Embodied learning in the Society 5.0: Physical literacy as an epistemological framework for contemporary physical education

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Abstract
This article aims to explore the epistemological foundations of physical education within the context of Society 5.0, examining the tension between empirical-experimental approaches and holistic perspectives in understanding embodied learning processes. Drawing on Buyse's pioneering integration of scientific methods into pedagogy, this paper proposes physical literacy as a transdisciplinary framework that bridges theoretical foundations and empirical methodologies in physical education research. Through critical analysis of contemporary research paradigms, the article identifies the convergence of bioecological, phenomenological, and critical realist perspectives that characterize the evolving epistemology of physical education. The analysis reveals how physical literacy offers a comprehensive framework for understanding the multidimensional nature of embodied learning, encompassing cognitive, affective, physical, and environmental domains while addressing the ethical implications of educational research. This integrated approach transcends the traditional dichotomy between qualitative and quantitative methodologies, enabling a more nuanced understanding of physical education that aligns with the complex demands of Society 5.0 while honoring the axiological dimensions of pedagogical science.

Key words: physical literacy; embodied learning; epistemology; physical education; experimental pedagogy; Society 5.0.

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1. Introduction

The 90th anniversary of Raimond Buyse's seminal work "L'expèrimentation en pèdagogie" (1935) invites critical reflection on the relationship between scientific methodologies and pedagogical practice in educational contexts. Buyse's formula

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"tayloriser l'instruction pour valoriser l'éducation" encapsulates his vision of integrating empirical-experimental approaches with educational values. In contemporary educational discourse, the tension between methodological rigor and respect for the complex, axiological dimensions of education remains central to pedagogical epistemology, particularly within the field of physical education and embodied learning. Within the rapidly evolving landscape of Society 5.0, characterized by the seamless integration of digital technologies with human activities, physical education faces unique epistemological challenges. The traditional divide between biomedical, pedagogical, and psychological domains in movement sciences (D'Isanto et al., 2024) has prompted calls for more integrated frameworks that can accommodate the multidimensional nature of physical learning processes. The concept of physical literacy has emerged as a potentially unifying paradigm that encompasses physical competence, motivation, confidence, and embodied understanding (Durden-Myers, 2024).

This article examines how physical literacy offers an epistemological framework that bridges the theoretical-empirical divide in physical education pedagogy, addressing Buyse's challenge of scientific rigor while honoring the distinctive characteristics of educational processes. Through a critical analysis of contemporary research paradigms, methodological approaches, and ethical considerations, this paper aims to articulate how physical literacy can serve as a robust epistemological framework for understanding embodied learning within Society 5.0, thereby reconciling the inherent tension between empirical precision and pedagogical values.

2. Research design and methodological approach

This study adopts a qualitative conceptual synthesis of recent academic literature to interrogate the intersection between pedagogical sciences and exercise epistemology within the broader framework of Society 5.0. In contrast to systematic reviews adhering to protocols such as PRISMA, this approach privileges narrative inquiry and conceptual mapping. Its aim is not to produce an exhaustive or quantitatively reproducible summary, but rather to construct a theoretically coherent and critically reflective epistemological framework through the selective integration of relevant scholarly contributions.

The conceptual synthesis was grounded in purposive sampling across major academic databases, including PubMed, Scopus, Web of Science, SportDiscus, and PsycINFO. A structured combination of search terms – such as *physical literacy, embodied learning, epistemology, physical education, Society 5.0, experimental pedagogy, phenomenology, critical realism, and bioecological*

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perspectives – was used to identify sources relevant to the epistemological foundations of movement and pedagogical sciences.

From an initial corpus of approximately 150 scholarly contributions, a final selection of 22 sources was retained based on conceptual richness, epistemological coherence, and methodological diversity, as detailed in the bibliography. Inclusion criteria encompassed peer-reviewed journal articles, academic monographs, and theoretical frameworks explicitly addressing the epistemological foundations of physical education, embodied cognition, or the deployment of physical literacy within educational and sociotechnical contexts. Methodological pluralism was embraced, including quantitative, qualitative, and mixed-methods designs, to foster a multifaceted understanding of the 'educational fact' in movement sciences. Exclusion criteria eliminated non-peer-reviewed publications, grey literature, and studies lacking a discernible theoretical or epistemological component.

