessment, persistent mind–body dualism, superficial cultural integration, and gaps in teacher preparation can prevent holistic principles from becoming part of everyday PE. Addressing these barriers requires aligned reform in curriculum, assessment, professional learning, policy, and school organisation. The HPERF brings these relationships together in a flexible visual structure and offers a practical means of moving between educational aims, pedagogical design, observed outcomes, and implementation challenges.

HPERF should be regarded as a starting point for cumulative inquiry rather than a finished model. Longitudinal, comparative, and implementation studies are needed to examine whether holistic PE produces sustained benefits, for whom, and under which educational and cultural conditions. Future research should also develop credible multidimensional assessment approaches and test the framework in collaboration with students, teachers, schools, and communities. Through such work, PE can be repositioned from a narrowly performance-oriented subject to a central context for learning through the body and supporting whole-person flourishing.

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Declaration of Generative AI and AI-Assisted Technologies in the Writing Process

During the preparation of this manuscript, the author(s) used ChatGPT to assist with improving language clarity, grammar, and phrasing. The author(s) carefully reviewed and revised the output to ensure accuracy and take(s) full responsibility for the content of the final manuscript.

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Ethics Statement

Ethical approval was not required because this systematic review synthesised previously published literature and involved no human participants or identifiable personal data.

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The Official Journal of the International Society for Comparative Physical Education and Sport

REVIEW

Evaluating the Effectiveness of Flipped Lesson Models in Physical Education: A Systematic Review of Student Engagement and Learning Outcomes

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Abstract

Flipped learning relocates direct instruction to pre-class activities and uses class time for guided practice, feedback, and collaboration. Its effectiveness in physical education (PE), where learning spans cognitive, psychomotor, and social domains, remains unclear. This systematic review was registered in PROSPERO (CRD42024543676) and reported in accordance with PRISMA 2020. Five bibliographic databases and Google Scholar were searched for peer-reviewed intervention studies published from January 2018 to January 2024. Ten studies met the eligibility criteria, and their findings were synthesised thematically. Across secondary and tertiary PE settings, flipped lessons were generally associated with higher motivation, participation, self-efficacy, collaboration, conceptual understanding, and skill performance. Outcomes varied according to the quality and alignment of pre-class materials, students' completion of preparatory work, teacher readiness, and contextual factors. Most interventions were short and geographically concentrated, and heterogeneity in study designs and measures precluded strong causal or long-term conclusions. Flipped lessons are a promising approach to active learning in PE, but benefits are not automatic. Effective implementation requires accessible, well-designed pre-class resources, purposeful in-class activities, teacher training, and support for students who struggle with self-directed preparation. Longer, more diverse, and methodologically robust studies are needed.

Introduction

Physical activity (PA) is a major determinant of health and well-being, yet participation remains inadequate worldwide. In 2024, 31% of adults and 80% of adolescents did not meet recommended activity levels (World Health Organization [WHO], 2024). This is particularly concerning because childhood and adolescence are formative periods for establishing lifelong patterns of PA (Bailey et al., 2013, 2016). Physical education (PE) is therefore a key setting for

developing the knowledge, skills, motivation, and confidence needed for sustained participation. However, conventional teacher-centred approaches do not consistently engage all learners, particularly in higher education (Yao et al., 2023).

The flipped classroom has emerged as one response to this challenge. It relocates direct instruction to pre-class study and uses class time for active application, feedback, and collaboration. Although flipped approaches have improved engagement in science, technology, engineering, mathematics, and medical education, their effectiveness in PE is less clearly established. A focused synthesis is therefore needed to examine their effects on student engagement, learning, and skill development.

The flipped classroom aligns closely with constructivist and active-learning perspectives (Bergmann & Sams, 2023; Bishop & Verleger, 2013). Constructivism proposes that learners build knowledge by connecting new information with prior experience (Moore & Piaget, 1971; Vygotsky, 1978), whereas active learning emphasises engagement, collaboration, and experience in the learning process (Bonwell & Eison, 1991). In a flipped design, students study foundational content independently before applying it through collaborative and practical activities. This sequence may support deeper understanding, retention, critical thinking, and self-directed learning (Lage et al., 2000; Tucker, 2012). However, conceptual clarity is essential because studies sometimes blur the distinction between genuinely flipped designs and broader forms of blended or active learning (Capella-Peris et al., 2023; Jensen et al., 2015).

Evidence from PE suggests that flipped lessons may improve motivation, participation, collaboration, and conceptual understanding (Botella et al., 2021; Østerlie, 2016; Østerlie et al., 2022). Their effectiveness nevertheless appears to depend on the quality and accessibility of pre-class materials, teacher preparation, student completion of preparatory work, and the alignment of pre-class and in-class activities (Chiang et al., 2018; Hsia et al., 2019). A review focused specifically on PE is therefore warranted to synthesise studies published since 2018 using a clear operational definition of the flipped model. The present review evaluates the effects of flipped lessons on student engagement and learning outcomes and considers their potential implications for lifelong physical activity.

Terminology: Flipped Classroom, Flipped Learning, and Flipped Lessons

The terms ‘flipped classroom’, ‘flipped learning’, and ‘flipped lesson’ describe related but distinct aspects of the same pedagogical approach. The flipped classroom refers to the organisation of the learning environment, flipped learning refers to the pedagogical principles that guide it, and a flipped lesson is the unit-level enactment of those principles. Distinguishing these terms clarifies the scope of the review and reduces conceptual overlap.

Flipped Classroom

The term ‘flipped classroom’ refers to a reorganisation of instruction in which content traditionally delivered during class is moved to pre-class learning, thereby freeing class time for interaction, practice, problem-solving, peer collaboration, and teacher feedback (Aidoo et al., 2022). This structural shift changes students’ role from passive recipients of information to active participants and may strengthen engagement and knowledge retention (Hsia & Hwang, 2020; Zheng et al., 2021).

