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Artificial Intelligence Literacy, Attitudes and Readiness for AI-Integrated Physical Education among Undergraduate Students: A Narrative Review

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Abstract

Artificial intelligence (AI) is spreading rapidly across the field of education, yet the study of AI literacy, attitudes toward AI and readiness for AI-integrated physical education (PE) among undergraduate students of physical education is still limited. **Objective:** This review paper synthesises selected research papers published between 2019 and 2026 to clarify the status of these three constructs, their interrelationships, and their implications for physical education. **Method:** Twenty-six studies for which free full text was available on Google Scholar and the ONOS (One Nation One Subscription) portal were included in this narrative review. **Key findings:** AI literacy among undergraduate students, particularly those in sport-science and PE teacher-education programmes, was found to be at a moderate level. Attitudes are cautiously positive, while ethical concerns, fear of job replacement and the absence of institutional guidance are the principal barriers. Both literacy and attitudes contribute positively to AI readiness. PE-specific empirical evidence in the Indian context is extremely limited: in the only available study (n=60), 80% of PE students use AI, yet 57% received no formal guidance. **Conclusion:** Mainstreaming AI literacy within the PE curriculum, developing training programmes and providing policy-level guidance are imperative.

Keywords: artificial intelligence literacy, attitudes toward AI, AI readiness, physical education, undergraduate students, sports science, narrative review, India

Introduction

The journey of the digital revolution that began in the closing decades of the twentieth century has now reached a new and far more transformative stage, the age of Artificial Intelligence (AI). Since the arrival of ChatGPT in November 2022, AI-based tools have entered educational institutions at an unprecedented pace. Two-thirds of German university students have begun using ChatGPT or equivalent AI tools in their studies (Kasneci et al., 2023), and this trend is now clearly visible in developing countries as well.

Physical Education (PE) has traditionally been a practical, body-centred discipline. However, AI-driven performance analysis, motion tracking, wearable devices, and personalised training systems have transformed the character of the field. The meta-synthesis of Gorzinmataee et al. (2025) confirmed that AI can enhance both instructional quality and student engagement. It therefore becomes essential that future PE teachers and sport scientists be comfortable, informed and ethically competent in working with these technologies.

Three interrelated capabilities are necessary for the effective educational use of AI: first, AI literacy, conceptual understanding of AI, the ability to apply it in practice, and critical evaluation (Long & Magerko, 2020; Wang et al., 2022); second, attitudes toward AI, the individual's cognitive, affective and behavioural inclinations regarding its use (Schepman & Rodway, 2020); and third, AI readiness, preparedness to function within an AI-integrated environment (Wang et al., 2023). Research indicates a sequential chain of literacy → attitudes → readiness (Aslan et al., 2026; Özüdoğru & Durak, 2025).

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In India, the National Education Policy 2020 (NEP 2020) has issued a clear directive to integrate AI and digital technology into higher education. Initiatives such as One Nation One Subscription (ONOS) are widening access to scientific literature. Even so, the empirical literature on AI literacy, attitudes and readiness among Indian undergraduate students of physical education is almost non-existent, only one small-sample descriptive survey (Ahmed et al., 2026) is available, and no validated measurement instrument has been used in the Indian PE context. This is the central research gap addressed by the present review.

This narrative review paper answers the following questions: (1) What is the current level of AI literacy, AI attitudes, and AI readiness in higher education, particularly among undergraduate students of PE teacher education and sport science? (2) What is the relationship among these three constructs? (3) Which factors influence them? (4) What are the implications for the PE curriculum and for teacher education?

2. CONCEPTUAL FRAMEWORK

2.1 Defining AI Literacy

Long and Magerko (2020) defined AI literacy as the ability to understand AI systems, evaluate them critically and work with them effectively. The AILS (Artificial Intelligence Literacy Scale) developed by Laupichler et al. (2023), one of the most widely used instruments in this field, measures three dimensions: Technical Understanding, Critical Evaluation and Practical Application. Scales such as the AILS of Wang et al. (2022) and the MAILS of Arranz-García et al. (2026) have also been adapted to PE-specific contexts.

The scoping review by Jones (2026) identified more than 30 different approaches to measuring AI literacy in higher education, yet the absence of theoretical uniformity remains a challenge. van der Linde, Rodriguez-Montoya and Garrido (2025) presented AI literacy as a prerequisite component of student readiness.

2.2 Attitudes toward AI

The GAAIS (General Attitudes toward Artificial Intelligence Scale) developed by Schepman and Rodway (2020) is based on two sub-scales: positive attitudes (the usefulness of, and opportunities offered by, AI) and negative attitudes (fear, distrust). Ayanwale et al. (2024) treated AI anxiety as the affective component of attitude, expressed through dimensions such as Sociotechnical Blindness, Job Replacement and AI Configuration Anxiety.

Aslan et al. (2026) showed that AI literacy and AI anxiety together explain 39% of the variance in attitudes. Bu et al. (2026) found a chain mediation of literacy → interaction perception → attitude, which is of particular importance in the context of sport universities associated with PE.

