Research on the Use of Artificial Intelligence Technology to Improve Teaching Quality for Physical Education Teachers

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Abstract: In the era of artificial intelligence, physical education (PE) teachers face challenges and opportunities in role transformation. To break free from the constraints of "technological colonization," PE teachers need to proactively adapt to and utilize AI technology. By designing a reasonable data framework, critically interpreting algorithmic logic, optimizing human-machine collaboration models, and building an ecosystem that supports decision-makers' transformation, PE teachers can gradually evolve from mere data "collectors" into decision-makers who possess both data intelligence and educational warmth. In this process, teachers must continuously enhance their data literacy and decision-making skills while upholding the essence of education and its humanistic values. In the future, institutional innovation and technical ethics will be key to ensuring that AI technology truly serves physical education teaching and promotes its high-quality development.

Keywords: Physical Education Teachers; Artificial Intelligence; Role Transformation; Data Literacy

1. Introduction

The rapid development of artificial intelligence (AI) technology has had a profound impact on the educational ecosystem. Physical education, as a key practice area for embodied cognition, is facing unprecedented opportunities and challenges [1]. On one hand, AI technology provides physical education with unparalleled data support and intelligent tools, enabling physical education (PE) teachers to easily access, deeply analyze, and effectively utilize vast amounts of student movement data, thereby optimizing teaching strategies and enhancing teaching outcomes [2]. On the other hand, the rapid spread of technology may also lead to risks of technological colonization and the weakening of educational subjectivity in the field of physical education. While PE teachers enjoy the convenience brought by technology, they might become overly reliant on data, even being dominated by algorithms, which could deviate from the original purpose of education and undermine cultural diversity. [3,4] To avoid these potential dangers, this article explores how PE teachers can fully leverage AI technology through proactive design of data frameworks, critical interpretation of algorithmic logic, and optimization of human-machine collaboration models, transforming their role from data "collectors" to wise "decision-makers," ultimately achieving a dialectical unity between technical utility and educational humanism.

2. PE Teachers Should Take the Initiative to Design Data Acquisition Paradigm

2.1 Fundamental Conflict between Technical Logic and Educational Goals

The use of artificial intelligence technology in physical education can provide rich data and deepen the analysis of the teaching process. However, when using AI technology, if it is detached from the essence and goals of physical education and blindly pursues quantitative techniques, it can easily reduce the teaching process to mere data, weakening the decision-making power of PE teachers and leading to the phenomenon of technological colonization. [5,6] This not only deviates from the original purpose of physical education but also overlooks individual differences among students and cultural diversity.

Currently, when developing AI sports

equipment, engineers generally follow a mindset that emphasizes the measurability of data over in-depth analysis of educational value. This can lead to conflicts between the logic of artificial intelligence technology and educational goals. For example, an AI system used for football instruction may overly standardize movement requirements, thereby suppressing the traditional “Mo Qiu Qiu” (a cultural expression of the Yi ethnic minority), ultimately overlooking the cultural diversity in physical education; another case involves a student physical fitness testing system whose intelligent algorithms are modeled based on data from urban students. When this system is applied to rural student populations, it may result in distorted evaluation scores for rural students and easily overlook individual differences among students. These cases highlight the limitations of AI technology in sports education applications, where developers often lack a deep understanding of the essence of physical education, leading to data collection and assessment that deviate from educational objectives.

2.2 Build a Three-Dimensional Index System by Anchoring the Value Orientation of Education

In order to get rid of the passive dependence on technical preset, PE teachers should refer to the Physical Education and Health Curriculum Standards for Compulsory Education in China (2022 edition) to actively cooperate with developers to design a three-in-one data collection framework of "physical ability-healthy behavior-sports morality".[7] This framework aims to comprehensively reflect students' physical literacy, while taking into account individual differences and cultural diversity(see Table 1). In terms of physical performance, in addition to traditional physiological indicators (such as speed, strength, and endurance), parameters like “unconventional movement innovation frequency” and “complex environment adaptation index” should also be added. For example, using multimodal sensors to record differences in students’ performance during rainy and sunny days can help assess their environmental adaptability. In terms of healthy behaviors, RFID chips and wearable devices can be used to monitor students ‘autonomous health management behaviors before and after exercise, such as checking the safety of equipment several times before exercise and actively stretching for a long time after exercise, so as to cultivate students’ health awareness and self-management ability. In terms of healthy behaviors, RFID chips and wearable devices can be used to monitor students’ autonomous health management behaviors before and after exercise, such as checking the safety of equipment several times before exercise and actively stretching for a long time after exercise, so as to cultivate students’ health awareness and self-management ability. By constructing such a three-dimensional indicator system, PE teachers can more comprehensively evaluate students’ sports literacy while ensuring that data collection serves educational goals rather than being dominated by technical logic.