In addition to contemporary literature, seminal historical sources – notably Buyse (1935) – were consulted to ground the analysis historically. Nevertheless, the review primarily focused on work published between 2013 and 2025, thereby privileging current paradigms in pedagogical and movement sciences.

The analytical process followed an iterative and interpretive logic, guided by principles of critical thematic analysis. It focused on identifying recurring theoretical orientations (e.g., bioecological systems theory, phenomenology of the lived body, and critical realism), methodological innovations (e.g., game-based assessments, design-based research), and ethical dimensions linked to inclusion, digital equity, and the axiological imperatives of physical education. This inductive process culminated in the construction of an integrative epistemological framework, reconciling empirical rigour with normative and axiological sensitivity.

The resulting thematic synthesis informs the structure and arguments of Sections 3, 4, and 5 of the present study.

3. Theoretical foundations: The evolving epistemology of physical education

3.1 The epistemological challenge in movement sciences

The epistemological landscape of physical education has historically been characterised by disciplinary fragmentation. D'Isanto et al. (2024) highlight the identity challenges within Movement, Exercise, and Sport Sciences (MEaSS), noting the concurrent operation of academic scientific disciplines across biomedical and pedagogical domains. Their analysis of Italian full professors' scientific production revealed a significant predominance of biomedical research (58.5% in M-EDF/01 and 47.5% in M-EDF/02), with pedagogical contributions constituting only 6.9% and 18.1% respectively. This imbalance reflects a broader epistemological challenge: the difficulty of establishing a

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unified scientific identity for physical education that integrates physiological, psychological, and pedagogical dimensions.

Barker et al. (2025) argue that this fragmentation has contributed to perceptions of stagnation in physical education research, with scholars investigating the same topics, presenting the same solutions, and at times failing to build on – or in some cases, even acknowledge – existing scientific findings. Their Bernsteinian analysis suggests that physical education possesses a horizontal knowledge structure that influences how knowledge is developed and legitimised within the field. This horizontal structure, characterised by specialised languages that exist in parallel rather than hierarchically, explains the modest nature of contributions, the repetitive character of research, and the challenges in knowledge accumulation.

3.2 Physical literacy as an integrative framework

Amidst this fragmented landscape, physical literacy has emerged as a potentially unifying epistemological framework. Defined as "the motivation, confidence, physical competence, knowledge, and understanding to value and take responsibility for engagement in physical activities for life" (Pushkarenko et al., 2024), this concept integrates physical, cognitive, and affective domains within a holistic understanding of embodied learning. Embodied learning, distinct from purely cognitive or physical skill acquisition, refers to the holistic process where knowledge and understanding are acquired through direct physical experience and interaction with the environment, deeply integrating sensory, motor, affective, and cognitive processes. It acknowledges that the body is not merely a vessel for the mind but an active agent in meaning-making and knowing, underpinning the situated and interactive nature of learning in physical contexts.

The epistemological value of physical literacy lies in its capacity to transcend disciplinary boundaries. Grauduszus et al. (2024) identified that interventions addressing all three domains of physical literacy (physical, cognitive, and affective) demonstrated more consistent positive effects on physical competence and enjoyment than those focusing solely on physical skills. This finding supports the epistemological premise that embodied learning requires an integrated approach that recognises the interconnectedness of physical competence, cognitive understanding, and affective engagement.

