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Artificial Intelligence and the Future of Physical Education Curriculum Design in India

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Abstract

The integration of Artificial Intelligence (AI) into physical education (PE) curriculum design presents a transformative opportunity for the Indian school education system. This paper examines how AI-enabled approaches can address long-standing challenges in PE, including limited personalization, inconsistent assessment, low student engagement, and inequitable access to quality instruction. Drawing on contemporary pedagogical theories and national policy priorities, particularly the National Education Policy 2020, the study conceptualizes an India-centric framework for AI-supported PE curriculum reform. AI applications such as adaptive learning systems, movement analysis, health and safety analytics, and assistive technologies are explored for their potential to enhance skill acquisition, monitor student well-being, and support inclusive participation across diverse learner populations. The paper also highlights the relevance of integrating indigenous sports and culturally responsive practices to ensure contextual alignment. Critical considerations related to infrastructure readiness, teacher capacity building, data ethics, and governance are discussed to ensure responsible and sustainable implementation. By positioning AI as a supportive tool rather than a replacement for teachers, the study emphasizes a balanced techno-pedagogical approach that strengthens human interaction in PE. Overall, the paper argues that thoughtfully designed AI integration can significantly improve the quality, equity, and long-term impact of physical education in India, fostering lifelong engagement in physical activity and holistic student development.

Keywords: Artificial Intelligence; Physical Education; Curriculum Design; Adaptive Learning; Inclusive Education; National Education Policy; Student Wellbeing

1. Introduction

Artificial Intelligence (AI) and its various uses for the betterment of student learning are progressively being adopted in educational institutions across India. Among the various uses of AI, the integration of Artificial Intelligence within the Physical Education curriculum is a highly complex process that aims to draw an integrated curriculum framework for Physical Education and Sports which can help students make lifelong Physical Activity a habit and enhance student participation and performance in sports and games. Moreover, the integration of AI enables personalization of content, adaptive learning, tracking of health and safety aspects while using technology, enhancing teaching, learning, and a combination of various aspects within Physical Education Pedagogy and Teaching. The Physical Education curriculum framework for the Indian school system focuses on the improvement of overall student wellbeing and supporting the government policies and NEP goals is the need of the time.

The existing situation of Physical Education and Sports in India is alarmingly, and the potential of using Adaptive Learning Technologies in Physical Education Curriculums is not extensively researched. Henceforth, the objective of this paper is to present how it is possible to integrate AI into Physical Education and other diverse applications that strengthens Indian physical Education Pedagogy and improves organisation and implementation of physical education classes across the nation. The guidance of this process in the Indian Physical Education scenario is very rare and this paper provides a great insight into the AI enabled potential of Physical Education which was never conceptualised and saw the light of day (Liu & Bu, 2021).

2. Theoretical Foundations and Context

In the context of growing interest in artificial intelligence (AI) integration into education, an evidence-based, ecological, techno-pedagogical perspective on AI-enabled physical education (PE) curriculum reform is outlined for India. The proposed curriculum addresses the urgent need to enhance the quality and accessibility of PE, and to promote lifelong engagement in physical activities for all learners, especially significant in light of rising health risks, academic behaviour issues, and a decline in physical activities after school (Liu & Bu, 2021). India's existing PE pedagogy, curricula, assessment, and the role of teachers are described, along with the current use of digital technology.

AI is defined, and applications relevant to PE identified—covering personalization, analytics, and assistive technologies. Foundational theories and models for integrating AI and education are also specified. Priority is given to India's PE curriculum, pedagogy, policy environment, and the limited integration of technology. In the absence of a universally endorsed definition of AI, it is identified as a branch of computer science that addresses the recreation of human intelligence by machines and computer systems, enabling learning, reasoning, identifying patterns, and drawing inferences. The “four pillars” of AI in education are: personalization, automatization, analytics, and assistive technology. The content focuses on personalization and analytics because interest has grown rapidly in AI applications that provide personalized education and continuous assessment through analytics systems.

