

Practical Research on AI-technology-assisted Motor Skill Teaching in Junior High School Physical Education Classrooms

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Abstract: In the context of the deep implementation of smart education, traditional junior high school physical education skills teaching has normalized problems such as single demonstration, lagging error correction, insufficient personalized guidance, and weak process evaluation, which are difficult to adapt to the formation laws and physical and mental development characteristics of junior high school students' sports skills. AI technology, with its advantages in dynamic capture, intelligent analysis, data feedback, virtual simulation, etc., can deeply integrate into the entire process of physical education classroom skill teaching and reconstruct the physical education teaching mode. This article is based on the actual teaching of junior high school physical education, explaining the educational value of AI technology assisted sports skills teaching, proposing practical teaching strategies that are suitable for junior high school physical education classrooms, helping to improve the accuracy, efficiency, and scientificity of junior high school physical education skills teaching, and promoting the normalization of sports smart classrooms.

1. Introduction

Middle school physical education is a crucial stage for students to develop their sports skills and cultivate their physical literacy. Traditional skill teaching often relies on teachers' manual demonstration, visual observation, and experiential correction, resulting in strong subjectivity and insufficient accuracy in teaching^[1]. There are significant individual differences in the coordination and motor perception abilities of middle school students, and a unified teaching model is difficult to accommodate the skill mastery progress of different students, which can lead to the accumulation of movement errors and insufficient standardization of skills. With the deep integration of artificial intelligence technology and basic education, AI visual capture, posture analysis, data analysis and other technologies provide new support for the transformation of physical education skills teaching. Empowering physical education classrooms with AI technology can break through the limitations of traditional teaching, achieve visual movements, precise error correction, hierarchical teaching, and data-driven evaluation, effectively improve the quality of sports skills teaching, and help students standardize their mastery of sports skills and develop scientific exercise habits.

2. The application value of AI technology in assisting middle school physical education classroom sports skills teaching

2.1 Enrich teaching presentation forms and break through the limitations of traditional teaching

The traditional teaching mode of middle school physical education skills is relatively rigid, relying on teachers' on-site demonstrations, oral explanations, and students' imitation exercises to carry out teaching. Due to the limitations of teachers' personal movement standards, demonstration angles, and classroom perspectives, there are obvious shortcomings in skill teaching. Some complex sports skills have tight connections and numerous details, making it difficult to fully present instantaneous movements through a single demonstration. Students are unable to accurately capture the details of the movements, which can lead to imitation deviations. At the same time, the outdoor physical education classroom has a wide distribution of students, making it difficult for teachers to consider the viewing perspectives of all students. Students in the back row and edge positions cannot clearly observe the demonstration details, resulting in uneven starting points for skill learning. The integration of AI technology can effectively break through the limitations of such teaching. With the support of high-definition dynamic cameras, 3D pose modeling, multi angle slow playback and other functions, instantaneous and complex motor skills can be transformed into visual, pause able, and repeatable dynamic teaching resources. It can comprehensively display the points of action force, body posture, action rhythm, and connection points, and compensate for the perspective limitations and instantaneous defects of manual demonstration. Diversified forms of intelligent teaching can adapt to the concrete learning characteristics of junior high school students, reduce the difficulty of learning complex motor skills, enable students to accurately grasp the movement standards, and effectively consolidate the foundation of motor skill learning.

2.2 Accurately capturing motion deviations and improving skill correction efficiency

The core of standardized mastery of sports skills lies in timely detection and correction of movement errors. In traditional physical education classrooms, teachers rely on visual observation and teaching experience to judge students' movement problems, resulting in blind spots in observation, lagging judgment, and vague error correction. Junior high school students have a weak foundation in sports, and in skill exercises such as running, long jump, and ball games, they are prone to problems such as incorrect force application, non-standard body posture, and chaotic rhythm. Most students cannot independently perceive their own movement deviations. If misunderstandings accumulate for a long time, it may not only lead to non-standard skill mastery, but also cause sports injuries. AI posture capture and intelligent analysis technology has the advantages of high precision, full coverage, and real-time performance. It can dynamically collect data on the entire process of student practice, accurately identify core details such as limb angle, force sequence, body center of gravity, and motion amplitude, automatically compare with standard motion models, quickly locate student motion deviation points, and provide real-time feedback through data annotation, voice prompts, and image comparison. Compared to manual error correction, AI intelligent error correction is more precise, detailed, and timely. It can accurately point to individual students' specific problems, help students quickly correct movement errors, and greatly improve the efficiency of correcting and polishing sports skills.