Further supporting this integrative perspective, Ravn (2022) argues that the development of embodied learning through physical activity encompasses both skill acquisition and "attunement to interaction" (p. 1). This concept signifies a dynamic, reciprocal process where individuals adapt their movements and perceptions in response to environmental cues and social interactions, moving beyond mere technical skill to a deeper, context-sensitive engagement with their physical and social surroundings. Drawing on phenomenological

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descriptions of embodiment processes, Ravn contends that despite differences in the inherent logic of various physical activities, a phenomenologically-based understanding of skills constructively helps describe the development acquired through practice. Drawing on phenomenological methods, Ravn examines lived bodily experiences, showing how qualitative descriptions of physical engagement reveal the experiential dimensions of skill development. This approach goes beyond observable performance, delving into the subjective feeling of movement, the perceptual shifts, and the evolving relationship between the body and its environment during practice. Phenomenology, in this context, helps to articulate the 'how' of embodied knowing, rather than just the 'what' or 'whether' of skill acquisition. This theoretical foundation aligns with the physical literacy paradigm's emphasis on the interrelationship between physical competence and environmental interaction.

4. Methodological considerations: Bridging theory and empirics

4.1 The challenge of appropriate methodologies

One of the central challenges in physical education research, echoing Buyse's concerns about experimental pedagogy, lies in identifying methodological approaches that respect both scientific rigour and the distinctive nature of educational phenomena. Zhang et al. (2025) highlight the limitations of traditional skill assessment methods that focus on isolated techniques, arguing for the adoption of game-based assessment tools that capture the complex interplay of perceptual-cognitive and motor skills in authentic contexts. Their systematic review identified 16 tools for assessing ball sport skills performance based on game scenarios, categorised according to comprehensiveness, sport phase, and skill type.

The methodological significance of these game-based assessment tools lies in their capacity to evaluate students' technical and tactical performance in real game scenarios, reflecting their sports decision-making and awareness of thinking (Zhang et al., 2025). This approach represents a shift from reductionist methodologies that isolate physical skills from their cognitive and social contexts toward more ecological approaches that recognise the situated nature of embodied learning.

This methodological evolution resonates with de Souza et al.'s (2025) action research on physical education curriculum systematisation in Brazilian schools. Their qualitative itinerary involved class observations, group meetings, and field diary analysis within a collaborative network of teacher-researchers. They found that curricular documents often prioritise cultural elements at the expense of intersubjective knowledge related to the body, movement and the environment. This finding underscores the need for methodological approaches

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that can capture the complex interrelationships between cultural, physical, and environmental dimensions of embodied learning.

4.2 Integrating quantitative and qualitative approaches

The tension between quantitative and qualitative methodologies in physical education research reflects the broader epistemological challenges identified in Buyse's work. Grecic et al. (2024) propose an "Epistemic Judgement Framework" to enhance physical education teachers' professional development, integrating epistemological considerations with bioecological and critical realist perspectives. This framework acknowledges the importance of understanding teacher beliefs and behaviours while recognising the complex environmental factors that influence teaching practices.

The methodological implications of this framework suggest that neither purely quantitative nor purely qualitative approaches can adequately capture the multidimensional nature of physical education. Instead, mixed-methods designs that integrate measurements of physical competence with qualitative explorations of meaning-making processes may provide more comprehensive insights into embodied learning. As Pushkarenko et al. (2023) demonstrate in their study of physical literacy among individuals experiencing disability, composite narratives derived from focus groups can complement quantitative assessments, providing an authentic understanding of physical literacy within the context of disability.

This methodological integration aligns with the epistemological foundations of physical literacy, which recognises the interdependence of measurable physical skills and subjective experiences of motivation, confidence, and understanding. By combining rigorous assessment of physical competence with interpretive explorations of lived experience, researchers can develop more nuanced understandings of embodied learning that respect both scientific standards and the distinctive nature of educational phenomena.

5. Ethical dimensions: Respecting the axiological nature of education

5.1 Inclusion and diversity in physical education research

The axiological dimensions of physical education research are particularly evident in studies addressing inclusion and diversity. Pushkarenko et al. (2024) emphasise the ethical limitations of applying physical literacy through a lens of normativity and standardisation by those who do not experience disability. Their multiple case study of physical literacy within the context of disability and impairment identified three overarching themes – environmental considerations, operating with intention, and ethical and informed practice –

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that together foster opportunities for physical literacy development across age and ability spectrums.

