Curriculum and Teaching Methodology (2025)
Clausius Scientific Press, Canada

DOI: 10.23977/curtm.2025.080625
ISSN 2616-2261 Vol. 8 Num. 6

Research on the Application of Personalized Physical Education Teaching in Universities under the Background of Artificial Intelligence

Sun Lin*, Song Yufang

Department of General Education, Liaoning University of International Business and Economics, Dalian, Liaoning, 116052, China

Keywords: University Physical Education; Artificial Intelligence; Personalized Teaching; Application Research

Abstract: The application of Artificial Intelligence (AI) in the field of higher education has brought new opportunities for the implementation of personalized physical education teaching in universities. To this end, teachers need to rationally apply AI technology to create accurate physical fitness profiles for students, thereby addressing the drawback of the "one-size-fits-all" teaching model; utilize AI as students' "personal trainer assistant" to develop customized physical training programs; leverage AI data analysis to build efficient collaborative teams, and adopt AI intelligent guidance to conduct more precise intelligent evaluations of students' progressive development. By empowering university physical education teaching with AI, the characteristics of personalized teaching can be highlighted, and the orderly development of students' physical literacy can be promoted.

1. Introduction

Physical education is a crucial component of university education, with a long-term impact on students. It not only concerns students' personal development but also relates to the overall national health. The Innovation Action Plan for Artificial Intelligence in Institutions of Higher Education clearly states that efforts should be made to vigorously develop new models of internet-based education services and take "the innovative development of smart education" as a key implementation initiative [1]. Guided by this educational philosophy, university physical education teaching should fully leverage the advantages of AI technology, develop personalized physical education learning plans for students, and effectively implement the principle of "teaching students in accordance with their aptitude". This will enable AI to become a valuable aid in students' physical education learning, training, and practice, and help construct a new "AI + Smart Physical Education" educational pattern in practice.

In the current wave of digitalization and intelligence in education, artificial intelligence, with its powerful capabilities in data processing, pattern recognition and intelligent decision-making, has injected new vitality into traditional physical education. Traditional physical education is often constrained by resources such as teachers, venues and time, making it difficult to provide meticulous attention and personalized guidance to each student. The introduction of AI technology

not only compensates for these shortcomings but also helps teachers to formulate more scientific teaching plans through real-time collection and analysis of massive sports data, truly realizing the teaching concept of "student-centered". Moreover, with the rapid development of AI subfields such as wearable devices, computer vision and natural language processing, physical education is shifting from experience-driven to data-driven, and from uniform teaching to individual empowerment, demonstrating broad application prospects and development potential.

2. AI-Powered "Precise Physical Fitness Profiling": Customizing the Exclusive Starting Point for Physical Education Learning

In physical education teaching observations, it is evident that there are significant physical fitness differences among students. For some sports programs that certain students can complete easily, the completion rate of other students may be less than 60%. If individual differences among students are ignored, it may lead to a situation where some students "cannot get enough of the training intensity" while others "cannot digest the training content". Under the traditional teaching model, it is difficult for teachers to accurately understand the physical fitness characteristics of each student. However, with the support of artificial intelligence, "precise profiling" of students' physical traits can be achieved. After students wear smart devices, the system can track, record, and analyze their physical fitness data, and generate visual physical fitness evaluation reports. Teachers can then customize exclusive starting points for students' physical education learning based on their individual differences [2].

Specifically, the AI physical fitness profiling system usually relies on wearable devices such as smart wristbands, heart rate monitors, and motion sensors to collect multiple physiological and exercise indicators of students in both static and dynamic states in real time, such as heart rate variability (HRV), maximum oxygen uptake (VO2 max), muscle load, and exercise recovery time. These data are cleaned, integrated, and modeled through machine learning algorithms, ultimately forming a "digital twin" physical fitness model for each student. Teachers can easily grasp the distribution of students' strengths and weaknesses, exercise risk points, and potential development space through a visual panel. For instance, the system may indicate that a certain student has good cardiopulmonary function but poor core muscle stability, suggesting that they should increase core strength exercises such as planks and Russian twists in their training. This data-based precise diagnosis greatly enhances the scientificity and targeting of teaching design and also provides a basis for subsequent dynamic adjustments.