2.3 Empowering students with differentiated teaching methods and implementing the goal of nurturing them effectively

There are significant individual differences in the physical and mental development, athletic talent, and physical fitness foundation of junior high school students. Unified teaching progress, training standards, and guidance methods are difficult to adapt to the needs of hierarchical education, and can easily lead to teaching difficulties where students with weak foundations cannot keep up and students with strong abilities cannot fully understand. Traditional physical education classrooms are difficult to quantify and judge students' skill mastery levels, and teachers rely more on subjective experience in stratified teaching, resulting in insufficient accuracy in stratification and weak implementation of personalized guidance. AI technology can continuously collect students' classroom practice data, construct a database of students' personal motor skill growth, quantitatively analyze core indicators such as students' skill proficiency, movement standardization, and physical fitness adaptation, and accurately distinguish students' ability levels. Based on the results of intelligent data analysis, teachers can set differentiated exercise goals, training intensity, and focus on improvement. For students with weak foundations, emphasis should be placed on standardized training of basic movements. For students with moderate abilities, emphasis should be placed on improving their proficiency in movements. For excellent students, emphasis should be placed on optimizing their movement skills and enhancing their athletic performance. The precise layered teaching supported by this data can fully respect individual differences of students, implement the concept of teaching according to students' aptitude, comprehensively assist students at different levels in achieving steady improvement of their sports skills, and consolidate their core sports literacy.

3. Practical strategies for AI assisted teaching of sports skills in junior high school physical education classrooms

3.1 Based on AI 3D modeling demonstration, optimize the pre teaching foundation of skills

The formation of motor skills follows the growth law of "cognition imitation proficiency automation", and whether the pre class cognitive foundation is solid directly affects the quality and efficiency of classroom practical exercises. The introduction of traditional physical education new courses mainly relies on oral explanations and simple demonstrations by teachers, with thin content and single forms. Students find it difficult to establish a complete, three-dimensional, and accurate understanding of movements in a short period of time, resulting in large imitation deviations, high error correction costs, and sluggish teaching pace in the early stages of classroom practice. In response to this issue, classroom teaching can fully rely on AI 3D motion modeling technology to optimize pre teaching design. Abstract motion principles, complex limb coordination, and hidden force details can be visualized and disassembled to construct a comprehensive, three-dimensional, and refined standard motion demonstration system, effectively filling the gaps in traditional pre class preparation. The AI system can generate standardized 3D action models that are suitable for the physical and mental characteristics of middle school students based on the skill specifications of the middle school physical education curriculum standards. It can complete various demonstration forms such as overall coherent demonstration, segmented disassembly demonstration, key detail freeze amplification, and fast slow rhythm comparison demonstration according to teaching needs. It clearly presents instantaneous actions that are difficult to capture with the naked eye, hidden force application methods, and body center of gravity switching processes, helping students comprehensively understand the key points of skills from the dimensions of action structure, force application logic, rhythm control, and limb coordination^[2]. Taking middle school basketball

dribbling teaching as an example, traditional classrooms rely solely on teachers' on-site demonstrations, making it difficult for students to see the dynamic changes of subtle wrist force and continuous sinking of the center of gravity, which easily leads to the wrong habits of dribbling with the head down, hitting the ball with the palm of the hand, and stiff body. With the assistance of AI technology, before class, the complete action chain of dribbling during movement can be displayed through 3D modeling animation, presenting core details such as "leaning forward sideways, pressing down on the center of gravity, soft pressing on the wrist, controlling the rebound height of the ball, and visually running forward" step by step. Error prone details such as wrist contact position, elbow joint swing angle, and body center of gravity landing point can be separately frozen. At the same time, a 3D model of incorrect movements can be played synchronously to visually compare the differences between standardized dribbling and inefficient dribbling. During the pre class preparation and classroom introduction stages, students can clearly establish the correct movement representation, identify the key and difficult points of practice, and avoid misunderstandings. During formal classroom practice, they can accurately imitate standard movements, greatly reducing the probability of trial and error and making skill learning more standardized and efficient.

3.2 Using AI real-time posture analysis to achieve dynamic and precise classroom error correction

Integrating AI visual posture capture technology into the entire classroom practice process, real-time collection of student motion data, intelligent comparison with standard motion databases, dynamic monitoring of the practice process, real-time problem correction, and solving the problems of lagging and insufficient coverage in traditional classroom correction. During classroom practice, the AI system can capture all students' exercise movements without any blind spots, automatically screen for movement deviations, and quickly identify individual student problems without the need for teachers to inspect and observe them one by one. At the same time, it generates concise and easy to understand error correction prompts, making it convenient for students to self check and correct in real time. Teachers can also rely on intelligent data to provide targeted tutoring^[3]. Taking the classroom teaching of standing long jump as an example, middle school students generally have common problems such as chaotic pre swing rhythm, improper depth of knee flexion, disconnection of ground force application, and unstable landing center of gravity. Teachers' manual inspections can only vaguely point out "incorrect force application and poor posture", and cannot accurately explain the specific problem points. The AI posture capture system can track the complete movement chain of students from pre swing, knee flexion, pedaling, to landing, accurately calculating the flexion and extension angles of the hip joint, knee joint, and ankle joint, as well as the movement trajectory of the body center of gravity. It can accurately identify individual problems, such as some students' insufficient pre swing amplitude leading to insufficient energy storage, some students' deep knee flexion leading to jumping lag, and students' stiff bodies and unsynchronized feet during the soaring stage and landing. The system real-time annotates deviation data on the screen, pushes standard action comparison images, and provides voice prompts for improvement points. Students adjust their actions in real time according to the prompts. Teachers combine AI to summarize high-frequency problems in the whole class to conduct concentrated lectures, and provide individual guidance for stubborn misconceptions, so that every action deviation can be accurately corrected and the standardization of student actions can be continuously optimized.