Flipped Learning

Flipped learning extends beyond the physical reorganisation of class time. It is a pedagogical approach in which students acquire foundational knowledge before class and use class time for higher-order processes, including application, analysis, synthesis, discussion, and collaborative problem-solving (Bergmann & Sams, 2023; Kwon, 2021). Its emphasis on self-regulation, autonomy, and purposeful in-class activity aligns with contemporary goals for critical thinking and lifelong learning (Hsia et al., 2019; Lin & Hsia, 2019).

Flipped Lesson

A 'flipped lesson' is the practical implementation of flipped-classroom and flipped-learning principles within a specific teaching session or unit. It combines structured pre-class preparation, such as video-based instruction or theoretical review, with active in-class application. In PE, students might review rules, tactics, or movement principles before class and then use class time for guided practice, feedback, and skill execution (Baig & Yadegaridehkordi, 2023). This lesson-level perspective allows flipped approaches to be adapted to different topics, learning objectives, and student needs (Chiang et al., 2018; Sevillano-Monje et al., 2022).

Together, these concepts form a coherent learner-centred framework. The flipped classroom denotes the structural organisation, flipped learning describes the underlying pedagogy, and the flipped lesson represents its practical enactment. This hierarchy provides the conceptual basis for identifying eligible PE interventions in the present review.

Theoretical Framework

Constructivist Theory and Flipped Learning

Constructivism holds that knowledge is actively constructed rather than passively received (Moore & Piaget, 1971; Vygotsky, 1978). By allowing students to engage with foundational material at their own pace before class, flipped learning can activate prior knowledge and give learners greater control over initial comprehension (Bergmann & Sams, 2023; Bishop & Verleger, 2013). In class, students apply, question, and refine that knowledge through guided practice and interaction (Férriz-Valero et al., 2022; Hsia et al., 2019). In PE, this process is especially relevant because conceptual understanding and psychomotor performance develop through repeated links between explanation, observation, practice, and feedback.

Active Learning Theory and the Flipped Classroom

Active-learning theory emphasises students' direct involvement in learning through discussion, problem-solving, collaboration, and experience (Bonwell & Eison, 1991). Flipped classrooms support these principles by transferring much of the initial content delivery outside class and reserving class time for purposeful activity (Freeman et al., 2014). Such activities can promote deeper cognitive processing and strengthen the retention and application of knowledge (Deslauriers et al., 2019; Prince, 2004). In PE, group tasks, guided practice, peer feedback, and tactical problem-solving may connect cognitive learning with physical performance (Chiang et al., 2018; Férriz-Valero et al., 2022; Hsia et al., 2019; Sevillano-Monje et al., 2022).

Integrating the Theoretical Perspectives

Flipped learning integrates constructivist and active-learning principles by combining independent preparation with collaborative, higher-order application (Tucker, 2012). This combination may support critical thinking, problem-solving, self-efficacy, autonomy, and self-directed learning (Baepler et al., 2014; Lage et al., 2000; Zheng et al., 2021). The theoretical value of the model therefore lies not simply in moving lectures online, but in creating a deliberate sequence through which pre-class learning prepares students for meaningful in-class activity (Figure 1).

In PE, this sequence may involve reviewing rules, techniques, or tactical concepts before class and then applying them through supervised practice, feedback, and reflection (Férriz-Valero et al., 2022; Hsia et al., 2019). Constructivism explains how learners build and revise understanding across these stages, whereas active-learning theory explains the value of participation and interaction during class. Guided by this integrated framework, the review assesses the effects of flipped lessons on student engagement, learning outcomes, and the potential development of enduring physical activity habits.

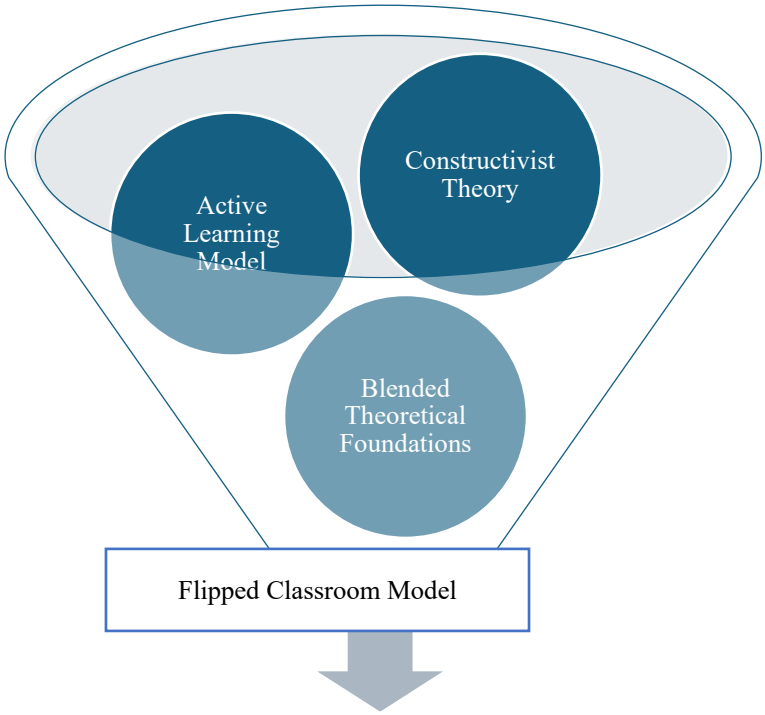

Figure 1. Flipped Classroom Theoretical Framework

Methods

This systematic review was reported in accordance with the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) 2020 statement (Page et al., 2021). The protocol was registered with the International Prospective Register of Systematic Reviews on 5 May 2024 (PROSPERO: CRD42024543676).

Eligibility Criteria

Studies were eligible if they met all of the following criteria:
(a) were published in English;
(b) were peer-reviewed and published between January 2018 and January 2024;
(c) focused explicitly on flipped lessons in PE;
(d) reported an experimental or intervention study and described the flipped-lesson design;
(e) examined flipped learning wholly or primarily within PE classes; and
(f) involved students in secondary or tertiary education.