2.1. The Role of Artificial Intelligence in Education

Artificial intelligence (AI) means computer systems that simulate human cognitive processes like learning or problem solving. In physical education (PE), AI customizes instruction, tracks progress, and supports disabled students through adaptive learning, performance analytics, and assistive technologies (Liu & Bu, 2021). Personalization goes beyond individualized learning to adapt content based on prior achievement (Aliabadi et al., 2023). Student–teacher interaction remains central, augmented with technology.

Physical education facilitates lifelong participation in physical activity. AI in India's curriculum promotes equity and quality, vital for sustaining engagement beyond school. These goals align with the National Education Policy 2020, which advocates measuring quality through direct and indirect indicators rather than inputs or infrastructure.

India's approach emphasises fitness, fundamental movement, games, sports, play, dance, and health, forming the subject's core. The pedagogy promotes physical coordination, teamwork, empathy, self-management, and social interaction within games and sports. PE educators advise

activity selection based on concept familiarity and progression, adopting frameworks like Gagne's hierarchies of learning or Anderson and Krathwohl's version of Bloom's taxonomy. Increasing participation and addressing student apathy are priority challenges, compounded by inconsistent teacher training and diverse abilities, interests, and aspirations.

2.2. Physical Education Pedagogy in India: Current Landscape

Currently, there is a stark need for improving physical education in India; despite its importance, PE is often viewed as an ancillary subject and is delivered poorly. Moreover, PE pedagogy remains largely theoretical and teacher-centric (Liu & Bu, 2021). Educational policies and curricular frameworks recommend technology integration in PE across school stages. The National Policy on Education (2020) emphasizes the effective use of technology to improve teaching and learning processes. All these factors underscore the necessity for integrating AI into the PE curriculum. Since technology is already being used in health and fitness apps, mobile phones, smart watches, and computers, considering the integration of AI into the PE curriculum is crucial. Through AI, PE can be made more accessible, enjoyable, safe, and equitable. It can empower learners to pursue lifelong physical activities as per their preferences and the availability of Indian sports, games, and modalities. AI-equipped technologies can facilitate continuous learning, self-regulated Physical activities, and health monitoring. The proposed integration of AI in PE curriculum is expected to establish an usher India phase of PE access using AI-enabled and adaptable techno pedagogical tools.

3. Objectives and Rationale for AI-Enhanced PE Curriculum

Emerging research highlights artificial intelligence (AI) as a promising approach for enhancing India's physical education (PE) curriculum (Liu & Bu, 2021); the present study seeks to contribute to this body of literature. The overarching objective is to explore the introduction of an AI-enabled PE curriculum, taking the National Curricular Framework for School Education (NCFSE, 2019) as a reference point. Several specific aims further clarify the focus of the investigation:

- (1) Identify the core components of an AI-enabled PE curriculum, specifying the role and mode of operation of each component;
- (2) Suggest context-specific design principles that inform the introduction of AI-enabled PE, considering the infrastructural, cultural, and ethical challenges relevant to the Indian educational environment.

The introduction of AI-enhanced PE is expected to boost fundamental movement skills, promote lifelong engagement in physical activity, and widen access to quality PE and sport across diverse populations. To this end, the following research questions guide the inquiry:

- (1) What AI-enabled components could be integrated into India's PE curriculum, and how would each operate?
- (2) What design principles would help shape AI-enabled PE within the Indian context?

National education policies underscore the importance of PE as a vehicle for talent detection, health awareness, and social equity. Targeting these objectives may reduce childhood obesity, diabetes, and other health-related issues, thereby improving overall physical and mental well-being. AI has emerged as a global priority across numerous sectors and disciplines; yet,

despite extensive integration into diverse areas of education, the role of AI in enhancing PE curriculum design remains underexplored.

The rationale for an AI-enabled PE curriculum can be situated within the broader policy context of India. Government directives highlight the urgency of improving access to quality education, particular for marginalized groups, and call for the adoption of innovative technology solutions to facilitate this process.

4. Core AI-Enabled Components for PE Curriculum

The teaching of physical education (PE) aims at helping students to acquire different sports skills and competence. The skill acquisition process consists of three learning phases: cognitive, associative and autonomous (Iyer & Debang, 2023). Achieving the autonomous stage is especially important since at this stage, all learners are equipped with the ability to be skilled. Currently, PE teachers around the world face difficulties in helping students to go beyond the associative stage. Individualizing instruction through adaptive learning and personalized learning is considered one of the solutions to facilitate learners' progression into the autonomous stage.