3.3 Utilizing AI data intelligence analysis to promote precise layered teaching and training

By relying on AI data collection and intelligent analysis functions, we can accurately assess

students' mastery level of motor skills, break the traditional experiential hierarchical model, promote precise hierarchical training and personalized guidance supported by data, and adapt to the growth rhythm of different students. The AI system can record students' practice data for the entire class, quantify and calculate core indicators such as action standardization rate, error rate, and completion quality, automatically generate students' personal skill learning reports, clearly present students' strengths and weaknesses, and provide objective data basis for teachers' hierarchical teaching^[4]. For example, in the teaching of short distance running starting skills, AI systems accurately distinguish the ability levels of different students by comparing multiple sets of practice data. For students with weak foundations such as stiff starting posture, slow reaction, and weak action standardization, they focus on designing basic content such as posture shaping and static reaction training to help students solidify their action framework; For intermediate level students who have basic movement norms but lack explosive power and unstable rhythm, we will provide specialized training on ground pushing and rhythm control to improve the quality and performance of their movements; For high-quality students with solid foundations, standardized movements, and outstanding abilities, design advanced training content such as starting, acceleration, and rhythm and speed control to tap into students' athletic potential. Accurate hierarchical training based on data can highly adapt the training difficulty, practice focus, and improvement goals to the individual learning situation of students, allowing each student to steadily improve on their existing foundation and fully implement the educational philosophy of teaching according to their aptitude.

3.4 Utilizing AI to retain data throughout the entire process and constructing a process oriented competency evaluation

Relying on the advantages of AI technology in full-process data retention, this study breaks the limitations of traditional summative evaluation in physical education, constructs a sports skill evaluation system balancing process and results and aligned with the requirements of student cultivation, and makes sports skill evaluation more scientific, comprehensive and objective. Traditional sports evaluation often relies on final physical fitness tests and skill achievement results to determine students' academic level, ignoring their classroom practice process, skill growth trajectory, and learning attitude. The evaluation is one-sided and lacks guidance^[5]. The AI system can fully retain the entire process data of students' practice duration, action standardization, error correction and improvement, and skill enhancement in each class, forming a dynamic and continuous growth file, and achieving comprehensive recording of students' skill learning process. For example, in the evaluation of middle school football's stationary frontal passing unit, traditional evaluation only relies on a final passing accuracy test score, which cannot reflect students' learning process and progress. The AI system can fully record the detailed data of students' passing movements, posture, foot shape control, force sequence, passing accuracy, number of errors, and corrective actions in each lesson of the entire unit, dynamically presenting the growth process of students from stiff movements and large passing deviations to standardized movements and stable passing. Teachers conduct comprehensive evaluations based on multiple dimensions such as students' participation in classroom exercises, improvement in movement norms, autonomous error correction ability, and final achievement. They provide growth encouragement to students with weak foundations but significant progress, and accurately point out problems for students with good foundations but relaxed attitudes and slow improvement. This makes the evaluation no longer solely based on results or scores, but more in line with the concept of nurturing people, and effectively plays the role of promoting learning and teaching through evaluation.

4. Summary

AI technology can not only enrich the presentation forms of physical education teaching, improve the accuracy of action correction, and implement the concept of educating people according to their abilities, but also reconstruct the complete system of teaching, learning, practice, and evaluation in physical education classrooms, promoting the transformation of junior high school physical education teaching from experiential teaching to data-driven, precise, and scientific teaching. This article constructs practical teaching strategies from four dimensions: pre class demonstration and preparation, dynamic correction during class, precise layered training, and full process evaluation. Combined with specialized sports skills scenarios, the application methods are refined, balancing innovation and practicality. In the subsequent teaching practice, physical education teachers need to continuously cultivate the concept of intelligent teaching, reasonably use AI technology to empower the classroom, balance the relationship between intelligent technology and manual teaching, avoid the problem of technology abuse, optimize the teaching mode based on the development law of students' sports skills, continuously improve the quality of education in junior high school physical education classrooms, and help students' core sports literacy develop in a long-term manner.

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