2.3 AI Readiness

Wang et al. (2023) defined AI readiness as the set of knowledge, skills, attitudes, and behaviours required to function effectively in an AI-integrated environment. The PLS-SEM study of Özüdoğru and Durak (2025) identified three dimensions (Cognition, Vision, and Ethics) and showed that ability and ethics readiness reduce perceived threat (β=–.234). In the TAM-based African sample of Falebita and Kok (2025), a clear pathway of readiness → self-efficacy → attitude → use emerged.

2.4 Theoretical Model

This review takes the Technology Acceptance Model (TAM; Davis et al., 1989) and the UTAUT framework as its theoretical basis, according to which perceived usefulness, perceived ease of use, social influence and

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self-efficacy are the principal determinants of AI readiness and use. The review further proposes the following pathway: AI Literacy → AI Attitudes (± AI Anxiety) → AI Readiness → AI Use in PE Context.

3. METHOD

This study is a narrative review, in which no primary data were collected from students. The purpose of the review is to provide a thematic synthesis of the available research literature.

3.1 Data Sources

Research papers were searched from two sources: (1) Google Scholar, for a broad search and for open-access and author-version papers; (2) the One Nation One Subscription (ONOS) portal, for peer-reviewed papers from publishers such as Elsevier, Springer Nature, Wiley, Taylor & Francis, SAGE and Emerald.

3.2 Search Keywords

The following keyword combinations (with AND/OR) were used: "artificial intelligence literacy", "AI literacy", "attitudes toward artificial intelligence", "AI anxiety", "AI readiness", "technology readiness", "physical education", "sports science students", "undergraduate students", "higher education", "ChatGPT", "generative AI", "artificial intelligence physical education India".

3.3 Inclusion and Exclusion Criteria

Inclusion criteria: (i) published between 2019 and 2026; (ii) peer-reviewed empirical studies or published reviews; (iii) focused on students in higher education (undergraduate, B.P.Ed., PETE, sport science); (iv) measurement of at least one of the constructs of AI literacy, AI attitudes or AI readiness; (v) PDF freely available on Google Scholar or accessible through ONOS.

Exclusion criteria: (i) studies at the school (K–12) level; (ii) papers focused solely on in-service teachers; (iii) papers based purely on technical AI development; (iv) year or journal reference unavailable; (v) papers whose full text was not freely available.

3.4 Study Selection

Following the keyword search, papers were evaluated based on title, abstract and full text. Finally, 26 studies were included in the review, of which 11 are PE/sport-specific, 9 general teacher education, 3 general undergraduate/multidisciplinary samples, and 3 reviews/meta-syntheses. One PE-specific Indian paper (Benny & Thangadurai, 2026, Retos) was excluded because it had been declared retracted by the publisher. A PRISMA flow chart is not an integral part of this narrative review; for methodological transparency, full details of each study are provided in Table 1.

3.5 Data Extraction and Analysis

The following information was extracted from each study: author and year, country, number and type of participants, research design, measurement instruments used, principal numerical findings, theoretical framework, and limitations. A thematic synthesis was then carried out: (5.1) level of AI literacy, (5.2) attitudes toward AI and AI anxiety, (5.3) AI readiness, (5.4) AI applications in PE, (5.5) influencing factors, and (5.6) the Indian context.

Table 1

Summary of Reviewed Studies (N = 26)

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No.	Author(s) (Year) / Journal	Country	N / Design / Tool	Construct (s)	Instrument	Key Findings (paraphrased)
1	Arranz-García, Castaño Calle & Fuentes Blanco (2026) Frontiers in Education DOI: 10.3389/feduc.2026.1846955	Spain	N=471 UG teacher-education (48.6% Sport Science) Survey; MAILS scale (34 items, α=.903); ANOVA	AI Literacy	MAILS (34 items)	Sport Science students scored highest on AI application (M=17.22) and creation (M=7.62), due to wearable-tech use. Theoretical understanding and AI recognition were moderate across groups. No significant ethical differences by discipline (p=.948).
2	Acar (2025) Anemon, 13(3), 1880–1903 DOI: 10.18506/anemon.1774773	Türkiye	N=410 Sport Science UG students Correlational survey; AILS (α=.970); 21st Century Skills Scale	AI Literacy, Readiness	AILS (31 items)	Positive but weak correlation between AI literacy and 21st-century skills (r=.274, p<.001). No gender effect. Senior-year students outperformed first-year on technical comprehension. PE-teaching and sports-management majors scored higher than coaching/recreation students.