Adaptive learning adjusts according to learners' individual skill levels and provides different individualized content. Personalised learning selects the content according to learners' preference and support different presentation formats, enabling varied ways for students to learn. Both concepts will help PE teachers to implement differentiated instruction in heterogeneous classrooms by providing different content to meet individual learners' needs during the learning process. An adaptive learning and personalisation system was developed to assist PE teachers in implementing differentiated instructional practices in skill acquisition. It collects data regarding learners' existing skills and makes decisions based on the collected information.

4.1. Movement Analysis and Performance Feedback

AI-enabled movement analysis and performance feedback tools can transform physical education classes by monitoring students' movements and providing real-time performance feedback to teachers and students (Liu & Bu, 2021). These tools employ cameras, depth sensors, and wearable devices to analyze student movements during specified activities or skills. A system may indicate whether a student is exhibiting the required movements and highlight the aspects that still need to be adjusted. Alternatively, the system may only track student movements and provides feedback on performance and adjustment suggestions, leaving evaluation of movement conformity to human teachers. Cadence of feedback delivery whether continuous, periodic, or final affects the student learning experience, and analysis reports may be provided for just one athlete or an entire class to determine health and safety factors.

4.2. Health Monitoring and Safety Analytics

Health education is a vital part of the process of improving the overall health and wellbeing of school-age children. The spread of unhealthy lifestyles and diseases that have been linked to those lifestyles require children to adopt a healthy lifestyle at an early age, thereby directly reducing the possibility of obesity and related health problems later on in life. Studies show that the best ways to raise awareness among school-age children and make them adopt a

healthy lifestyle is the inclusion of specific topics related to health in their day-to-day classes for example in physical education classes (Deng et al., 2022). Other methods of communicating health-related information to students include: engaging psychological tests and health consultation to enhance children's health awareness; holding parent-child health report card competitions to emphasize parental guidance on school-age children's health awareness; conducting formal health education programmes and planning health education lectures, movies, and drama competitions all seem to work (Liu & Bu, 2021).

4.3. Inclusion and Accessibility through Assistive Technologies

Assistive technologies can contribute to inclusion and accessibility in PE for all learners. Assistive technologies (ATs) are products, equipment, or systems designed to maintain, or improve the functional capabilities of individuals with disabilities. In PE, AT covers a range of technologies that accommodate skilful and non-skilful participants. For instance, it facilitates activities previously excluded and has been found advantageous for many learning environments (Renuga Devi & Sarkar, 2019). Activities can be adapted for language, cognition, hearing, vision, and mobility restricted learners using a wide range of simple non-electronic developments.

Universal design technology integrates principles that make physical education equally effective, understandable and appealing to learners of all ages and cognitive, sensory or physical ability (Heller, 2011). For PE, AT-compatible materials and games can greatly enhance skills of purchasing a game and permits application at the professional level. Textual manuals developed and supported in regional languages.

Assessment and content can easily be customized for all relevant PE materials to suit differentiated needs of students (Liu & Bu, 2021). PE activities and games can be selected, so learning progression can be extended from fun to modify at non-technical and routine level to enrichment at upper technical and skill sheet clearly indicates stage at which video should be shown in the immediate.

5. Design Principles for India-Centric AI-Integrated PE Curriculum

Artificial intelligence (AI) provides significant opportunities for enhancing pedagogical quality, equity, safety, motivation, and enjoyment in physical education (PE) across various curricular themes. Generating the fundamental components of an AI-integrated PE curriculum tailored to the Indian context constitutes an urgent priority for research, scholarship, and practice.

Empirical data underpin the motivation for and anticipated benefits of AI-supported reform of PE curricula in India. With the country facing an exponential burden of lifestyle-related health challenges, one of the highest global incidences of school-age obesity, and an alarming increase in sedentary behaviour during the early years of the COVID-19 pandemic, there is a critical need for engaging initiatives that foster lifelong physical activity engagement (Liu & Bu, 2021).

