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Research on the Theoretical Logic and Practical Path of Empowering University Sports Health and Wellness Governance with Artificial Intelligence

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Abstract: Under the dual impetus of the in-depth implementation of the "Healthy China" strategy and the accelerated advancement of educational digital transformation, artificial intelligence (AI) technology, with its core advantages in data processing, pattern recognition, and intelligent decision-making, offers a new paradigm and technical support for the innovation of the health and sports governance system in colleges and universities. This paper, taking the theories of collaborative governance, technology empowerment, and health behavior change as the core analytical framework, comprehensively employs methods such as literature research, case analysis, and comparative study to systematically explore the application value and practical forms of AI in core areas such as optimizing physical education teaching in colleges and universities, dynamic monitoring of physical health, health and safety risk prevention and control, and scientific governance decision-making. It deeply analyzes the current practical challenges faced in the process of AI empowering the health and sports governance in colleges and universities, including insufficient technical adaptability, prominent data security risks, ambiguous algorithmic ethical boundaries, and poor coordination among multiple stakeholders. Based on the principle of combining problem orientation with goal orientation, it proposes practical paths from four dimensions: technology research and development and iteration, institutional system construction, ethical norms improvement, and innovation of collaborative mechanisms among multiple subjects, including building a dedicated intelligent governance platform for colleges and universities, improving the full-process data governance system, establishing a dynamic ethical review mechanism, and creating a multi-party collaborative network, to enhance the precision, intelligence, and scientific level of health and sports work in colleges and universities.

Keywords: Artificial Intelligence; College Physical Ecation; Health and Sports Governance; Technology Empowerment; Data Governance; Collaborative Mechanism.

1. Introduction

The "Healthy China 2030" Planning Outline explicitly sets forth the strategic requirement of "strengthening school physical education and promoting the coordinated development of cultural learning and physical exercise among teenagers", elevating the work of physical health and hygiene in colleges and universities to a strategic height that concerns the future of the country and the rejuvenation of the nation. As an important base for cultivating high-quality talents, colleges and universities bear the significant mission of providing young students with high-quality physical health and hygiene services and fostering healthy lifestyles. However, the current governance system for physical health and hygiene in colleges and universities in China still faces many deep-seated difficulties, which are unable to meet the diverse and personalized health needs of students in the new era. In the physical education teaching process, the traditional "one-size-fits-all" standardized teaching model still dominates. Teachers often conduct teaching based on a unified teaching syllabus and movement norms, making it difficult to accurately capture the differences among students in terms of physical fitness, motor ability, and interest preferences. This results in some students with weaker physical fitness being unable to keep up with the teaching pace, while students with better athletic

talent cannot receive targeted improvement, significantly reducing the teaching effectiveness [1]. In terms of physical health monitoring, most colleges and universities still rely on the traditional model of regular centralized testing. Data statistics and analysis mainly depend on manual entry and simple aggregation, which is not only inefficient but also prone to data errors. Moreover, the analysis dimensions are mostly limited to basic indicators such as height, weight, and endurance, making it difficult to achieve dynamic tracking and in-depth analysis of students' physical health conditions.

The breakthrough development of artificial intelligence technology and its deep penetration into various fields provide strong technical support and new ideas for solving the governance predicaments of physical health and hygiene in colleges and universities. In recent years, the application scenarios of artificial intelligence in the sports field have been continuously expanding, from performance analysis, training plan optimization to health status monitoring, and its technical value has become increasingly prominent. The related market size has shown an explosive growth trend. Its core capabilities such as data mining, deep learning, and real-time feedback can effectively make up for the shortcomings of the traditional governance model in data processing, personalized services, and risk warning. Systematically sorting out the theoretical logic of artificial intelligence empowering the governance of physical health and hygiene in colleges and universities, summarizing practical experiences, analyzing real challenges, and proposing optimization paths is not only an inherent requirement for implementing the "health first" educational concept and promoting the high-quality development of physical health and hygiene work in colleges and universities, but also an inevitable choice to adapt to the trend of educational digital transformation and enhance the modernization level of college governance.

This paper, supported by multi-disciplinary theories, constructs a fusion analysis framework of artificial intelligence and the governance of physical health and hygiene in colleges and universities, explores the internal mechanism and realization path of technology empowerment, which can enrich the cross-disciplinary research results of educational technology, sports management, public management, and other related disciplines, provide new theoretical perspectives and research paradigms for technology-empowered educational governance and health governance, and promote the deepening and expansion of theoretical research in related fields. This paper, combining the actual cases of multiple colleges and universities, proposes specific and operational artificial intelligence application plans and optimization strategies for core scenarios such as physical education teaching, physical health monitoring, and health and hygiene prevention and control in colleges and universities, which can provide decision-making references for the management departments of physical health and hygiene in colleges and universities.