Search Strategy

Five bibliographic databases, Education Research Complete, Psychology and Behavioural Sciences Collection, Scopus, SPORTDiscus, and Web of Science, together with Google Scholar, were searched systematically. The final search was conducted on 21 April 2024. Two reviewers independently screened titles and abstracts and then assessed potentially eligible full texts against the predefined criteria. Disagreements were resolved through discussion until consensus was reached. Data from included studies were extracted independently by two reviewers to improve accuracy.

Education Research Complete (EBSCOhost): (“physical activit*” OR “physical educat*” OR sport*) AND (flip* OR blend*) AND (“secondary school” OR “high school” OR “secondary education” OR colleg* OR universit* OR “tertiary education” OR “higher education”).
Psychology and Behavioural Sciences Collection (EBSCOhost): (“physical activit*” OR “physical educat*” OR sport*) AND (flip* OR blend*) AND (“secondary school” OR “high school” OR “secondary education” OR colleg* OR universit* OR “tertiary education” OR “higher education”).
Scopus: TITLE-ABS-KEY (“physical activit*” OR “physical educat*” OR sport*) AND (flip* OR blend*) AND (“secondary school” OR “high school” OR “secondary education” OR colleg* OR universit* OR “tertiary education” OR “higher education”).
SPORTDiscus (EBSCOhost): (“physical activit*” OR “physical educat*” OR sport*) AND (flip* OR blend*) AND (“secondary school” OR “high school” OR “secondary education” OR colleg* OR universit* OR “tertiary education” OR “higher education”).
Web of Science: TI=(“physical activit*” OR “physical educat*” OR sport*) AND (flip* OR blend*) AND (“secondary school” OR “high school” OR “secondary education” OR colleg* OR universit* OR “tertiary education” OR “higher education”).
Google Scholar: at least one of the terms “flipped” or “blended”, together with the exact phrase “physical education”; the first 200 results were screened. Table 1 presents the records identified through database searching.

Table 1. Records identified through database searching

Database	Results
Education Research Complete	614
Psychology and Behavioural Sciences Collection	167
Scopus	13
SPORTDiscus	27
Web of Science	75
Google Scholar	200
Total	1096

Operational Definition of a Flipped Lesson

To maintain a clear PE-specific focus, the review applied a strict operational definition during screening. Eligible interventions had to include both of the following features: first, a clear temporal sequence in which direct instruction on theoretical or procedural knowledge was delivered before class, usually through digital resources; and second, the purposeful use of class time for supervised skill practice, application, formative feedback, or other knowledge-informed physical activity. Studies described as blended or active learning were included only when they met this two-stage structure. Interventions that merely supplemented face-to-face teaching with online materials, or that used active-learning strategies without the required pre-class and in-class sequence, were excluded. This definition was intended to distinguish genuinely flipped lessons from broader technology-enhanced or student-centred approaches.

Quality Appraisal and Data Synthesis

Methodological quality was appraised independently by two reviewers using the prespecified 16-domain AMSTAR 2 framework (Shea et al., 2017), supplemented by criteria drawn from previous sport-pedagogy reviews (Araújo et al., 2014; Chu & Zhang, 2018; Hastie & Casey, 2014). Seven domains were treated as critical. In accordance with AMSTAR 2 guidance, no overall numerical score was calculated; instead, confidence was classified as high, moderate,

low, or critically low according to the number and severity of critical and non-critical weaknesses (see Table 2). Disagreements were resolved by consensus or, when necessary, by a third reviewer.

Extracted findings were synthesised thematically (Braun & Clarke, 2006; Kiger & Varpio, 2020; Lorenc et al., 2014). The reviewers familiarised themselves with the data, generated inductive codes, developed candidate themes, and refined those themes through repeated comparison across studies. The synthesis focused on intervention characteristics, student engagement, learning outcomes, implementation conditions, and any evidence concerning the development of sustained fitness habits.

An audit trail documented decisions made during study selection, quality appraisal, data extraction, and synthesis. Reflexive discussion was used throughout the analytical process to identify assumptions and reduce the risk that individual reviewer perspectives would dominate the interpretation. Conclusions integrated the thematic findings with the appraisal of methodological strengths and weaknesses. Figure 2 presents the PRISMA flowchart for the study-selection process. Meanwhile, Figure 3 shows the AMSTAR 2 appraisal process used to assess the methodological quality of the included reviews.

Table 2. Score and Criteria

AMSTAR 2 Questions	Yes	Partial yes (PY)	No	No meta-analysis conducted (NMA)
Q1* Did the research questions and inclusion criteria for the review include the components of PICO?				
Q2 Did the report of the review contain an explicit statement that the review methods were established prior to the conduct of the review and did the report justify any significant deviations from the protocol?				
Q3 Did the review authors explain their selection of the study designs for inclusion in the review?				
Q4* Did the review authors use a comprehensive literature search strategy?				
Q5 Did the review authors perform study selection in duplicate?				
Q6 Did the review authors perform data extraction in duplicate?				
Q7* Did the review authors provide a list of excluded studies and justify the exclusions?				
Q8 Did the review authors describe the included studies in adequate detail?				
Q9* Did the review authors use a satisfactory technique for assessing the risk of bias (RoB) in individual studies that were included in the review?				
Q10 Did the review authors report on the sources of funding for the studies included in the review?				
Q11* If meta-analysis was performed did the review authors use appropriate methods for statistical combination of results?				
Q12 If meta-analysis was performed, did the review authors assess the potential impact of RoB in individual studies on the results of the meta-analysis or other evidence synthesis?				
Q13* Did the review authors account for RoB in individual studies when interpreting/discussing the results of the review?				
Q14 Did the review authors provide a satisfactory explanation for, and discussion of, any heterogeneity observed in the results of the review?				
Q15* If they performed quantitative synthesis did the review authors carry out an adequate investigation of publication bias (small study bias) and discuss its likely impact on the results of the review?				
Q16 Did the review authors report any potential sources of conflict of interest, including any funding they received for conducting the review?				