Nevertheless, the introduction of AI-enabled PE solutions in India must heed the specific constraints and requirements of the nation's educational, social, cultural, political, and economic contexts. Considerations such as equity of access, long-term pedagogy alignment, and adherence to national policy frameworks, combined with the prioritisation of regional and vernacular relevance, are paramount to achieving both governmental and societal buy-in.

5.1. Equity, Access, and Infrastructure Considerations

Equity, access, and infrastructure considerations are crucial for AI-enhanced physical education (PE) in India. Widespread inequalities, both across geographical regions and among diverse socio-economic groups, hinder equitable opportunities for quality PE curriculum and instructional delivery. In 2020–21, 25% of schools lacked electricity, and 11% did not have a usable health and nutrition room. The teacher workforce also faces major challenges, marked by serious shortages approximately one third of government school teachers were absent on any given day and widespread concerns regarding subject-matter expertise and qualifications in PE and sports.

India's digital divide further limits access to technology-aided PE resources, and especially detrimentally affects vulnerable populations. Although 92% of secondary school students had access to mobile phones in 2020, internet availability for rural households was only 33% compared to 86% for urban households. Major connectivity gaps exist at different levels: only 9% of rural Council schools received Digital Infrastructure for Knowledge Sharing (DIKSHA) content in 2020; in 2021, the percentage of students enrolled in public schools who received State Council of Educational Research and Training (SCERT)-developed digital learning resources was 23% in rural and 34% in urban areas; and the percentage of students having access to any educational content on a computing device was merely 5.4% (Liu & Bu, 2021). Further innovations are needed to bolster infrastructure support, especially for students attending multi-grade/multi-level (MGM) settings, and to facilitate new forms of learning centered around individual, pair, and group projects (Sambasivan et al., 2021).

5.2. Cultural Relevance and Indian Sports Ecosystem

Traditional Indian sports—including kho-kho, kabaddi, malakhra, silambam, and gilli-danda have broad appeal among youth and often absence from educational curricula (Wang & Liu, 2022). Recognizing the significance of national traditions, the proposed AI-enabled curriculum incorporates these games and vernacular-language materials as essential components while retaining the flexibility to align with evolving youth interests. Such integration fosters cultural relevance, inviting broader student engagement (Liu & Bu, 2021).

India's education system is entrenched in examination-driven, transferrable-skill-acquisition-focused pedagogical paradigms that often perceive physical education as a mere leisure pursuit. Engaging a diverse stakeholder ecosystem—including policymakers, education leaders, school authorities, sport federations, and teachers—in interpreted co-design supports the articulation of complementary proposals that sustain alignment with the educational mainstream.

5.3. Teacher Roles, Professional Development, and Capacity Building

The physical education curriculum has played a vital role in the overall development of school-age children around the world. Education, sporting activities, exercises, and health awareness are all components of a physical education curriculum. Educational institutions use advanced teaching platforms, such as virtual reality or extended reality, inside and outside of the classroom to optimise children's health (Liu & Bu, 2021). AI-based physical education introduces new methods to assist teachers in preparing courses and providing accurate and timely

assessments to target the teaching process and encourage more students to participate in activities or educational games.

5.4. Data Ethics, Privacy, and Governance

Each AI-enabled PE curriculum component generates and relies on various learner data, necessitating careful consideration of data ethics, privacy, and governance. Rigorous safeguards for informed consent, data ownership, retention, and governance constitute a prerequisite for deployment.

Informed consent must articulate data collection purposes, the nature of the data involved, and use cases. Data ownership encompasses classification of data generated by learners and any supplementary data required for effective utilization, alongside stakeholder clarity on ownership rights for each category of data and post-departure ownership retention. The governing framework delineates key stakeholder roles in protocol development, monitoring, auditing, and compliance, along with grievance redressal avenues and their associated procedures and contacts.

6. Challenges, Risks, and Mitigation Strategies

The physical education (PE) curriculum in India faces challenges in addressing ever-evolving student requirements. One prominent solution is the integration of artificial intelligence (AI), which personalizes the learning experience and examines the protective aspects of student health during the learning process (Liu & Bu, 2021).