3	Johnson (2026) Educational Practices in Kinesiology, 6(2), Art.1	USA	PETE UG students Pedagogical reflection; non-empirical	AI Literacy, PE Application	Course-embedded AI tasks	Integrating ~30 min/week AI prompting in assessment courses increased students' self-reported confidence and critical awareness of AI limitations in PE contexts.
4	Solamillo (2025) LatIA, 3:245 DOI: 10.62486/latia2025245	Philippines	N=200 pre-service PE teachers (100 pre-service + 100 in-service) Descriptive-correlational; GAAIS; AIAS	Attitudes, Anxiety, Readiness	GAAIS (Schepman & Rodway, 2020); AIAS (Wang & Wang, 2022)	Moderate-positive attitudes (M=3.28) and moderate anxiety (M=4.31). Highest anxiety: Sociotechnical Blindness (5.01) and Job Replacement (4.70). Pre-service teachers had slightly more positive attitudes (3.32 vs 3.24). Strong negative correlation between anxiety and negative attitudes (r=–.512).
5	Gülünay & Coşar (2025) J. Global Sport & Education Research, 8(2), 1–19 DOI: 10.55142/jogser.1673255	Türkiye	N=362 pre-service PE teachers Correlational survey; DLS + AIAS (16 items)	AI Literacy, Attitudes	Digital Literacy Scale (Ng, 2012); AIAS	High digital literacy (M=37.27/50); moderate AI anxiety (46.17/80). Weak negative correlation between DL and

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						AI anxiety (r=–.115, p=.029). Women showed higher AI configuration anxiety (p=.043). Urban/high-income students had higher DL; anxiety showed no income or location differences.
6	He, Han, Ruizhu & Li (2026) Scientific Reports, 16:14467 DOI: 10.1038/s41598-026-45316-4	China	N=864 PE-program UG (yr 1–4; ~80% male) Scale development; EFA/CFA; 4 factors	AI Use, Literacy, Readiness	AI Use Scale for Sport & Exercise Science (14 items, α=.90–.94)	84% had used AI tools; primary use was coursework writing/summarising (70%) and information search (60%). Only ~29% used AI for training/rehabilitation tasks. Moderate-high item means (3.22–3.56/5). Students sought clearer institutional guidelines and practical AI training; sport-science curricula lagged in AI literacy integration.
7	Bu, Wang, Ji, Huang & Lu (2026) Frontiers in Psychology, 17:1838803	China (Shandong Sport	N=966 UG (54.8% female, yr 1–4)	AI Literacy, Attitudes, PE context	AILS (Wang et al., 2023); AIAS-4	AI literacy M=3.30/5, attitudes M=3.12. Literacy–attitude

	DOI: 10.3389/fpsyg.2026.1838803	University + 3)	Cross-sectional; AILS; AIAS-4; Perceived AI Interaction Scale; PROCESS mediation			r=.436. Women showed more positive attitudes (p=.008). Senior students reported higher AI interaction perception. Chain mediation: literacy → interaction perception → attitude → innovative thinking accounted for 70% of indirect effects.
8	Gorzinmataee, Rezaee & Farrokhnia (2025) Interdisciplinary J. Virtual Learning in Medical Sciences, 16(3), 213–231	Iran (multi-country synthesis)	41 peer-reviewed studies Meta-synthesis; SPIDER framework	AI in PE, Readiness, Ethics	SPIDER qualitative synthesis	AI can enhance instructional quality and student engagement in PE. Ethical concerns and implementation challenges vary by cultural context and resource availability. Effective AI integration requires context-aware design, instructor readiness, and ethical leadership.

9	Bilbao-Eraña & Arroyo-Sagasta (2025) Frontiers in Education, 10:1668078 DOI: 10.3389/feduc.2025.1668078	Spain	N=60 pre-service primary teachers (48 post-test) Quasi-experimental pre–post; 8-hr AI-literacy training; PAICE questionnaire	AI Literacy → Attitudes (intervention)	PAICE questionnaire	Training significantly improved AI knowledge (2.63→3.40, p=.001) and general attitudes (3.63→3.96, p=.004). Trust in AI did not change significantly, indicating that cognitive gains do not automatically transfer to affective trust.
10	Özüdoğru & Durak (2025) Information Development, 41(3), 916–932 DOI: 10.1177/02666669251335657	Türkiye	N=816 pre-service teachers PLS-SEM; AI Readiness Scale; GenAI Literacy Scale; Perceived Threats	AI Readiness, Literacy, Attitudes	AI Readiness Scale (Wang et al., 2023); GenAI Literacy Scale	Readiness dimensions (cognition, vision, ethics) predicted AI-based innovation (β=.51–.59). Ability and ethics readiness reduced perceived threats (β=–.234, p=.001). Gender differences found on readiness sub-dimensions.
11	Hu & Wang (2026) Frontiers in Education, 11:1876627 DOI: 10.3389/feduc.2026.1876627	China	N=161 3rd-yr pre-service teachers + 9 interviews Mixed methods;	AI Literacy, Readiness	AILST (Ning et al., 2025)	Overall, AI literacy moderate-high (M=3.67/5). Perception and Ethics dimensions higher; Knowledge and