*Note. PY = partial yes; NMA = no meta-analysis conducted. * Critical domain.*

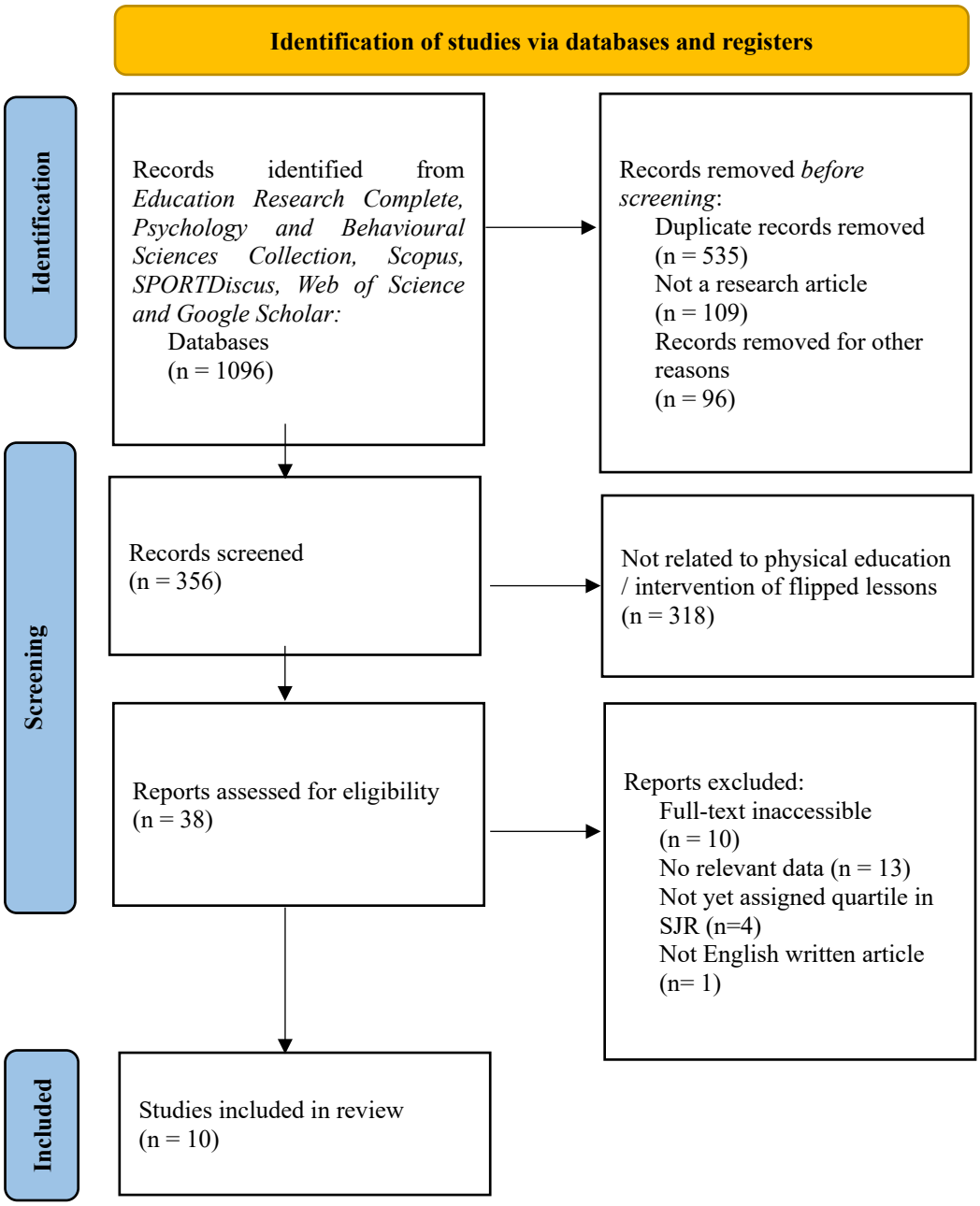

Figure 2. Identification of studies from databases and registers (last searched on 21 April 2024)