For example, after new students enroll, teachers can establish "electronic files" for them through AI evaluation. These files contain basic data on students' physical fitness, such as strength tests, endurance tests, speed tests, balance and flexibility tests. This data enables teachers to fully understand students' physical fitness status and set appropriate exclusive starting points for their physical education learning that match their physical capabilities. Take a male freshman as an example: his 50-meter run time in the physical test was 8.2 seconds, slightly lower than the standard range of 7.5-8.0 seconds for students of the same grade. When the teacher further investigated the student's situation, it was found that he had injured his left knee during a high school football game, and the injury still affected his sports performance. After learning about this, the teacher specifically designed a "safe, gentle, and progressive" physical training program for the student. On the premise of protecting the student's knee, the teacher arranged static stretching activities three times a week, each lasting about 7 minutes, to improve the flexibility of the knee and leg muscles and bones, while avoiding intense running and jumping movements. Later, the teacher conducted dynamic evaluations of the student's sports data and gradually increased the intensity of the activities when the student's physical fitness allowed. Through the precise physical fitness profiling of students via

AI devices, not only the safety of students during exercise is ensured, but also a progressive ladder of physical training is established.

3. AI-Intelligent "Personal Trainer Assistant": Customizing Personalized Movement Guidance Programs

AI boasts significant computing power advantages, enabling it to capture and recognize the completion of sports movements, as well as conduct quantitative analysis of students' technical movements. By integrating this data, teachers can develop personalized movement guidance programs for students-this makes it easier to focus on the problems and shortcomings in students' physical exercise, and correct irregular or inadequate aspects of their movements. AI is capable of "full-range capture and positioning"; in contrast, physical education teachers have limited field of vision and cannot attend to multiple students simultaneously during sports activities. Therefore, AI can serve as an intelligent "personal trainer assistant" for students [3].

AI personal training systems typically integrate computer vision technology and biomechanical analysis models to accurately capture and compare students' movement postures. For instance, through cameras or depth sensors, the system can extract key parameters in real time, such as joint angles, body center of gravity trajectories, and movement rhythms, and match them with a standard movement library. Once deviations are detected, the system immediately provides feedback through voice, vibration, or on-screen prompts, such as "Knees are turning inward. Please spread them out" or "Swing amplitude is insufficient. Increase arm swing." This immediate feedback mechanism not only helps students quickly correct mistakes but also reduces the burden of repetitive guidance on teachers. Additionally, the system can generate long-term improvement suggestions based on students' historical data, such as weekly flexibility training plans and strength enhancement exercises, truly achieving a closed-loop management of "training - evaluation - improvement".

For instance, during students' shooting training in basketball, "OpenPose"-a tool with human pose estimation functionality-can simultaneously capture 25 joint points of the human body and generate dynamic skeletal posture maps. By tracking students' shooting movements, OpenPose can identify data such as the wrist flexion angle, arm abduction angle, and knee joint flexion range. If the system detects that a student's knee joint buffer range is less than 15 °,below the standard range of 20-30 °, it will issue a red warning and recommend the student perform static stretching to prevent knee joint injuries.

Human pose estimation allows the identification of students' non-standard movements, and the system simultaneously proposes corresponding improvement measures. Take "standing long jump" training as an example: when teachers open the Web interface, the system can monitor the movement completion of 10 students at the same time and generate a "movement completion radar chart". Using this chart for analysis, teachers can identify common problems in students' training-for example, 60% of students have "insufficient arm swing range". Based on the system's prompts, teachers can correct students' movement techniques and improve the standardization of their technical movements. The AI-intelligent "personal trainer assistant" ensures that students have exclusive "technical guidance" at every stage of their physical training, thereby enhancing their enthusiasm and effectiveness in sports training.

4. AI-Dynamic "Grouping Engine": Building Efficient Collaborative Practice Teams

Sports activities are typically characterized by team collaboration. In physical training, students are often divided into several teams based on factors such as sports events and training requirements. With the support of AI technology, grouping algorithms can assist teachers in rational team division and intelligent matching of team members. These algorithms generate "homogeneous grouping" and

"heterogeneous grouping" decision models based on factors including students' physical fitness, athletic ability, and sports strengths and weaknesses [4].