This ethical perspective aligns with Wang's (2025) phenomenological analysis of bodily movements in digital environments, which argues that the projected and flattened videogaming situation constrains bodily movements and future movement possibilities. Drawing on Merleau-Ponty's concept of embodiment, Wang contends that humans are primordially situated body subjects taking up the world in and through movement. This phenomenological perspective highlights the ethical importance of recognising diverse embodied experiences and the potential limitations of standardised approaches to physical education.

The ethical implications of these studies suggest that physical education research must move beyond normative conceptions of physical competence to embrace diverse embodied experiences. Ackermann et al. (2025) found that while the physical presence of AI tutor agents increased initial on-task enjoyment among students, certain anthropomorphic characteristics hindered learning. This finding underscores the ethical complexity of technological interventions in embodied learning, suggesting that respect for diverse learning preferences and experiences must guide research and practice in physical education.

5.2 Balancing rigour and respect in educational research

The tension between methodological rigour and respect for individual dignity echoes Buyse's challenge of "tayloriser l'instruction pour valoriser l'éducation." Liu et al. (2024) propose a "Retroverse" concept that integrates physical fitness with embodied learning in virtual environments, aiming to stimulate people's memory through physical fitness activities. This innovative approach exemplifies the potential of combining scientific precision with educational values, creating immersive learning experiences that engage both physical and cognitive dimensions.

The ethical balance between rigour and respect is further explored in Pushkarenko et al.'s (2023) study of the value individuals experiencing disability attribute to physical literacy. Their thematic analysis revealed three key themes: "imagine the possibilities," "dance like nobody's watching," and "no wrong way to move." These themes reflect the ethical imperative to recognise the intrinsic value of diverse movement experiences rather than imposing standardised expectations based on normative assumptions.

This ethical perspective suggests that physical education research must balance methodological rigour with respect for the axiological nature of educational processes. As Durden-Myers (2024) argues, physical literacy offers an attractive concept to help reframe and address physical inactivity and poor health and wellbeing, utilising a different and integrated approach to physical

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activity, health and wellbeing promotion. This integrated approach acknowledges the ethical importance of respecting individual agency and diverse embodied experiences while maintaining scientific standards in research and practice.

6. Discussion: Physical Literacy in Society 5.0 – An integrated epistemological synthesis

This section synthesises the theoretical, methodological, and ethical considerations presented in the preceding sections, arguing that the concept of physical literacy offers a robust, integrated epistemological framework for contemporary physical education within the evolving landscape of Society 5.0. By bridging historically fragmented domains, physical literacy provides a comprehensive lens through which to understand and address the complexities of embodied learning.

6.1 Convergence of bioecological, phenomenological, and critical realist perspectives

Building upon the critical analysis of the literature presented in Section 3, this discussion synthesises how physical literacy emerges as a robust epistemological framework for contemporary physical education. The preceding sections illuminated the disciplinary fragmentation within movement sciences, the integrative potential of physical literacy, the evolving methodological landscape, and the critical ethical considerations inherent in physical education research. This comprehensive review reveals that the concept of physical literacy, as explored throughout this paper, represents a significant convergence of bioecological, phenomenological, and critical realist perspectives. This convergence is not merely an aggregation of viewpoints; rather, it offers a profoundly more integrated epistemology for physical education in Society 5.0, directly addressing the tension between empirical precision and pedagogical values.

This integrated epistemological perspective, informed by the varied insights gleaned from our review, significantly enriches the understanding of physical education's role within Society 5.0. For instance, bioecological approaches, as evident in Grecic et al.'s (2024) Epistemic Judgement Framework, recognise the complex and dynamic interactions between individual development and environmental systems – a cornerstone for understanding how physical activity is fostered or hindered. This echoes the challenges identified in Section 3.1. regarding the difficulty of establishing a unified scientific identity, demonstrating how a bioecological lens offers a necessary breadth.