2. Theoretical Foundation of AI-Enabled Health and Wellness Governance in Higher Education Institutions

2.1 Collaborative Governance Theory

The collaborative governance theory was proposed by scholars such as Elinor Ostrom. Its core essence lies in breaking the governance limitations of a single entity and achieving the optimization of governance goals and the enhancement of governance efficiency through the equal participation, resource sharing, responsibility sharing, and collaborative interaction of multiple entities. In the complex system of health and wellness governance in higher education institutions, multiple entities are involved, including the sports department, medical department, student affairs department, information technology department, student groups, and technology service providers. Each entity has different resource advantages and governance responsibilities [2]. Under the traditional governance model, the fragmented state among these entities often leads to problems such as waste of governance resources, poor information transmission, and delayed service response. The introduction of AI technology provides a technical link and platform support for building a collaborative governance network among multiple entities. Through an AI intelligent governance platform, data from the sports department's physical fitness tests, the medical department's health records, the student affairs department's basic student information, and students' self-reported data on their exercise and health can be

efficiently circulated and shared across departments and entities, breaking the traditional "information silo" dilemma. Smart terminal devices provide personalized health service access points for students, transforming them from passive recipients of governance to active participants. Technology service providers offer stable technical support for the governance process through continuous algorithm optimization and technological iteration. On this basis, all entities form a governance loop of "data-driven - information sharing - division of labor and collaboration - precise service - feedback and optimization" around the core goal of student health, achieving the optimal allocation of governance resources and the maximization of governance efficiency.

2.2 Technology Empowerment Theory

Modern science and technology have a profound impact on the governance process by reconstructing information acquisition channels, optimizing resource allocation methods, and enhancing the action capabilities of entities, promoting the innovation of governance models and the improvement of governance efficiency. In the health and wellness governance of higher education institutions, the empowerment of AI is not a single-dimensional application of technology, but rather a comprehensive innovation of the governance process through three interrelated and progressive dimensions: data empowerment, algorithm empowerment, and scenario empowerment. Data empowerment is the foundation. AI technology, through various data collection terminals such as smart wearable devices, video capture devices, and online reporting systems, breaks the spatiotemporal and dimensional limitations of traditional data collection, achieving comprehensive, real-time, and precise collection of multi-source information such as students' exercise data, physiological data, and health behavior data. At the same time, through data cleaning, integration, and deep mining techniques, valuable governance information is extracted from massive raw data, providing data support for subsequent precise services and scientific decision-making [3]. Algorithm empowerment is the core. Based on algorithm models such as deep learning and machine learning, AI can analyze and evaluate the collected multi-source data, achieving precise assessment of students' physical conditions,

early warning of exercise risks, and intelligent generation of personalized exercise and health plans, converting data resources into specific governance services and decision-making bases. Scenario empowerment is the guarantee. AI technology is not an abstract application detached from specific scenarios but is deeply integrated with specific governance scenarios such as sports teaching, physical fitness tests, daily health monitoring, and infectious disease prevention and control in higher education institutions. Through the optimization of technology and scenario adaptation, it breaks the spatiotemporal limitations and capability boundaries of traditional governance models, enabling intelligent services to permeate every aspect of students' sports and health lives, enhancing the pertinence and effectiveness of governance.

2.3 Health Behavior Change Theory

The "Knowledge-Attitude-Practice Model" in health behavior change theory posits that the transformation of an individual's health behavior is a progressive process from "knowledge acquisition" to "belief establishment" and then to "behavior practice". Among these, precise knowledge dissemination and positive belief reinforcement are the key links driving behavioral change. In traditional college sports and health education, the dissemination of health knowledge is often carried out through single forms such as classroom lectures and promotional posters, which are difficult to precisely match the individual needs of students, resulting in low efficiency of knowledge dissemination and low acceptance by students, making it difficult to effectively transform into healthy behaviors. The application of artificial intelligence technology provides an effective solution to this problem, enabling precise engagement with each stage of the "knowledge-belief-practice" transformation. At the knowledge acquisition stage, AI collects students' movement and physiological data in real-time through smart devices and generates personalized health reports in forms easily understandable by students, such as visual charts, voice broadcasts, and text interpretations, allowing students to clearly and intuitively understand their physical condition, exercise effects, and potential health risks, thus achieving precise knowledge transmission[4]. At the belief establishment stage, the AI system sets phased

goals based on students' exercise goals and health conditions. When students achieve these goals, they receive positive feedback and incentives such as exercise medals and health points. At the same time, through continuous health monitoring and data comparison, students can directly perceive the improvement in their health conditions, enhancing their confidence and motivation to adhere to healthy behaviors. At the behavior practice stage, the personalized exercise prescriptions and health suggestions generated by AI fully consider students' physical foundations, interest preferences, and living habits, reducing the threshold and difficulty of implementing healthy behaviors, enabling students to easily transform health knowledge and beliefs into daily exercise and health management practices, ultimately achieving a shift from passive cognition of "I should be healthy" to active behavior of "I want to be healthy".