AI grouping engines typically use algorithms such as clustering analysis, collaborative filtering, and graph neural networks to model students' multidimensional data. The system not only considers static physical fitness indicators but also incorporates dynamic factors such as real-time athletic performance, willingness to collaborate, and psychological traits. For example, in football training, the system might automatically generate recommended combinations of forwards, midfielders, and defenders based on data like students' running distances, passing success rates, and defensive reaction times, continuously optimizing during the training process. Additionally, the system supports manual adjustment of grouping strategies by teachers, such as setting different modes like "strong-weak pairing," "mixed gender," and "interest-oriented" to accommodate diverse teaching scenarios. This intelligent grouping not only enhances the effectiveness of team training but also fosters interaction and cohesion among students, helping to cultivate a spirit of collaboration and a sense of collective honor.

The homogeneous grouping model centers on ability matching: the system groups students with similar abilities by calculation. For example, students with comparable endurance levels, lower limb strength, and running speed are grouped together. The design of sports goals for such groups is relatively unified-for instance, a combination of "500-meter interval running" and "wall-sit" constitutes suitable intensive training content for this group. Since members within the group have similar abilities, it is easier to maintain a consistent training rhythm.

Heterogeneous grouping, on the other hand, focuses on ability complementarity among students. In basketball, for example, the AI system records core indicators such as shooting accuracy, defensive movement speed, and tactical coordination. Teachers use data analysis to form complementary teams of students. For instance, Student A has relatively weak physical fitness but scored 85 in the AI "passing vision" assessment-far higher than the class average of 23. Therefore, Student A is assigned to a team as a "passing organizer" and forms a basketball training team with students who have high shooting accuracy and strong defensive abilities. This mutual complementarity of strengths and weaknesses enhances the team's training effectiveness and competitive strength.

With AI support, the dynamic performance of team members can also be recorded, and dynamic plans for team adjustments can be proposed. For example, if the system detects that multiple students in a team have the problem of "knee valgus" (knock knees) during training, the teacher will temporarily assign students with standard knee joint movements to the team. Under the triple effect of system prompts, teachers' targeted corrections, and student demonstrations, the team can quickly correct technical issues, thereby maintaining the team's long-term and stable combat effectiveness.

5. AI Growth "Intelligent Navigation": Realizing Whole-Process Developmental Evaluation

Students' physical fitness, sports proficiency, and practical activities are always in a state of dynamic change. Leveraging the advantages of AI tools in intelligent evaluation, it is possible to record the entire process of students' physical fitness and sports proficiency development, and form dynamic developmental evaluations. By integrating intelligent evaluation, student observation, and process-based evaluation, teachers can propose more targeted improvement plans for students' physical education learning [5].

For example, at the end of each semester, the system generates a visual evaluation report based on each student's individual performance. The report uses data charts to illustrate changes in the student's various training indicators-such as mastery of technical movements, changes in endurance and speed, and the type and duration of participation in sports activities. These indicators all reflect

the trajectory of the student's changes, allowing the student to see their own progress or shortcomings. At the same time, the system also proposes development suggestions and plans based on the student's evaluation results. These suggestions typically feature the characteristic of "one plan per student". For instance, the system might evaluate a student as follows: "Speed and strength have improved significantly; subsequent training can continue to strengthen aerobic exercises."

It is important to emphasize here that although AI can provide personalized evaluations for students, AI evaluation cannot completely replace teacher evaluation. Teachers will make the final evaluation by integrating system evaluation, students' actual performance, process records, and phased problem analysis, thereby realizing a multi-dimensional hybrid model combining "AI evaluation + manual evaluation". This model more clearly reflects the developmental changes of students in physical training. More importantly, applying the evaluation results to physical education teaching practice enables the construction of a physical education classroom integrating "teaching, learning, and evaluation", and promotes the quality and efficiency improvement of university physical education teaching through intelligent evaluation.

6. Conclusions

To summarize, artificial intelligence provides support for the implementation of personalized physical education teaching in universities, with dual advantages in technology and practice. AI tools can create precise profiles of students' physical fitness, sports ability, interests, and hobbies, enabling the true realization of "one plan per student". This highlights students' individual differences and makes physical education teaching more targeted. AI personal trainers achieve one-on-one tracking and guidance through intelligent devices, ensuring each student has an "intelligent portable trainer". At the same time, AI tools can also assist in the construction of sports teams and track students' growth records. All these are concrete practices of the concept of "teaching students in accordance with their aptitude". They can stimulate students' enthusiasm for physical education learning, lay a solid foundation for the physical and mental health development of students, and at the same time maximize the application effects of artificial intelligence in physical education classrooms.

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