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Phenomenological perspectives, exemplified by Ravn's (2022) analysis of embodied learning processes (as introduced in Section 3.2), illuminate the subjective dimensions of physical experience and skill acquisition. Ravn's work, through detailed descriptions of lived movement experiences, demonstrates *why* subjective dimensions and skill acquisition are intertwined. Phenomena such as 'attunement' reveal the deep subjective engagement and meaning-making inherent in physical activity, moving beyond mere mechanistic views of skill and highlighting the individual's lived experience as central to learning. This emphasis on lived experience provides a vital counterpoint to purely quantitative assessments, enriching the understanding of what it means to be physically literate.

Critical realist viewpoints, reflected in Barker et al.'s (2025) Bernsteinian analysis of knowledge structures (discussed in Section 3.1), acknowledge the social construction of knowledge. This perspective emphasizes that embodied learning is not merely an individual cognitive or motor process but is deeply intertwined with social interaction. The body, as the primary medium through which individuals engage with and interpret their world, plays a crucial role in shaping shared understandings and collective practices within a given social context, thereby contributing directly to the social construction of knowledge about movement and health. Critical realism further demands recognition of underlying material realities and power structures that influence access to and engagement in physical education.

This epistemological convergence, drawing upon the insights from Sections 3, 4, and 5, offers a more comprehensive framework for understanding embodied learning in Society 5.0, characterised by the increasing integration of virtual and physical environments (Liu et al., 2024). As digital technologies increasingly permeate educational contexts, physical literacy provides a conceptual foundation for understanding how embodied learning occurs across physical and virtual spaces. Wang's (2025) phenomenological analysis of video game experiences highlights the constraints of virtual environments on bodily movements, suggesting the need for critical engagement with digital technologies in physical education. This includes acknowledging potential pitfalls such as the risk of increased sedentary behaviour if screen time replaces active movement, the perpetuation of normative body ideals in virtual spaces, or the exacerbation of digital divides if access and design are not equitably managed for all populations.

6.2 Physical literacy as a catalyst for interdisciplinary collaboration and global health in society 5.0

The emergence of physical literacy as an epistemological framework not only bridges the theoretical-empirical divide within physical education, as demonstrated by the methodological insights in Section 4, but also positions it

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as a catalyst for interdisciplinary collaboration in Society 5.0, where technological advancements and human-centred solutions converge to address global challenges. This framework's integrative nature – spanning physical, cognitive, and affective domains – offers a unique opportunity to unite diverse fields such as public health, urban planning, and digital technology design, fostering a shared language and methodology for tackling issues like physical inactivity and health disparities. For instance, Whitehead (2019) emphasises that physical literacy is not merely a pedagogical construct but a lifelong journey that equips individuals with the tools to navigate increasingly sedentary environments shaped by digitalization – a hallmark of Society 5.0.

This perspective is reinforced by Cairney et al. (2019), who demonstrate through longitudinal studies that physical literacy correlates strongly with improved physical activity levels, mental well-being, and social connectedness across age groups, suggesting its potential as a public health intervention. In this context, interdisciplinary efforts could leverage physical literacy to inform urban design that promotes movement, such as walkable cities or smart playgrounds, aligning with Society 5.0's vision of harmonising technology with human needs. Recent research by Zhang et al. (2024) highlights how physical literacy interventions, when paired with wearable technology, enhance engagement in physical activity among adolescents, illustrating a practical synergy between pedagogy and digital innovation. Moreover, the framework's emphasis on inclusion and diversity – evident in the ethical considerations discussed in Section 5 – underscores its adaptability to varied cultural and ability contexts and addresses ethical imperatives in global health equity.