Table 1. Three-Dimensional Data Index System Oriented by Education

Key competence	Quantitative indicators example	Technical support
Movemental ability	Number of unconventional action innovations	Video analysis AI + motion capture
	Complex environment adaptation index (differences in performance between rainy and sunny days)	Multimodal sensor + environmental parameter recording
Healthy behavior	Number of times to check the safety of equipment before exercise	RFID chip + behavior recognition
	Duration of active stretching after exercise	Wearable devices + behavior recognition
Movemental virtue	Number of times you actively lift your partner	Social network analysis algorithm
	Frequency of leadership behaviors in team tasks	Group behavior recognition algorithm

2.3 Respect the Differences between Students and Cultures by Establishing a Dynamic Baseline Adjustment Mechanism

This mechanism consists of three levels. Physiological regulation: By accessing the growth and development database of children in different regions, the evaluation threshold of different bone age and BMI range can be matched to ensure the accuracy and fairness of data assessment. Cultural adaptation: In minority schools, traditional sports movements are incorporated into the AI recognition model to avoid cultural misjudgment and respect and protect students’ cultural diversity. Psychological resilience: By designing "challenge difficulty adaptive algorithm", the action standard is dynamically adjusted

according to the results of students' attempts to stimulate their intrinsic motivation and confidence. Through the above path, PE teachers can actively build a data collection ecology that serves educational goals, so as to get rid of the passive dependence on technical preset and realize the reconstruction of data acquisition ability.

3. PE Teachers Should Interpret the Logic of Algorithms Critically

The "black box" nature of AI systems makes their decision-making processes complex and difficult to understand intuitively, leading to the pitfalls of causal inversion and decontextualization in data interpretation. For example, an AI swimming instruction system mistakenly attributed "improved goggles performance" to algorithm optimization; a football training model, due to overlooking the tactical characteristics of women's football, resulted in a decrease in female players' passing accuracy. These cases highlight the critical thinking and contextual awareness that teachers need to possess when interpreting data.

3.1 Deeply Integrate "Data-Behavior-Context" and Establish a Triple Verification Mechanism

In order to avoid falling into the trap of data determinism, PE teachers need to establish a triple verification mechanism, namely data layer verification, behavior layer verification and context layer verification. Data layer verification: The error compensation model is established by comparing the physiological indicators collected by multiple devices to ensure the accuracy and consistency of the data. Behavioral layer verification: Through the classroom video analysis system, the emotions and motivations behind the data can be identified to better understand the students' behavior. Context layer validation: Build a multi-factor regression model by forcing environmental variables (such as audience interference, weather changes, etc.) to more accurately assess student performance. Through the triple verification mechanism, PE teachers can restore discrete data points into embodied teaching narratives and have a deeper understanding of students' sports performance and learning process.

3.2 Promote Algorithm Open Source and Transparency

In order to further improve the accuracy and transparency of data interpretation, PE teachers need to promote the open source and transparency of algorithms. Specific measures include: Granting teachers code review rights: Require developers to disclose key model parameters and algorithmic logic so that teachers can gain insight into the decision-making process of AI systems. Establish data traceability mechanism: track the source of the training set with algorithmic bias, identify and correct potential bias problems. Build an open source community for educational AI: Encourage teachers to participate in algorithm optimization and iteration, and jointly promote the progress and development of educational AI technology. By promoting the open source and transparency of algorithms, PE teachers can better understand and apply AI technology, avoid being misled by algorithmic bias, and improve the accuracy and reliability of data interpretation.

4. PE Teachers Should Optimize the Human-Machine Collaboration Mode and Inject Humanistic Care

AI technology should serve "holistic education" rather than becoming an efficiency-driven tool. In physical education, over-reliance on AI technology may lead to a lack of humanistic care and weakened team cohesion. Therefore, PE teachers need to infuse humanistic care into the application of technology, optimize the human-machine collaboration model, and achieve warmth and intelligence in data application.

4.1 Design a Hybrid Feedback Mechanism in Physical Education Teaching

There are two important incentive mechanisms in the process of education: immediate feedback and delayed feedback. Neuroscientific research has shown that immediate feedback can quickly activate the brain reward circuit and improve students 'motivation and participation. However, excessive reliance on immediate feedback may inhibit the prefrontal cortex's ability to plan for long-term goals and affect students' sustained progress. [8] Therefore, PE teachers need to design a mixed feedback mechanism to balance the role of these two incentive

mechanisms. Through AI technology, students 'action errors can be corrected in real time, and immediate guidance and feedback can be provided to activate students' short-term learning motivation. Through narrative design such as growth curve chart and medal system, students' progress and achievements are displayed to cultivate their sense of long-term goals and self-reflection ability. Through the design of this mixed feedback mechanism, PE teachers can not only stimulate students' short-term motivation, but also cultivate their long-term planning ability, so as to maximize the teaching effect.