Nonetheless, several difficulties related to technology, pedagogy, ethics, and sustainability persist. Technological readiness, the lack of infrastructure, and routine maintenance represent potential hindrances and must be overcome. Pedagogically, ensuring alignment with existing curricular outcomes, educator-associated resistance to change, and the gradual exploration of upgraded modes of PE instruction pose significant challenges. Examination of data security, student privacy, and the ethical use of digital footprints is also crucial. Finally, addressing sustainability both from a financial and logistical perspective is vital to project the educational benefits of AI-enhanced PE over the long term (Aliabadi et al., 2023).

6.1. Technological Readiness and Infrastructure Gaps

As part of efforts to improve and expand the physical education curriculum to positively impact student participation in lifelong physical activity, educational planners are exploring the potential of artificial intelligence (AI) technologies to facilitate an adaptive, personalised curriculum. However, the successful integration of AI into physical education remains contingent upon a number of considerations, among them the basic levels of technology readiness and the existing infrastructure supporting schools' ability to choose, procure, implement, and maintain technology-assisted curricular tools. Although the widespread availability of digital devices, Internet connectivity, and online content indicates that opportunities may exist to incorporate AI into physical education, further investigation is needed to assess these factors in more detail for schools in India, including the focus of this study.

The widespread availability of audiovisual devices (e.g. smartphones, tablets, laptops, and projectors), peripherals (e.g. cameras and microphones), and Internet connectivity throughout India suggests the potential for various technology-enhanced pedagogies. For physical education, existing tools range from projectable digital content (demonstration videos, animated graphics, etc.) to personalised coaching systems. At the same time, widespread access to technology does

not guarantee adequate technology readiness; policymakers therefore need to assess the current status of school- and teacher-level technology readiness as part of AI-enhanced curriculum design. Factors to consider include the level of procurement and ongoing funding for technology adoption and maintenance, the status of teacher-related support structures (e.g. initial training, follow-up support, and peer-networking opportunities), equipment-repair services, and government schemes that channel funds for technology. (Liu & Bu, 2021)

6.2. Pedagogical Alignment and Resistance to Change

While the potential and promise of technology to enhance the function and reach of physical education continues to expand, pedagogical alignment remains an important limitation to incorporating Artificial Intelligence into pedagogy and curriculum. Developing more sophisticated technology, such as Artificial Intelligence, has actually made the gap between innovational technology and physical education wider. Physical education in India tends to gravitate towards the traditional pedagogical stance of a behaviouristic approach. This traditional behaviouristic approach has been dominant for many years, and has created a challenge for any beneficial advancement to take root.

Similar to the friction experienced by physical education when the internet began to emerge, many reasons exist to justify the resistance. If, or perhaps when, Artificial Intelligence is introduced, India must engage in comprehensive efforts to ensure that the bridge created by technology will uplift health and physical education, rather than restrict its advancement. Current transformations in education have caused the world to wobble on the brink of change that may elevate education, or completely destroy it. Demands and excitement for sticking with the old world or boldly forwarding towards a much better future may clash, causing turmoil within. The situation is even worse in education, where so many people have no idea of or aren't interested in education. Institutions are required to move carefully with evidence when introducing other valuable technologies, including Artificial Intelligence (Aliabadi et al., 2023).

6.3. Data Security, Privacy, and Ethical Considerations

The collection and analysis of data associated with learning and human behaviour, including data related to physical education, has the potential to optimise the process, deliver timely feedback to students and educators, and provide guidance on modifying the instructional approach. The advantages of such systems, particularly in developing skill knowledge and improving performance, are amplified when integrated with artificial intelligence techniques (Yu & Yu, 2023). Diverse data inputs may be assimilated and analysed across different layers, enabling large-scale processing of rich data sourced from countless individuals and interactions, beyond the limited scope of traditional means.

Among the ethical considerations associated with data-intensive approaches to education, security, privacy, and appropriate use of the information hold particular significance (Latham & Goltz, 2019). The aggregation of educational records and other sensitive information poses risks to confidentiality, potential misuse by third parties, or unanticipated disclosure to parents or other supervisors or authority figures. Concerns related to data-driven methods for education or concentrated expression of human experience also arise, such as unwanted exposure of subtleties considered too private to reveal or data manipulation that alters the integrity or authenticity of

the information (Lakkaraju et al., 2024). Enabling the flow of data under a governance framework that carefully addresses these considerations remains vital for leveraging the benefits of such technology.