			AILST (α=.973)			Application lower. Maths-specialist students outperformed language-specialist peers (η^2=.105–.138). Positive attitudes did not always translate to instructional confidence. Ethical awareness was surface level.
12	Aleksić, Mandić & Ivanović (2025) Education Sciences, 15(12), 1582 DOI: 10.3390/educsci15121582	Serbia	N=93 IT-engineering and CS-teacher-education UG Correlational; AILS + DigComp objective test	AI Literacy	AILS (Wang et al., 2022); DigComp test	Programming, signal processing, and creative thinking correlated with AI literacy dimensions (r=.24–.44). English proficiency linked to Awareness and Ethics. No gender effect. Rural students scored higher on ethics (p=.02).
13	Aslan, Püsküllü, Topuz & Avados (2026) Int. J. Turkish Education Sciences, 14(2), 790–802 DOI: 10.46778/goputeb.1791452	Türkiye	N=223 final-yr pre-service teachers (73.5% female) Correlational; multiple regression; GAAIS,	Literacy → Attitude; Anxiety → Attitude	GAAIS (α=.83); AIAS (α=.93); AILS (α=.72)	AI literacy positively predicted attitudes (β=.317, p<.001); anxiety negatively predicted attitudes (β=–.481, p<.001). Together they

			AIAS, AILS			explained 39% of attitude variance (R^2=.39). Literacy–anxiety r=–.191; literacy–attitude r=.409; anxiety–attitude r=–.542.
14	Ulker, Cevik & Perzycka-Borowska (2025) Comunicar, 82, 1–11 DOI: 10.5281/zenodo.15993731	Türkiye	N=375 education-faculty UG (79% female; 4 departments) Survey; AILS (Laupichler et al., 2023; 7-pt)	AI Literacy	AILS (31 items, α=.97)	95% had no AI course. All three literacy dimensions below scale average (4): technical understanding lowest (M=3.11), critical evaluation 3.70, practical application 3.85. No gender effect. Small-moderate department effect; foreign-language students scored lowest.
15	Özbay (2026) Hacettepe University Journal of Education, 41(2), 426–439 DOI: 10.16986/hunefd.1774522	Türkiye	N=400 UG (health, education, arts-science, engineering; 60.5% female) Cross-sectional; AILS; GAAIS; Technostress Scale	Literacy ↔ Attitudes; Readiness	AILS; GAAIS; Technostress Scale	90% familiar with AI, only 5.5% had formal training; 93.5% knew ChatGPT; 60.5% uncertain about AI reliability. Literacy–positive-attitude r=.42; technostress–positive-attitude r=–.13. GPA, IT-proficiency and positive attitude

						predicted literacy (R^2=.25).
16	Pingmuang, Koraneekij & Khlaisang (2025) Electronic Journal of e-Learning, 24(1), 1–18 DOI: 10.34190/ejel.24.1.3990	Thailand	N=1,673 pre-service UG teachers (66% female; 4 university types) Scale development; EFA+CFA; 39 items, 4 factors	AI Literacy, Readiness	AI Literacy Scale for Teachers (AI Recognition, Comprehension, Pedagogy, Ethics; CFI=.974)	All four dimensions scored 5.58–5.70/7 (high). Ethical Use highest (5.70); Fundamental Comprehension lowest (5.58). Framework aligned with UNESCO AI competency guidelines and Thailand National AI Policy 2022–27.
17	Falebita & Kok (2025) Journal for STEM Education Research, 8, 257–282 DOI: 10.1007/s41979-024-00132-1	Nigeria	N=176 pre-service STEM-education teachers (61.9% female) PLS-SEM; TAM-based	Readiness → Attitude → Use	TAM-based 6-construct model	Technological readiness → self-efficacy (β=.624). Attitude was the strongest predictor of AI tool use (β=.285). Perceived ease of use and usefulness shaped attitude (β=.417, .305). R^2 attitude=.632, R^2 use=.508.
18	Dumagay (2025) EthAIca, 4:432 DOI: 10.56294/ai2025432	Philippines	N=378 pre-service teachers (65% female; 45% low-income)	Literacy, Anxiety, Attitudes	GAAIS; AIAS (Ayanwale et al., 2024)	Literacy moderate-high (3.80), anxiety moderate (3.00), attitudes positive (3.60). Males had higher literacy and lower

			Descriptive - correlational; GAAIS; AIAS; AI Literacy Scale			anxiety; women had slightly more positive attitudes. Higher-income groups had higher literacy and lower anxiety (η^2=.27, .31). Training raised literacy but not anxiety. Literacy–anxiety r=–.610.
19	Toker Gökçe, Deveci Topal, Geçer & Dilek Eren (2024/25) Education and Information Technologies DOI: 10.1007/s10639-024-13081-4	Türkiye	N=664 UG students (multi-faculty incl. PE) Survey; AILS; CHAID decision-tree	AI Literacy	AILS (Laupichler et al., 2023)	Overall literacy and critical evaluation were average; technical understanding was low. AI-use frequency was the strongest predictor. Gender was decisive for technical understanding (males higher). Among low-frequency users, faculty type was the differentiating variable.
20	Ponomarenko et al. (2026) Contemporary Educational Technology, 18(2), ep650 DOI: 10.30935/cedtech/18458	Russia (multi-country review)	33 studies (2021–24) Systematic review; Scopus/WoS	Literacy, Attitudes, Readiness (synthesis)	Review synthesis	Pre-service teachers show both positive attitudes and anxiety. Initial AI knowledge is limited but improves with training (Younis, 2024: 2.29→4.33). Key