Edwards et al. (2017) argue that physical literacy's phenomenological roots enable it to transcend standardised metrics, offering a flexible approach that respects individual embodiment while meeting scientific demands for measurable outcomes. This adaptability is critical in Society 5.0, where personalised education and health interventions, supported by artificial intelligence and big data, are becoming the norm. For example, a study by Pushkarenko et al. (2023) explores how physical literacy programmes in low-income communities, integrated with community-based participatory research, empower participants to co-create movement opportunities, bridging local knowledge with empirical rigour. This aligns with Buyse's vision of balancing scientific precision with educational values, as it respects the axiological dimensions of human experience while advancing evidence-based practice. Furthermore, the convergence of bioecological and critical realist perspectives within physical literacy facilitates a systems-level understanding of how environmental, social, and technological factors interplay in shaping embodied learning. Bronfenbrenner's bioecological model (Rosa & Tudge, 2013), when applied to physical literacy, underscores the nested influences – family, school,

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community, and digital ecosystems – that must be considered in designing effective interventions. Simultaneously, critical realism, as articulated by Bhaskar (2016), provides a lens to examine the underlying mechanisms (e.g., motivation, access to resources) that drive physical activity behaviours, ensuring that research moves beyond surface-level observations to address root causes. This interdisciplinary potential is exemplified in initiatives like the UNESCO Quality Physical Education framework (McLennan & Thompson, 2015), which advocates for physical literacy as a cornerstone of education policy, linking it to sustainable development goals such as health, gender equality, and inclusive societies.

In practice, this could translate to collaborative projects where physical educators, data scientists, and policymakers co-develop AI-driven platforms that personalise physical literacy experiences – think adaptive fitness apps that respond to users' emotional and physical states – while ensuring accessibility across socioeconomic divides. Such efforts resonate with the article's call for mixed-methods approaches (Section 4.2), as they combine quantitative data from technology with qualitative insights into lived experiences, honouring the complexity of embodied learning. Ethically, this interdisciplinary application of physical literacy demands vigilance to avoid reinforcing digital divides or marginalising non-tech-savvy populations, a concern raised by Lupton (2016) in her critique of digital health technologies. By integrating these diverse perspectives, physical literacy not only enriches physical education pedagogy but also amplifies its societal impact, offering a robust epistemological foundation for addressing the multifaceted demands of Society 5.0 while upholding Buyse's legacy of uniting science and human values.

7. Implications for research, practice, and future directions

The integrated epistemological perspective offered by physical literacy, grounded in bioecological, phenomenological, and critical realist insights, has profound implications for the future of research and practice in physical education. However, fully embracing this paradigm necessitates a critical examination of the practical shifts it demands, the challenges it presents, and the collaborative strategies required for successful implementation in real-world contexts.

7.1. Research implications: Towards integrated and ecological methodologies

First, this perspective necessitates a shift towards more ecologically valid and context-sensitive research methodologies. As highlighted in Sections 3 and 4, the call for mixed-methods designs, combining rigorous quantitative assessment with rich qualitative explorations of lived experience, is paramount. This demands interdisciplinary teams capable of bridging the gaps between

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exercise science, educational psychology, sociology, and ethics. Future research should prioritise longitudinal studies to track the developmental trajectories of physical literacy across the lifespan, particularly within diverse cultural and technological contexts. Furthermore, methodologies such as participatory action research and autoethnography are essential to capture the nuanced, lived experiences of embodied learning, complementing quantitative outcome measures and fostering co-construction of knowledge with participants. This approach is vital to uncover the underlying mechanisms and contextual factors influencing physical activity behaviours.