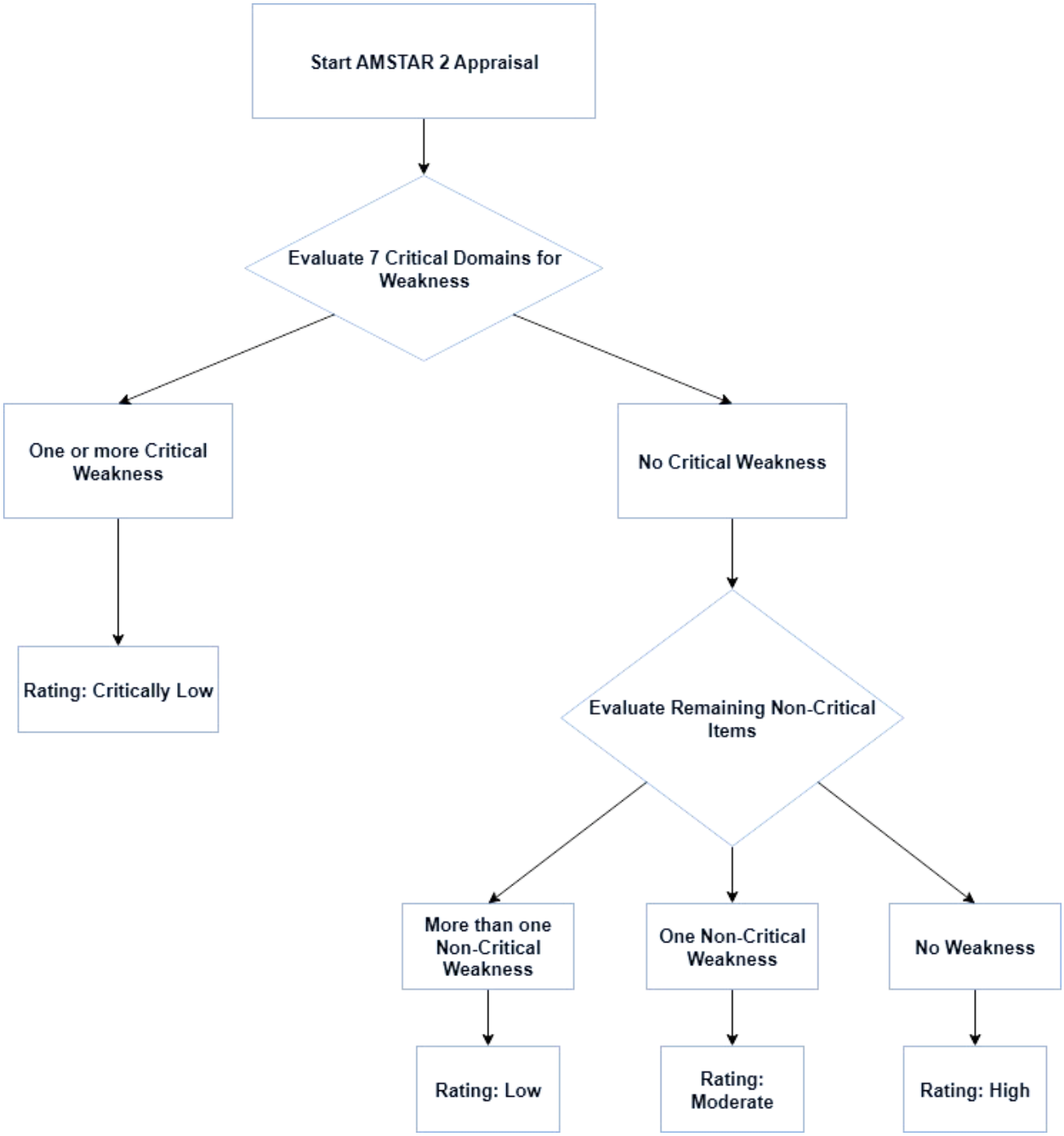

Figure 3. AMSTAR 2 Appraisal Process

Results

Ten studies met the inclusion criteria. Publication years were distributed as follows: one study in 2018, two in 2019, one in 2020, three in 2021, two in 2022, and one in 2023. Seven of the 10 studies were published from 2020 onward, indicating growing interest in flipped approaches within PE, although the overall evidence base remains small. Table 3 presents the Investigation Quality Score Checklist used to assess the quality of the included studies.

Intervention Duration and Sample Size

Nine studies examined learning, motivation, engagement, or performance outcomes across a range of physical activities (Capella-Peris et al., 2023; Chao et al., 2021; Chiang et al., 2018; Férriz-Valero et al., 2022; Hsia et al., 2019, 2021; Hsia & Hwang, 2020; Lin & Hsia, 2019; Zheng et al., 2021), whereas one focused primarily on competence development and student satisfaction (Sevillano-Monje et al., 2022). Five interventions lasted between 8 and 12 weeks. Longer interventions included an 18-week programme (Hsia et al., 2021) and a course delivered from mid-February to the end of May (Zheng et al., 2021). Sample sizes ranged from 80 students (Lin & Hsia, 2019) to 326 students (Chiang et al., 2018). This variation in duration and sample size limits direct comparison across studies and should be considered when interpreting the reported effects (see Table 4).

Study Designs

Eight studies used quantitative designs and two used mixed methods. The quantitative studies employed pretest-posttest measures, and most included intervention and comparison groups. Chao et al. (2021), Chiang et al. (2018), and Férriz-Valero et al. (2022) explicitly compared flipped learning with conventional instruction. Other studies evaluated technology-supported or strategy-enhanced variants of the flipped model. Six of these studies were conducted in Taiwan, including four that examined dance instruction (Chao et al., 2021; Hsia et al., 2019; Hsia & Hwang, 2020; Hsia et al., 2021). Outcome measures varied by activity and included knowledge, motivation, self-efficacy, satisfaction, creativity, collaboration, and skill performance, which precluded a pooled quantitative analysis (see Table 5).

Geographical Distribution

The studies were conducted in four geographical settings: Taiwan (Chao et al., 2021; Chiang et al., 2018; Hsia et al., 2019; Hsia & Hwang, 2020; Hsia et al., 2021; Lin & Hsia, 2019), mainland China (Zheng et al., 2021), the United States (Capella-Peris et al., 2023), and Spain (Férriz-Valero et al., 2022; Sevillano-Monje et al., 2022). The concentration of studies in Taiwan and Spain limits the extent to which the findings can be generalised to other educational systems and cultural contexts (see Table 6).

Table 3. Investigation Quality Score Checklist

Articles	Q1*	Q2	Q3	Q4*	Q5	Q6	Q7*	Q8
Capella-Peris et al. (2023)	Yes	PY	Yes	PY	Yes	No	No	Yes
Chao et al. (2021)	Yes	PY	Yes	PY	Yes	No	No	Yes
Chiang et al. (2018)	Yes	No	Yes	PY	Yes	Yes	No	Yes
Férriz-Valero et al. (2022)	Yes	No	Yes	PY	Yes	Yes	PY	Yes
Hsia et al. (2019)	Yes	PY	Yes	PY	Yes	No	PY	Yes
Hsia & Hwang (2020)	Yes	PY	Yes	PY	Yes	No	PY	Yes
Hsia et al. (2021)	Yes	Yes	Yes	PY	Yes	No	PY	Yes
Lin & Hsia (2019)	Yes	PY	Yes	PY	Yes	No	PY	Yes
Sevillano-Monje et al. (2022)	Yes	PY	Yes	Yes	Yes	No	PY	Yes
Zheng et al. (2021)	Yes	PY	Yes	PY	Yes	No	PY	Yes

Articles	Q9*	Q10	Q11*	Q12	Q13*	Q14	Q15*	Q16	Quality level
Capella-Peris et al. (2023)	Yes	Yes	NMA	NMA	Yes	Yes	NMA	Yes	Low
Chao et al. (2021)	Yes	No	NMA	NMA	Yes	Yes	NMA	No	Low
Chiang et al. (2018)	Yes	Yes	NMA	NMA	Yes	Yes	NMA	Yes	Moderate
Férriz-Valero et al. (2022)	Yes	Yes	NMA	NMA	Yes	Yes	NMA	Yes	Moderate
Hsia et al. (2019)	Yes	Yes	NMA	NMA	Yes	Yes	NMA	Yes	Low
Hsia & Hwang (2020)	Yes	Yes	NMA	NMA	Yes	Yes	NMA	Yes	Low
Hsia et al. (2021)	Yes	Yes	NMA	NMA	Yes	Yes	NMA	Yes	Moderate
Lin & Hsia (2019)	Yes	Yes	NMA	NMA	Yes	Yes	NMA	No	Low
Sevillano-Monje et al. (2022)	Yes	Yes	NMA	NMA	Yes	Yes	NMA	Yes	Low
Zheng et al. (2021)	Yes	Yes	NMA	NMA	Yes	Yes	NMA	Yes	Low

Note. High = no weaknesses; moderate = one non-critical weakness; low = more than one non-critical weakness; critically low = one or more critical weaknesses.