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						determinants of AI-adoption intention: perceived usefulness, ease of use, social influence, self-efficacy (TAM/UTAUT/TPB). Ethical concerns include privacy, academic integrity, fairness, and over-reliance.
21	Yadav (2025) Int. J. Emerging Voices in Education, 1(3), 41–56 DOI: 10.59828/jive. v1i3.14	Multi-country (Indian author)	N=280 final-yr pre-service teachers (60% female) + 45 focus-group Convergent mixed-methods; TAM-based 45-item survey (α=.78–.87)	Literacy, Attitudes, Readiness	45-item TAM-based instrument	73% recognised AI's importance, but only 34% felt prepared; 23% had AI-focused coursework. Attitudes cautiously positive (M=3.4/5). Prior tech-experience (β=.42) and AI literacy (β=.31) were strongest attitude predictors. No gender effect. Ethical concerns highest (M=4.1/5): privacy 84%, bias 78%.
22	Easwaran et al. (2025) Scientific Reports, 16:1747	India (12 states, 49 institutions)	N=395 PharmD UG (72% female)	Awareness, Attitudes, Practice	KPP questionnaire (Knowledge,	\>90% aware of ChatGPT basics; 85.8% perceived benefits; 74.4%

	DOI: 10.1038/s41598-025-31298-2		Nationwide web-based cross-sectional; validated 5-section questionnaire (α=.80–.87)	(Indian context)	Benefits, Concerns, Practice)	concerned about reduced mentor interaction; 57.2% high users. Prior AI experience and training significantly associated with higher practice (p<.001). Benefits–practice r=.377; concerns–practice r=–.126.
23	Singh, Bajpai & Singh (2026) Discover Education, 5:283 DOI: 10.1007/s44217-026-01300-8	India (BHU + multi-university)	N=60 students + 20 teachers Qualitative FGD; thematic analysis (MAXQDA); TAM-based framework	Attitudes, Readiness Barriers (Indian context)	Semi-structured FGD protocol	Students showed limited recognition of ChatGPT's academic value; key barriers: prompt-literacy gap, perceived knowledge inadequacy, cultural norm of earning through effort ("mehnat se arjit karna"), fear of academic judgment. Teachers cautiously accepted AI but raised concerns about cognitive dependency and academic integrity. Absence of institutional guidelines was

						the major barrier for both groups.
24	Ahmed, Ahmed & Khan (2026) Int. J. Physiology, Exercise and Physical Education, 8(2), 1–7 DOI: 10.33545/26647249.2026.v8.i2a.241	India (AMU Aligarh, LNIPE Gwalior, HVPM Amravati, degree colleges)	N=60 PE students: BPEd 73%, MPEd 10%, BPES/BA/BSc (63% male) Descriptive survey; self-developed 19 closed + 3 open items; Google Forms	AI Use, Awareness, Readiness (Indian PE context)	Self-developed questionnaire (expert-reviewed; reliability not assessed)	80% use AI frequently (ChatGPT, Gemini, Grammarly, Quill Bot, Canva AI). Main uses: note preparation (76.6%), grammar/paraphrasing (70%), presentations (65%). 82% reported positive academic impact. 54% worried about originality/plagiarism; 46% about ethics/privacy; 32% faced device/internet limits. 57% received little or no formal guidance; only a few institutions had AI-literacy workshops.
25	Maberah et al. (2025) Int. J. Information and Education Technology, 15(4), 767–773 DOI: 10.18178/ijiet.2025.15.4.2282	Jordan / Egypt / Saudi Arabia	N=210 PE students Descriptive survey; attitude + perceived-usefulness questionnaire	Attitudes, Perceived Usefulness (PE-specific)	Attitude and Perceived Usefulness scales	PE students expressed low-to-moderate positive attitudes toward AI in learning and a moderate level of perceived usefulness. Attitudes and perceived

						usefulness did not differ significantly by gender, age, or prior experience.
26	Eid & Zhao (2026) Frontiers in Education, 11:1888874 DOI: 10.3389/feduc.2026.1888874	Egypt (instrument); China (authors)	N=230 PE educators (30% undergraduate, 23% postgraduate, 27% PE teachers, 20% lecturers) Scale development; EFA+CFA; TAM/UTAUT	AI Awareness, Educational Value, Curriculum Integration, Ethics, Behavioural Intention (PE-specific instrument)	AI-PEQ (18 items; α=.76–.86; overall α=.89; CFI=.95, RMSEA=.056)	First validated PE-specific AI-acceptance instrument. AI awareness M=4.12, educational value 4.35, curriculum-integration readiness 4.21, ethics 3.78, future acceptance 4.48 (5-pt). Awareness–intention r=.65; educational value–intention r=.71. No gender differences; ethical awareness positively (not negatively) related to intention (r=.46).