4.2 Establish a Reasonable Man-Machine Division of Labor Model in Teaching

In the teaching environment of human-computer collaboration, PE teachers need to clarify the division of labor between AI technology and themselves, and construct a reasonable practice model of human-computer division of labor. For AI technology, it mainly undertakes technical tasks such as action decomposition demonstration for skill learning, physiological load monitoring and risk warning, so as to improve teaching efficiency and safety. For PE teachers, they are mainly responsible for observing students 'emotional changes, designing team collaboration scenes, guiding innovative solutions and other humanistic tasks, so as to cultivate students' social communication ability and innovation ability. For example, in football instruction, AI can generate reports on passing accuracy rates, while teachers can organize students to analyze the communication strategies missing behind the data and design role-playing tasks to enhance students' leadership. By establishing a model of human-machine division of labor in teaching, PE teachers can fully leverage the strengths of AI technology and their own expertise, achieving collaborative decision-making and mutual improvement in teaching quality.

4.3 The Transformation from Digital to Art is Realized through the Narrative of Education

Educational narrative is an important bridge connecting knowledge and emotion. PE teachers can draw on Bruner's narrative cognitive theory and put specific events into the overall story through narrative processing [9], that is, transform discrete data points generated by AI into narrative clues and growth stories to stimulate students' interest and motivation in learning. First, the "explosive weakness" data generated by AI can be transformed into a challenge task of the Cheetah Awakening Plan to stimulate students 'internal motivation. The cardiopulmonary function improvement curve can also be transformed into a script for the Climber's Medal to strengthen students' achievement motivation. At the same time, we should design contextualized and story-based teaching tasks and activities based on students' actual life and learning environment, so that students can learn and grow in specific situations.

5. Through the Reform of Management System, an Ecosystem Should be Gradually Built to Support PE Teachers to Transform from ‘Data Collector’ to ‘Decision Maker’

5.1 Reform the Teacher Qualification Certification System

To enhance the data literacy and decision-making capabilities of PE teachers, it is necessary to innovatively reform the teacher certification system by incorporating sports data literacy into the evaluation criteria. [10] First, a ‘Sports Data Literacy’ assessment module can be added to the ‘Standards for Teacher Qualification Examinations in Primary and Secondary Schools’ with levels divided into beginner, intermediate, and advanced to evaluate teachers’ algorithmic critical thinking, data interpretation skills, and narrative transformation abilities. In addition, senior teachers are required to design ‘reverse algorithm alienation’ teaching plans during teaching, such as traditional games against AI standardized scoring and other practical cases, to show teachers’ innovative ability in technology application and humanistic care. Through the reform of teacher qualification certification, PE teachers can continuously improve their data literacy and decision-making ability, laying a solid foundation for becoming wise decision-makers.

5.2 Establish a School-Based Data Governance Committee

In order to ensure the rational use of educational data and its effective supervision,

a school-based data governance committee needs to be established. This committee is composed of representatives from teachers, parents, ethicists and other parties, who jointly exercise the ‘veto power’ over commercial AI systems. First of all, a negative list of data collection can be formulated to explicitly prohibit the collection of sensitive information (such as family income) and protect students’ privacy rights and interests. Second, the educational adaptability of AI systems should be reviewed each semester to ensure that they meet educational goals and the actual needs of students. Finally, the disputes in the application of arbitration data should be properly handled, such as whether to include BMI index into the evaluation and assessment, so as to ensure the fairness and rationality of data use. The establishment and operation of the school-based data governance committee can ensure the reasonable use and effective supervision of educational data, and provide support and guarantee for the decision-making of PE teachers.

5.3 Innovatively Establish an Intelligent Education Platform

In order to support the decision-making transformation of PE teachers, it is necessary to establish intelligent education platform innovatively. First, by developing a dynamic data cockpit and adding early warning and reflection modules, the rationality of AI recommendations can be monitored in real time to provide decision support for teachers. For example, when AI suggests that nearsighted students participate in unsuitable activities such as shooting training, the early warning module can trigger an alert to remind the teacher. Secondly, by developing platform tools with teacher sovereignty functions, such as ‘data filters’ and ‘anti-algorithm buttons’ PE teachers can use these tools to independently block redundant monitoring items implanted by commercial companies or temporarily disable AI recommendations, entering a purely manual decision-making mode. Through the paradigm innovation of intelligent education platform, teacher sovereignty and data governance can be strengthened to improve the accuracy of AI decision-making and the flexibility of education, thus providing strong support for the decision transformation of PE teachers.

6. Conclusion

In the era of artificial intelligence, the transformation of PE teachers' roles is crucial for reconstructing educational subjectivity. By designing data frameworks, interpreting algorithmic logic, optimizing human-computer collaboration, and building decision support ecosystems, teachers can break through "technological colonization" and become decision-makers endowed with both data and educational wisdom, thereby enhancing teaching quality. In the future, it is necessary to promote institutional innovation and technical ethics construction to ensure that AI technology serves the mission of "educating through sports." PE teachers need to continuously improve their data literacy and decision-making skills while upholding the essence of education and humanistic values, achieving a unity between technological utility and educational humanism, and promoting high-quality development in physical education teaching.

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