A 'no' or 'partial yes' response to any of the seven critical items was treated as a critical weakness. A 'no' or 'partial yes' response to any of the nine non-critical items was treated as a non-critical weakness.

Table 4. Analysis of Study Duration and Sampling

Study Citation	Intervention Duration	Sample Size
Capella-Peris et al. (2023)	Not specified	n = 158
Chao et al. (2021)	10 weeks	n = 290
Chiang et al. (2018)	5 weeks	n = 326
Férriz-Valero et al. (2022)	8 weeks	n = 284
Hsia et al. (2019)	12 weeks	n = 173
Hsia & Hwang (2020)	10 weeks	n = 129
Hsia et al. (2021)	18 weeks	n = 125
Lin & Hsia (2019)	11 weeks	n = 80
Sevillano-Monje et al. (2022)	4 weeks	n = 136
Zheng et al. (2021)	14–16 weeks	n = 274

Table 5. Research Designs and Regional Focus

Research category	Number of Studies	Key Methodological Characteristics	Example Studies
Quantitative	8 (80%)	Pretest and posttest measures; intervention and comparison groups; discipline-specific measurement tools.	Chao et al. (2021); Chiang et al. (2018); Férriz-Valero et al. (2022)
Mixed methods	2 (20%)	Combination of quantitative data with qualitative insights.	Sevillano-Monje et al. (2022)
Regional focus	6 studies in Taiwan	A substantial cluster of studies examined flipped learning in Taiwan, particularly in dance education.	Chao et al. (2021); Chiang et al. (2018); Hsia et al. (2019); Hsia & Hwang (2020); Hsia et al. (2021); Lin & Hsia (2019)

Table 6. Geographic Distribution of Studies

Country	Number of Studies	Specific Region (if noted)	Example Studies
Taiwan	6	Not specified	Chao et al. (2021); Chiang et al. (2018); Hsia et al. (2019); Hsia & Hwang (2020); Hsia et al. (2021); Lin & Hsia (2019)
Mainland China	1	Fujian Province	Zheng et al. (2021)
Spain	2	Not specified	Férriz-Valero et al. (2022); Sevillano-Monje et al. (2022)
United States	1	Not specified	Capella-Peris et al. (2023)

Implementation and Teaching Approaches

The synthesis supports the theoretical expectation that pre-class preparation can enable deeper in-class engagement, but it also highlights the central role of teacher readiness. Effective implementation requires pedagogical and technical competence to produce accessible pre-class materials, use learning-management systems, monitor preparation, and facilitate active in-class learning. Studies described the use of instructional videos, the Watch-Summary-Question approach, guided reflection, and other strategies intended to connect preparatory work with higher-order thinking and collaborative practice (Capella-Peris et al., 2023; Hsia et al., 2019; Hsia & Hwang, 2020; Sevillano-Monje et al., 2022).

Implementation also created challenges. Teachers faced additional workload when developing high-quality digital content and assessing learning across pre-class and in-class stages (Férriz-Valero et al., 2022; Zheng et al., 2021). Students varied in their willingness and ability to complete preparatory activities independently, making scaffolding and accountability important (Chao et al., 2021). The studies further suggested that teachers should adapt resources and interaction patterns to learners' digital experience, language, cultural background, and support needs. In diverse classes, synchronous guidance or other blended supports may help students who are less familiar with self-directed online learning (Hsia et al., 2021; Lin & Hsia, 2019).

Overall, effective flipped lessons required more than transferring lectures to digital media. They depended on purposeful instructional design, close alignment between pre-class and in-class tasks, ongoing monitoring of student preparation, and institutional support for teacher development (see Table 7).

Table 7. Teaching Approaches and Instructor Preparedness

Category	Key Findings	Supporting Evidence
Theoretical alignment	Benefits align with constructivist and active-learning theories.	Chiang et al. (2018); Hsia & Hwang (2020)
Teacher preparation and skills	Requires pedagogical and technical skills in digital content creation, learning management system use, and active-learning strategies.	Sevillano-Monje et al. (2022); Hsia & Hwang (2020); Hsia et al. (2019)
Instructional design	Requires alignment between pre-class and in-class activities to promote higher-order thinking and collaboration.	Capella-Peris et al. (2023)
Implementation challenges	Includes high teacher workload, difficulty fostering self-directed learning, and the need to adapt to diverse learner needs and cultural contexts.	Férriz-Valero et al. (2022); Zheng et al. (2021); Chao et al. (2021); Hsia et al. (2021)

Effects on Engagement and Learning Outcomes

Across activities such as dance, volleyball, basketball, and billiards, flipped lessons generally created more class time for practice, feedback, and collaboration. Dance-based interventions that incorporated reflection and creative problem-solving reported improvements in performance, self-efficacy, creative expression, and collaborative learning (Chao et al., 2021; Hsia et al., 2021). In lower-secondary volleyball, flipped instruction was associated with stronger motivation and conceptual understanding, suggesting potential benefits across both cognitive and psychomotor domains (Férriz-Valero et al., 2022).