Note. UG = undergraduate; AILS = Artificial Intelligence Literacy Scale; GAAIS = General Attitudes towards Artificial Intelligence Scale; AIAS = AI Anxiety Scale; MAILS = Meta AI Literacy Scale; DLS = Digital Literacy Scale; PAICE = Perceptions of AI in Classroom Education; KPP = Knowledge, Perceptions and Practices; TAM = Technology Acceptance Model; UTAUT = Unified Theory of Acceptance and Use of Technology; PLS-SEM = Partial Least Squares Structural Equation Modelling; EFA/CFA = Exploratory/Confirmatory Factor Analysis; FGD = Focus Group Discussion; SPIDER = Sample, Phenomenon of Interest, Design, Evaluation, Research type; PE = Physical Education; PETE = Physical Education Teacher Education.

4. REVIEW OF LITERATURE

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4.1 Level of AI Literacy among Undergraduate Students

The reviewed studies make it clear that the AI literacy of undergraduate students in higher education is at a moderate level, with considerable variation. In the Turkish study of Özbay (2026), 90% of 400 multi-faculty students were familiar with AI, yet only 5.5% had received formal AI education, indicating a deep shortfall in training. Similarly, Ulker et al. (2025) found among 375 education-faculty students that all three literacy dimensions, technical understanding (M=3.11), critical evaluation (M=3.70) and practical application (M=3.85), fell below the midpoint of the seven-point scale, and that 95% of participants had never taken an AI-focused course.

A different trend was evident in sport-science and PE-specific samples. Studying 471 education-faculty students in Spain, Arranz-García et al. (2026) found that sport-science students were ahead of other faculties in the practical application (Apply; M=17.22) and creation (Create; M=7.62) of AI, an advantage arising from their daily use of wearable devices and performance-monitoring technology. Acar (2025) clarified this further in a study of 410 Turkish sport-science students, in which senior-year students outperformed first-year students across all dimensions of AI literacy, pointing to growth in AI literacy with the accumulation of academic experience.

In the scale-development study of He et al. (2026), conducted with 864 students of a Chinese PE programme, 84% had used AI tools, but use was confined to essay writing and information search (70% and 60% respectively). Only 29% used AI for PE-specific tasks such as training and rehabilitation, which reflects the shortage of AI literacy within the curriculum. Using CHAID analysis with 664 multi-faculty students (including PE), Toker Gökçe et al. (2024/25) found that frequency of AI use is the strongest determinant of literacy, that is, students who use AI more are more literate in it.

In sum, the level of AI literacy depends on faculty type, experience, and formal training. Where sport-science and PE students have greater technical exposure, gaps remain in the critical and ethical dimensions, and these can be bridged through curricular reform.

4.2 Attitudes toward AI and AI Anxiety

In most studies the AI attitudes of undergraduate students were found to be cautiously positive. In the Philippines-based PE teacher-education study of Solamillo (2025), the general attitude of pre-service PE teachers was M=3.28/5, neither highly enthusiastic nor negative. In the sport-university-based Chinese sample of Bu et al. (2026) (n=966), AI attitude was M=3.12/5, while among the Turkish pre-service teachers of Aslan et al. (2026) it was associated with literacy at r=.409. Among the 210 PE students from three Arab countries studied by Maberah et al. (2025), attitudes were low-to-moderately positive and perceived usefulness was at a moderate level; no significant differences were found by gender, age or prior experience, an indication that enthusiasm for AI among PE students is more restrained than in other faculties.

AI anxiety emerged in this review as an important and growing sub-theme. Solamillo (2025) found that anxiety among PE trainees was highest for "Sociotechnical Blindness" (M=5.01) and "Job Replacement" (M=4.70). In the study of 362 pre-service PE teachers by Gülünay and Coşar (2025), AI anxiety was moderate (46.17/80) and showed a negative correlation with digital literacy (r=–.115). In the Philippine study of Dumagay (2025) (n=378), a negative correlation of r=–.610 was found between literacy and anxiety, that is, students who are more AI-literate are less anxious.

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In a multiple regression, Aslan et al. (2026) confirmed that AI literacy (β=.317) and AI anxiety (β=–.481) together explain 39% of the variance in attitudes (R^2=.39), with the negative effect of anxiety exceeding the positive effect of literacy. This finding carries a message for policymakers: increasing knowledge alone is not sufficient; building psychological safety is equally necessary.

The eight-hour AI-literacy training intervention of Bilbao-Eraña and Arroyo-Sagasta (2025) showed significant post-training improvement in knowledge (2.63→3.40, p=.001) and in general attitudes (3.63→3.96, p=.004), but no significant change in trust, underlining the independence of the cognitive and affective components.

4.3 AI Readiness for AI-Integrated Physical Education

AI readiness has been found to be multidimensional. In the PLS-SEM study of Özüdoğru and Durak (2025) with 816 students, three dimensions of readiness (Cognition, Vision, and Ethics) were significant predictors of AI-based innovation (β=.51–.59). Importantly, ability and ethics readiness reduced perceived threats (β=–.234, p=.001), showing that readiness not only increases proactive engagement but also lowers fear.

In the PE-specific sample of He et al. (2026), students wanted clear institutional guidelines and practical AI training, underlining the key role of institutional support in readiness. In the Nigerian study of Falebita and Kok (2025), a clear pathway of technological readiness → self-efficacy → attitude → use was found (R^2=.632 for attitude), which is particularly relevant to developing-country contexts such as India.