7.2. Practical implications for physical education pedagogy

The adoption of physical literacy as a guiding paradigm fundamentally reshapes pedagogical practice. It shifts the focus from isolated skill drills to holistic, context-rich learning environments that foster motivation, confidence, and understanding alongside physical competence. Teachers will require specialised professional development opportunities that extend beyond biomechanics, encompassing phenomenological approaches to movement, critical realist perspectives on systemic barriers to physical activity, and bioecological insights into individual development within their environments. Implementing this shift in pedagogical practice is not without its challenges. It requires a fundamental re-evaluation of curricula, moving away from prescriptive skill acquisition models towards more learner-centred, context-rich experiences. Teachers may face resistance from traditional assessment methods or lack the necessary training and resources to facilitate truly embodied learning environments. This paradigm also calls for new alliances between physical education departments, school administrators, and community organisations to create supportive ecosystems for physical literacy development beyond the gymnasium. Furthermore, it implies a need for new pedagogical tools and technologies that ethically support, rather than replace, genuine embodied experience, ensuring digital solutions enhance rather than hinder diverse movement pathways This might involve training in designing truly inclusive activities that cater to diverse abilities, integrating digital tools ethically and effectively, and promoting intrinsic motivation over extrinsic rewards. Curriculum design would ideally move towards more embodied, problem-based learning scenarios that encourage critical thinking, self-directed physical activity, and a lifelong appreciation for movement. The challenge lies in equipping educators with the philosophical understanding and practical skills to navigate this complex, multi-dimensional space.

7.3. Broader societal implications and strategic alliances

Beyond the classroom, the physical literacy framework calls for strategic

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alliances to address global health challenges in Society 5.0. This includes collaboration with urban planners to design movement-friendly cities, technology developers to create ethical and engaging digital platforms that support embodied learning, public health authorities to implement population-level interventions informed by a holistic understanding of physical literacy, and policymakers to integrate physical literacy into national education and health strategies. Such cross-sectoral collaborations are vital for creating supportive ecosystems that enable lifelong physical activity and well-being, leveraging technology as an enabler rather than a substitute for genuine embodied experience. The goal is to foster a society where physical literacy is a foundational capability, promoting equity and health across all demographics.

7.4. Limitations of the present review

While this essay provides a comprehensive synthesis of the epistemological intersections between pedagogical science and exercise epistemology, it is not without limitations. The reliance on qualitative synthesis and purposive selection of literature may introduce subjective bias in the choice of sources, potentially overlooking divergent perspectives or underrepresented empirical studies. Additionally, the broad interdisciplinary scope, while a strength, limits the in-depth analysis within any single disciplinary lens, such as highly specific quantitative evaluations of intervention efficacy. The focus on theoretical integration also restricts the inclusion of primary empirical data or practical case studies, which could further validate the proposed framework. These limitations suggest opportunities for future research to complement this work with targeted empirical investigations and broader systematic reviews that can rigorously test hypotheses derived from this conceptual synthesis.

Conclusion

Ninety years after Buyse's pioneering integration of scientific methods into pedagogy, the field of physical education continues to navigate the tension between empirical-experimental approaches and holistic understandings of educational processes. The concept of physical literacy offers an epistemological framework that transcends this dichotomy, integrating physical, cognitive, and affective dimensions within a comprehensive understanding of embodied learning.

This integrated perspective aligns with the complex demands of Society 5.0, characterised by the seamless integration of digital technologies with human activities. As virtual and physical environments increasingly converge, physical education must adopt epistemological frameworks that can accommodate diverse learning experiences across multiple domains. Physical literacy

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provides such a framework, recognising the interdependence of physical competence, cognitive understanding, and affective engagement.

The methodological implications of this perspective suggest the need for mixed-methods approaches that combine rigorous assessment of physical skills with interpretive explorations of meaning-making processes. This methodological integration honours both the scientific standards emphasised by Buyse and the distinctive nature of educational phenomena that resist reductionist analysis.

The ethical dimensions of this perspective highlight the importance of inclusive approaches that recognise and value diverse embodied experiences. By moving beyond normative conceptions of physical competence, physical education research and practice can embrace the axiological nature of educational processes while maintaining scientific rigour.

As physical education pedagogy continues to evolve within the emerging framework of Society 5.0, maintaining this epistemological sophistication will be essential for addressing the complex challenges facing movement education in contemporary contexts. By embracing methodological pluralism, transdisciplinary collaboration, and axiological sensitivity, researchers can develop approaches to investigating the educational phenomenon that respect both the scientific rigour of pedagogical inquiry and the fundamental dignity of the individuals who are its subjects.

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