Some effects varied across student groups and contexts. In mobile-supported 3-on-3 basketball, gender-related differences in performance were reported, although students of both

genders benefited from the interactive design (Chiang et al., 2018). In a digitally supported university dance course, Taiwanese students reported greater satisfaction than international students, suggesting that familiarity with the cultural and technological context may influence students' experiences (Chao et al., 2021). These findings indicate that flipped lessons should be adapted rather than implemented as a uniform model.

The reviewed studies also reported outcomes related to motivation, teamwork, autonomy, reflective thinking, and creativity. Active in-class environments appeared to support intrinsic motivation and self-directed learning when students completed the preparatory work (Férriz-Valero et al., 2022; Zheng et al., 2021). Reflective activities in dance were associated with technical proficiency, critical thinking, and peer interaction (Hsia & Hwang, 2020), while a strategy-based billiards intervention supported planning and reflection (Lin & Hsia, 2019).

Taken together, the findings suggest that flipped lessons can support engagement and learning across several PE activities. However, positive outcomes were not uniform and depended on instructional design, teacher preparation, student readiness, and contextual fit. The short duration and heterogeneity of the studies also limit conclusions about sustained effects and inclusiveness (see Table 8).

Table 8. Effects and Implications of Flipped Lessons

Category	Specific Effects/Findings	Supporting Studies
Performance and engagement	Enhanced performance, self-efficacy, motivation, and conceptual understanding across various sports.	Chao et al. (2021); Hsia et al. (2021); Férriz-Valero et al. (2022); Sevillano-Monje et al. (2022)
Demographic and cultural effects	Gender: Male students outperformed female students in basketball. Culture: Taiwanese students reported higher satisfaction than international students in dance courses.	Chiang et al. (2018); Chao et al. (2021)
Psychosocial and cognitive benefits	Fostered intrinsic motivation, teamwork, creative thinking, critical thinking, and reflective practice.	Férriz-Valero et al. (2022); Zheng et al. (2021); Hsia & Hwang (2020); Lin & Hsia (2019)

Discussion

This review suggests that flipped lessons can support student engagement and learning in PE when pre-class instruction and in-class practice are deliberately connected. Across secondary and tertiary settings, the included studies generally reported improvements in motivation, participation, collaboration, conceptual understanding, self-efficacy, creativity, or skill performance. These patterns are consistent with constructivist and active-learning perspectives: students first develop a foundational understanding independently and then refine it through guided practice, feedback, and peer interaction (Bergmann & Sams, 2023; Férriz-Valero et al., 2022). Nevertheless, the small and heterogeneous evidence base does not justify treating flipped learning as uniformly superior to conventional instruction. Table 9 summarises the studies included in the systematic review.

Implementation conditions appear to be central to effectiveness. Students must be able and willing to engage with pre-class materials, and those with lower self-efficacy or weaker self-regulation may require additional structure, reminders, or support (Hsia & Hwang, 2020; Hsia et al., 2021). Pre-class resources must also be accessible, concise, and clearly connected to the practical work undertaken during class. Teacher competence in digital content design and active facilitation is therefore as important as the technology itself. Because most interventions

were short, the observed improvements in engagement and self-direction cannot yet be interpreted as evidence of lifelong fitness habits.

The review extends previous syntheses by applying a more explicit PE-specific definition of a flipped lesson and by examining the implementation conditions associated with positive and inconsistent findings. Its conclusions broadly accord with the scoping review by Østerlie et al. (2022), which identified potential gains in motivation, conceptual understanding, and skill acquisition. For practice, the evidence favours short and accessible pre-class resources, mechanisms for checking preparation, in-class tasks that require active application, timely feedback, and alternatives for students with limited digital access or self-regulatory skills. Professional development should help PE teachers align these components rather than focus only on producing instructional videos.

Table 9. Summary of Studies Included in the Systematic Review

Author and year	Objectives	Methods	Country	Teaching Approaches	Findings
Capella-Peris et al. (2023)	To analyse the effects of active learning (AL) on social entrepreneurship (SE) among physical education teacher education students (n = 158) from an urban school.	Mixed-methods design	United States	Flipped classroom and active learning	Quantitative analysis indicated that AL benefited SE among physical education teacher education students (PETEs); qualitative analysis also indicated a positive effect on their SE.
Chao et al. (2021)	To explore the effects of different teaching methods on dance-skill performance and satisfaction among Taiwanese and international students in a physical activity course.	Experimental design	Taiwan	Blended learning (BL), flipped learning (FL), and traditional teaching methods in dance	Compared with traditional teaching, BL improved Taiwanese students' dance skills and satisfaction in cognitive development, fun and enjoyment, diversionary experiences, and relaxation. It also improved international students' dance skills.
Chiang et al. (2018)	To reduce gender differences in learning through autonomous flipped learning and a diverse choice of learning channels.	Experimental design	Taiwan	Flipped classroom with an app (FCA), projecting teaching (PT), and traditional teaching (TT) in basketball	The results showed a significant interaction between teaching strategy and student gender in relation to learning performance.
Férriz-Valero et al. (2022)	To assess the effects of a flipped classroom (FC) approach on 284 Spanish secondary PE students' conceptual learning in volleyball and their motivation from a self-determination theory (SDT) perspective.	Natural experiment	Spain	Flipped classroom and traditional methodology in volleyball	Participation in the FC approach had positive effects on student motivation and learning.