Toward PE-specific measurement of readiness, Eid and Zhao (2026) developed the first validated instrument, the AI-PEQ, which measures five constructs: AI Awareness, Educational Value, Curriculum Integration Readiness, Ethical Considerations and Behavioural Intention. In their Egyptian sample of 230 PE educators and students (30% undergraduate), AI awareness (M=4.12) and future acceptance (M=4.48) were high, and the awareness–intention correlation was r=.65. Notably, ethical awareness was positively associated with acceptance intention (r=.46), that is, ethical alertness is an indicator of informed discernment rather than of resistance. This instrument is the most suitable candidate for adaptation to the Indian PE context. Pingmuang et al. (2025) developed a teacher-centred framework of AI literacy on a large sample of 1,673 pre-service teachers in Thailand, aligned with UNESCO AI competency guidelines and the national AI policy. This approach offers a model for an AI-literacy policy consistent with India's NEP 2020.

4.4 AI Applications in Physical Education and Sports

Applications of AI in physical education are highly diverse and expanding rapidly. According to the 41-study meta-synthesis of Gorzinmataee et al. (2025), AI can contribute meaningfully to instructional quality, student engagement, personalised training, and performance analysis. In the study of He et al. (2026), the 864 PE students used AI most for information search and coursework writing, while its use in training planning and sport analysis remains limited.

Johnson (2026) presented a practical model for integrating AI literacy into the PETE curriculum, approximately 30 minutes per week of AI prompting and output analysis in an assessment course increased both students' confidence and their understanding of the limitations of AI. Liu et al. (2026) issued a "Call to Action" for AI literacy in PETE, advocating a principal place for AI in the physical education teacher-education curriculum.

The systematic review of Ponomarenko et al. (2026) (33 studies) identified the principal determinants of AI application in PE and teacher education within the TAM, UTAUT and TPB frameworks: perceived usefulness,

ease of use, social influence, and self-efficacy. In addition, the ethical challenges of AI application (privacy, academic integrity, bias, and over-reliance) have emerged as major points of consideration in this field.

4.5 Factors Influencing AI Literacy, Attitudes and Readiness

Several crucial factors influencing AI literacy, attitudes and readiness emerged from the reviewed studies.

4.5.1 Gender

Findings on gender differences are mixed. Acar (2025) and Aleksić et al. (2025) found no significant gender difference. In Gülünay and Coşar (2025), AI configuration anxiety was higher among female PE trainees ($p=.043$). In Dumagay (2025), men had higher literacy and lower anxiety, while women's attitudes were slightly more positive. In Bu et al. (2026), women's AI attitudes were found to be more positive ($p=.008$). The role of gender thus varies with context and measurement approach.

4.5.2 Academic Year

AI literacy and attitudes were better among students in higher academic years. In Acar (2025), sport-science students in the second to fourth years outperformed first-year students in technical understanding and critical evaluation. In Bu et al. (2026), perception of AI interaction was higher among senior students. This demonstrates the key role of accumulated experience and curricular exposure.

4.5.3 Prior AI Experience and Training

Prior experience of AI use and formal training emerged as the most powerful determinants across all studies. In Yadav (2025), prior technological experience ($\beta=.42$) and AI literacy ($\beta=.31$) were the most influential predictors of attitude. In the Indian study of Easwaran et al. (2025), prior AI use ($\chi^2=15.01$, $p=.001$) and training ($\chi^2=18.11$, $p<.001$) were significantly associated with ChatGPT practice. Bilbao-Eraña and Arroyo-Sagasta (2025) showed that a structured training intervention can improve both literacy and attitudes.

4.5.4 Discipline and Subject Specialization

Subject specialisation influences AI literacy. In Arranz-García et al. (2026), sport-science students led in practical application. In Hu and Wang (2026), mathematics specialists outperformed language specialists. In Acar (2025), students specialising in PE teaching and sports management were more literate than those in coaching and recreation. STEM specialisation is associated with higher AI attitudes (Yadav, 2025).

4.5.5 Digital Access and Socioeconomic Factors

Dumagay (2025) showed that students in higher-income groups had higher AI literacy and lower anxiety ($\eta^2=.27, .31$), underlining the role of the digital divide. In Gülünay and Coşar (2025), the digital literacy of urban and higher-income PE trainees exceeded that of rural and lower-income trainees. In the Indian study of Singh et al. (2026), the requirement of a paid ChatGPT subscription emerged as a technological barrier.

4.6 Indian Context

The empirical literature available on AI literacy and AI attitudes in India is still extremely limited. Easwaran et al. (2025) conducted a national survey of PharmD undergraduates (n=395) across 49 institutions in 12 states and found that more than 90% possessed basic knowledge of ChatGPT and 85.8% regarded it as beneficial, yet 74.4% were concerned about reduced mentor interaction and only 29.6% had received formal training in the use of AI tools. Although this study relates to pharmacy education, it nevertheless presents a broad picture of AI awareness and attitudes in the Indian higher-education context.