6.4. Sustainability and Cost Implications

Drafting an AI-enabled physical education (PE) curriculum in India must address sustainability and cost factors. Funding impacts the design and supports initiative uptake and long-term viability, shaping human and technology resources. PE remains a low-priority subject and supports a limited share of school budgets. Scaling nationwide depends on resource alignment with other initiatives in health, wellness, and foundational literacy. The revised National Education Policy (2020) offers opportunities to integrate AI and PE across the learner's journey and outline public-private partnership funding pathways.

Budgeting, procuring requisite resources, and securing long-term viability pose challenges, given fixed financial support and limited sector resources (Liu & Bu, 2021). Multiple funding sources public and private, corporate and institutional can address facility and infrastructure shortfalls, augment mentorship and training, and provide equipment and modifications; they align explicitly with existing central and state government PE schemes. Central and state governments allocate funds for physical education and sports in public schools, which can sustain coordinated, within-school PE initiatives.

Emerging AI-enabled PE initiatives in Indian public school systems can take advantage of existing national and state pedagogical, curricular, and infrastructural frameworks. PE encompasses the development of diverse sport-specific capabilities and flexibility of approach within those domains, enabling a wide range of progressive and teachable physical education constructs.

7. Policy Implications and Strategic Governance

With the government's intent to integrate artificial intelligence (AI) into educational governance, the urgency of general secondary physical education curriculum design in India is heightened. It is the first policy document in India to explicitly include AI as an area for education reform. AI provides powerful computing capabilities that promote curriculum development and autonomous learning in various disciplines on a global scale while possessing vast content and pedagogical resources for physical education. AI-based education is becoming a trend in building future-oriented talent. AI has profoundly influenced human development and will continue to impact physical education (Liu & Bu, 2021). Combining artificial intelligence (AI) with physical education (PE) in different education systems has not been discussed in India; the topic is urgent, policy-relevant, and significant.

Eight dimensions—pedagogical, activity-based, health, community, skill-based, outdoor, assessment, and information literacy—were presented in the National Education Policy 2020, which serve as defaults to PE curriculum design. Given that the AI topic is emerging in India, the following general characteristics and principles should be observed: (i) addressing basic developmental needs of PE curriculum at the system level (policy framework, curriculum implementation and pilot study, assessment systems, teacher competency construction, etc.); (ii) promoting deep integration of technology, culture, and literacy (sports culture and life-long scientific fitness instructions that are relevant to Indian specific context); (iii) supporting a smooth transition among the three physical education systems (general secondary, vocational and

higher education) at the transition period since independence; (iv) applying across-white-space design considering large population resources as the major capital stake at different educational levels (government focus on primary and secondary education, strategic investment on vocational education, higher education at general PE curriculum implementation).

7.1. National Education Policy Alignment

India's National Education Policy (NEP) of 2020 programmatically emphasizes the urgency of educational reform, reflecting an understanding of the need for curricular revision at various levels because of it being outdated in terms of relevance and effectiveness (Government of India, 2020). Acknowledging the NEP's programmatic thrust towards educational reform and, more specifically, towards reform of the physical education (PE) curriculum, the aim is to evaluate how artificial intelligence (AI) could enable adaptation of the curriculum in ways that meet the demands of the 21st-century economy and the changing social reality of the nation (Government of India, 2020). Many definitions of artificial intelligence (AI) exist; the one employed suits the educational context best: artificial intelligence is the branch of computer science dealing with the simulation of intelligent behaviour, where intelligent refers to the ability to learn from experience, to relate and integrate these experiences in novel situations, and so to change one's actions to deal better with these situations (Mitchell, 1997). Due to its sensitivity to varying inputs, adaptive learning represents one of the most promising and potent applications of AI; an adaptive learning system can function as a personal tutor, proposing learning resources that fit a learner's needs. Such a system also serves as a significant assistant to teachers, helping them to devise features for their students (Alhassan et al., 2022).