Author and year	Objectives	Methods	Country	Teaching Approaches	Findings
Hsia et al. (2019)	To enhance students' performance in dance courses.	Experimental design	Taiwan	Watch-Summary-Question (WSQ)-based flipped learning and a conventional learning approach in dance	The WSQ guiding mechanism significantly improved students' dance skills, indicating that it can facilitate learning and improve performance.
Hsia & Hwang (2020)	To examine the benefits of an annotation, reflection, questioning, and interflow (ARQI)-based flipped learning approach.	Experimental design	Taiwan	ARQI-based teaching approach in dance	The ARQI approach significantly enhanced students' dance performance, and interviews indicated that it promoted reflection.
Hsia et al. (2021)	To develop a creative problem-solving (CPS)-based dance-learning approach that facilitates active learning, provides more opportunities for peer collaboration, and stimulates creativity.	Experimental design	Taiwan	Creative problem-solving (CPS)-based flipped learning in dance	The CPS-based flipped learning approach significantly improved students' choreography creativity, dance skills, and creative-thinking tendencies.
Lin & Hsia (2019)	To propose an annotation, summarising, questioning, and interflow (ASQI) mobile flipped learning approach that strengthens pre-class learning through social interaction and the sharing of experiences and strategies for billiards competition cases.	Experimental design	Taiwan	ASQI mobile flipped learning in billiards	Compared with traditional flipped learning, the ASQI-based flipped classroom helped students with lower initial skill performance catch up with peers who had stronger initial skills.
Sevillano-Monje et al. (2022)	To examine differences in knowledge acquisition among first-year students after using the flipped classroom method, analyse its effect on competence levels, and determine student satisfaction.	Mixed-methods, pre-experimental design	Spain	Holistic flipped classroom methodology	Knowledge acquisition differed significantly after the methodology was applied, with a significant effect on students' competence levels. Students also reported high levels of satisfaction across several areas.
Zheng et al. (2021)	To propose, examine, and discuss a new blended teaching method.	Experimental design	Mainland China (Fujian)	Blended learning through live online broadcasts and WeChat official account notifications	Students in blended learning performed better across the measured outcomes than students in single-mode learning, supporting the practicality and effectiveness of the proposed method.

Limitations

This review has several limitations. Only English-language, peer-reviewed studies published between January 2018 and January 2024 were eligible, and only the first 200 Google Scholar results were screened. The final evidence base comprised 10 studies, most of which were conducted in a small number of geographical settings. Considerable heterogeneity in activities, intervention designs, durations, outcome measures, and participant characteristics prevented meta-analysis and limited generalisability. Most interventions were short, several outcomes relied on self-report, and implementation fidelity was not consistently described. The appraisal framework was also not designed specifically for the full range of primary study designs included, which may have limited the precision of quality judgements. Consequently, evidence concerning long-term learning, transfer beyond the course, and the formation of lifelong fitness habits remains insufficient.

Future Research Directions

Future research should use adequately powered experimental or strong quasi-experimental designs, preregistered protocols, clearly defined flipped components, and measures of implementation fidelity. Longer follow-up periods are needed to determine whether improvements in engagement, knowledge, and skill persist and translate into sustained physical activity. Studies should include more diverse educational systems, age groups, ability levels, and cultural contexts, and should examine equity in access to devices, connectivity, and learning support. Greater consistency in outcome measurement would facilitate meta-analysis. Research should also compare alternative forms of pre-class content, identify the most effective methods for supporting students who do not prepare independently, and evaluate teacher workload, training needs, and cost-effectiveness.

Conclusion

The available evidence suggests that flipped lessons are a promising, but context-dependent, approach to PE. By moving selected instructional content before class, teachers can create additional time for guided practice, feedback, collaboration, and higher-order learning. Reported benefits include stronger engagement, motivation, conceptual understanding, self-efficacy, and skill performance, although findings are based on a small and heterogeneous group of mostly short-term studies. Successful implementation requires accessible pre-class resources, clear alignment with in-class activities, support for student self-regulation, and sustained teacher development. More rigorous and diverse research is needed before firm conclusions can be drawn about long-term effects or lifelong physical activity habits.

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During the preparation of this manuscript, the author(s) used ChatGPT to assist with improving language clarity, grammar, and phrasing. The authors carefully reviewed and revised the output to ensure accuracy and take full responsibility for the content of the final manuscript.

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PRESIDENT'S MESSAGE

Rosa López de D'Amico
International Society for Comparative Physical Education and Sport

It gives me great pleasure to share some of the activities we have been developing this year. In addition to the special issue on Gender that we published early this year in partnership with IAPESGW, the elected ISCPES Board has been undertaking various responsibilities. ISCPES continues its work in three main directions: publication, research and events.

In terms of publication, the journal *International Sport Studies* has continued its regular publication schedule, and interest in publishing in it has increased enormously! Our Co-Editors-in-Chief, Maria Luisa M. Guinto and Richard Peter Bailey, together with the editorial team, have been doing a great job coordinating the workflow and maintaining quality. We appreciate the addition of Walter Ho as Associate Editor to the editorial team.

Our ISCPES Book Series, published by Routledge, is also proud to announce the publication of *Physical Education in India. Tradition, Development, and Contemporary Perspectives*, edited by Usha Nair. The book features nearly 50 contributors, and Usha Nair has done an impressive job coordinating its compilation. We have two more book proposals in progress at this stage!

On March 12th, we celebrated our first 2026 webinar. On International Women's Day, the theme of the webinar was: 'Empowering Women Through Sport: Student Voices on Women's Participation in Sport'. The event was held together with the students from the Master Program in Sport Administration of the Russian International Olympic University (RIOU), who served as speakers. We had speakers from China, Ghana, Guatemala, India, Kazakhstan, Nigeria, Pakistan, Russia, The Gambia, Uganda, Zambia, and Zimbabwe. Thanks to the logistical support from Ms. Iya Macharadze and the technical team from RIOU. In August, we will celebrate our 2nd webinar. For more information, please check our webpage!

In terms of research, the International Study on Quality Physical Education (ISQPE), coordinated by Dr Walter Ho, was launched in July 2026. The purpose of the research project is to develop a benchmark and evaluation tool that can be used internationally to investigate the overall performance and developmental proficiency across four issues in physical education: 1. Inclusion in QPE, 2. Extended Learning in Sport, Exercise and Physical Activities, 3. Classroom Learning, and 4. Use of the Latest Technology in Physical Education. The invitation to participate as a researcher is still open!

Finally, I am pleased to announce that our ISCPES 24th Biennial Conference will take place from 6 to 8 October 2027 in the beautiful city of Monterrey, Mexico. It will be hosted by the Universidad Autónoma de Nuevo León (Autonomous University of Nuevo León) at the Faculty of Sport Organization (FOD). Please include it in your academic agenda for 2027. Further information will be available on our website!

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