The BHU-based qualitative FGD study of Singh, Bajpai and Singh (2026) (60 students, 20 teachers) exposed the empirical reality of ChatGPT in Indian higher education: the principal barriers were students' lack of prompt-writing ability, the clash with the cultural value of "earning through effort", and the absence of institutional guidance. Teachers expressed concern about cognitive dependency and academic integrity.

The only available empirical study of Indian physical education students is that of Ahmed, Ahmed and Khan (2026), a descriptive survey of 60 PE students (73% B.P.Ed.) from Aligarh Muslim University, LNIPE Gwalior, HVPM Amravati and several degree colleges. 80% of students extensively use AI tools (ChatGPT, Gemini, Grammarly, Quill Bot, Canva AI), for note preparation (76.6%), grammar correction (70%), and presentation building (65%); 82% reported a positive effect on academic performance. However, 54% were concerned about originality and plagiarism, 46% about ethics and privacy, 32% lacked reliable internet or devices, and 57% reported receiving no formal guidance. The authors acknowledged that, owing to time constraints, the reliability and validity of the questionnaire were not assessed, this, together with the small sample, constitutes the principal limitation of the study.

The position in the Indian PE context is therefore as follows: the use of AI is widespread but untrained and unstructured; no validated AI literacy, attitude or readiness scale has been administered to Indian PE undergraduates; and no study with a large, representative sample exists. This is an important and publishable research gap, particularly because, under NEP 2020, the role of physical education teachers in AI-integrated classrooms is set to become still more significant.

5. DISCUSSION

The findings of this review may be synthesised into three central themes.

First, the literacy–attitude–readiness chain emerged consistently across contexts. Aslan et al. (2026) and Özüdoğru and Durak (2025) established that higher AI literacy is associated with more positive attitudes and greater readiness. The chain mediation of Bu et al. (2026) and the TAM pathway of Falebita and Kok (2025) lend further strength to this theoretical proposition.

Second, PE specificity plays a key role. Practical AI experience among sport-science students (wearables, performance analytics) raises the technical dimension of their literacy, but the critical and ethical dimensions still lag. The PETE interventions of Johnson (2026) and Liu et al. (2026) demonstrate that small curricular integrations of AI can have a large effect.

Third, the Indian context presents distinctive challenges. The findings of Ahmed et al. (2026), Singh et al. (2026) and Easwaran et al. (2025) all point in the same direction: AI awareness and use are high in India, but AI literacy and readiness remain incomplete and unstructured in the absence of formal training. This gap is especially clear among PE students, 57% of whom received no guidance at all (Ahmed et al., 2026). Cultural beliefs, the digital divide, and the absence of institutional policy are the distinctive barriers here.

6. IMPLICATIONS

6.1 For Physical Education Curriculum

AI literacy should be included in the PE curriculum not as an "add-on" but as a core component. The assessment-embedded AI training of Johnson (2026) and the "Call to Action" of Liu et al. (2026) offer practical guidance in this direction.

6.2 For Teacher Education Programs

Modules teaching the practical and ethical use of AI tools should be added to the training of pre-service PE teachers. The intervention model of Bilbao-Eraña and Arroyo-Sagasta (2025) and the UNESCO-aligned framework of Pingtung et al. (2025) are useful for this purpose.

6.3 For Policy (NEP 2020 and ONOS)

In India, an AI-literacy curriculum should be standardised at national level in physical education colleges under NEP 2020. The accessibility of the ONOS portal should be used to promote a research culture. As recommended by the Indian study of Singh et al. (2026), clear institutional AI-use guidelines (institutional AI policies) should be framed.

7. LIMITATIONS AND FUTURE RESEARCH

The principal limitations of this review are as follows: (1) only studies with freely available full text were included, so some relevant paywalled studies may have been missed; (2) PE-specific empirical evidence from India is confined to a single small-sample study (n=60) whose questionnaire reliability was not assessed; (3) most studies come from Türkiye and China, indicating a lack of geographical diversity; (4) a PRISMA-based systematic protocol is absent, which makes the review less formal than a systematic review; (5) most studies are cross-sectional, making causal inference difficult.

Directions for future research: (1) empirical cross-sectional study of AI literacy, attitudes and readiness among Indian undergraduate students of physical education, particularly women students in government colleges; (2) Hindi adaptation and validation in the Indian context of PE-specific AI literacy and acceptance scales such as the AI-PEQ (Eid & Zhao, 2026) and the AI Use Scale of He et al. (2026); (3) the longitudinal impact of AI-literacy interventions; (4) comparative analysis of the role of gender, rural–urban location and socioeconomic factors.

8. CONCLUSION

This narrative review makes clear that in higher education, particularly among undergraduate students of PE and sport science, AI literacy, AI attitudes, and AI readiness are all empirically interrelated and together determine preparedness for AI-integrated instruction. The theoretical pathway of literacy → attitudes → readiness is supported by multiple studies. Sport-science students have greater technical exposure to AI, but investment is needed in the critical and ethical dimensions.

For India, this review carries a clear message: there is an urgent need for targeted empirical research on AI literacy in PE. If the aspirations of NEP 2020 are to be realised, mainstreaming AI within PE teacher education is not merely desirable but indispensable.

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