The recent transition of PE from a content-based to a competence-based paradigm emphasizes the necessity of a well-sequenced progression of skill acquisition (Government of India, 2020). Under the current pedagogical approach, teachers play a gatekeeping role by determining what materials and activities are suitable for each learner; as a consequence, opportunities for children to become actively engaged are restricted, leading to disengagement altogether (Saiyad et al., 2021). Together with the increasing uptake of home-based and online learning initiated by the pandemic, attempts have begun to exploit technology to mediate PE instruction without losing sight of pedagogical intent. However, the majority of available resources remain focused on improving content delivery rather than fostering pace and engagement; educators in both India and around the world have repeatedly voiced concerns that content is received but not absorbed because active participation and opportunities to practice are limited.

A systematic review of studies focusing on AI-enabled educational technologies for PE and health demonstrates that three applications are particularly pertinent to the subject: (1) tracking and monitoring of health-related physical activity, fitness and performance; (2) movement analysis with feedback on form and technique; and (3) assistive technologies that promote inclusive practices (Gonzalez-Gomez et al., 2023). Movement analysis and health monitoring represent critical dimensions of pedagogy and safety respectively, yet very few, if any, resources directed at children below secondary school level are available at present, and none are known to reflect symptomatic behaviours of fundamental movement skill acquisition or to integrate the corresponding theoretical framework.

7.2. Public-Private Partnerships and Academia–Industry Collaboration

Partnerships between government, academia, and the private sector are critical for developing an ecosystem conducive to the long-term scale and sustainability of AI-enabled physical education (PE) curriculum in India. Collaborative models from other countries can provide a foundation for exploring local adaptations and optimizations. Adopting publicly available collaborative ecosystems can facilitate the exploration of alternative structures and settings.

A range of models exists for public–private partnerships in education. The Netherlands has initiated a national AI program that funds applied research through partnerships between businesses, educational institutions, research organizations, and public authorities. The United Kingdom has launched “AI for People and the Planet,” a consolidated program of AI-related initiatives spanning government, industry, and academia. In the United States, a public–private partnership has been established among the National Institute of Standards and Technology, non-profit organizations, industry partners, and academia to address AI bias and establish guidelines for regulatory frameworks and standards.

7.3. Evaluation, Scaling, and Long-Term Impact

AI can support evaluation of the pilot program, determine scalability prospects, and assess prospective long-term impacts on student outcomes and equity. For evaluation, qualitative data collection could be supplemented by analysis of athlete performance modeling general capacity, assessing fundamental motor skills, quantifying participation, and tracking goal attainment. Standardized national benchmarks exist for each dimension, facilitating cross-state comparisons. To gauge wider scaling potential, consideration can be given to similar education technology initiatives whose diffusion and uptake have been documented (Yang & Lin, 2022). Anticipated long-term impacts centre on growth in the number of students engaging in regular physical activity, with equity dimensions arising from both deployment in schools equipped with AI solutions and alignment with wider curricular materials already used in the national system (Liu & Bu, 2021).

8. Conclusion

Artificial intelligence (AI) has permeated every aspect of human development and social life, including education, trade, medicine, and industry, and it is now entering the domain of physical education. The emerging technologies related to AI are expected to provide unprecedented experiences for the development of sports at all levels, such as in school, college, community, and elite settings. However, these changes bring with them the unprecedented challenges of data privacy risk and the need for more teacher-led back-up (Liu & Bu, 2021). The introduction of intelligent technologies associated with AI into the field of physical education can assist educators in the design of corresponding educational programs and in the collection of real-time feedback information, thereby improving training efficiency. Nevertheless, concerns persist regarding data security and the potential for users to become confined to a social-information bubble. In this continually evolving landscape, educators, physical education teachers, and sports coaches ought to take the initiative to embrace emerging technologies, meanwhile striving to safeguard the privacy of learners and maintain human values. In India today, the content and pedagogy of physical training occur in nearly all establishments, but curricular specification and technology integration are still at an early stage. Hence, the introduction and integration of AI

into the physical education system in India can provide great value added by the turnaround of the way such education is delivered.

Incorporating state-of-the-art technology into physical education in India is therefore timely and relevant for public policy, teacher training and upskilling, learning in school and at home, and the design of educational digital platforms. The focus is on the need for future generations to remain physically active throughout life in view of growing sedentary behaviour and associated health and mental well-being issues.

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