3. Application Status of Artificial Intelligence in the Governance of College Sports and Health

3.1 Personalized Transformation of Physical Education

The traditional college physical education teaching model is often teacher-centered, with uniform teaching content, progress, and evaluation standards. This makes it difficult to take into account the differences among students in terms of physical fitness, athletic talent, and interest preferences, leading to the common problem of "excellent students not being challenged enough and poor students not being able to keep up", which restricts the improvement of teaching quality and the development of students' athletic potential. The in-depth application of artificial intelligence technology has driven a fundamental transformation in physical education from "standardized supply" to "personalized demand", establishing a new student-centered personalized teaching paradigm. During this transformation, many colleges and universities have carried out fruitful practical explorations. The system generates a personalized exercise prescription for each student: for students with insufficient endurance, it designs a "stepwise variable-speed running" training program that gradually increases in intensity based on the student's training feedback; for students with poor

flexibility, it customizes a combination training plan of "dynamic stretching activation + static holding strengthening", clearly specifying the standard requirements and practice duration for each movement; for students with low interest in sports, it recommends specialized sports courses such as basketball, football, and badminton based on their interest preferences, and matches corresponding basic training content[5]. Through this personalized guidance, students' participation in sports and training effectiveness have been effectively enhanced.

3.2 Intelligent Upgrade of Physical Health Monitoring

The traditional college physical health monitoring model mainly relies on regular centralized tests, usually conducted once a semester or a year. This "point-in-time" monitoring method is difficult to comprehensively reflect the dynamic changes in students' physical health and is limited to basic indicators such as height, weight, lung capacity, and endurance running, making it impossible to conduct multi-dimensional and in-depth evaluations of students' health conditions or provide early warnings of potential health risks. As a result, health interventions are often lagging behind the emergence of problems. With the maturation of wearable device technology and the optimization of artificial intelligence algorithms, the monitoring of college students' physical health is transforming towards a direction of "regularization, dynamicization, and early warning", achieving a full-time and multi-dimensional precise control over students' health conditions. Wearable devices such as smart bracelets, sports watches, and smart rings can collect students' heart rate, heart rate variability, sleep duration and quality, energy consumption from exercise, step count, and other multi-dimensional physiological and exercise data in real time. These data are synchronized to the AI health monitoring platform through wireless transmission technologies such as Bluetooth, enabling the continuous accumulation of health data. AI algorithms then conduct in-depth analysis of these massive continuous data, building individual health data models for students. By comparing with the data standards of healthy people of the same age and gender and analyzing the long-term changes in students' own data, potential health problems can be accurately identified. In a related practice by a

research team in Japan, by equipping college students with smart rings and conducting long-term tracking and monitoring of their physiological data, it was found that during high-pressure periods such as exam weeks and job hunting seasons, students' heart rate peaks significantly increased, while heart rate variability showed a decreasing trend[6]. These data changes became important indicators reflecting students' psychological stress states, providing precise data support for schools to carry out targeted group stress intervention and individual psychological counseling.

3.3 Precise Promotion of Health and Epidemic Prevention and Control

As places with a high concentration of people, colleges and universities have a relatively high risk of infectious disease transmission. At the same time, college students are in a critical period of psychological development and face multiple pressures such as academic studies, employment, and interpersonal relationships, with mental health problems becoming increasingly prominent. These all pose higher requirements for health and epidemic prevention and control in colleges and universities. Traditional health and epidemic prevention and control models mainly focus on "post-event handling", lacking forward-looking risk prediction and precise intervention measures, making it difficult to effectively deal with complex and changing health and epidemic risks. Artificial intelligence technology, with its powerful data processing and pattern recognition capabilities, has shown unique advantages in the prevention and control of infectious diseases and mental health intervention in colleges and universities, promoting the transformation of prevention and control work from "passive response" to "active prevention" and from "comprehensive coverage" to "precise targeting". In terms of infectious disease prevention and control, AI epidemic prevention and control systems can integrate multi-source information such as students' travel trajectory data, health declaration data, temperature monitoring data, campus access control data, and national epidemic prevention and control big data. Through algorithm models, these data are comprehensively analyzed to build an infectious disease transmission risk early warning model. This model can accurately identify high-risk groups, such as students who have recently traveled to medium and high-risk areas or have had contact with confirmed cases, and issue risk warnings in a timely manner, providing precise basis for schools to take isolation observation, nucleic acid testing and other prevention and control measures, achieving early detection, early warning, and early handling of infectious diseases, effectively blocking the transmission chain of the epidemic on campus. In daily infectious disease prevention, the AI system can also push targeted infectious disease prevention knowledge to students based on seasonal changes and regional epidemic trends, enhancing students' awareness of self-protection [7]. In terms of mental health intervention, the AI psychological assessment system breaks the limitation of traditional psychological counseling being "passive waiting", achieving active monitoring and assessment of students' mental health conditions through multi-dimensional data collection. This system not only analyzes students' responses in psychological assessment questionnaires but also integrates their exercise data, sleep data, social behavior data, and other indirect information reflecting their mental state. Through natural language processing, sentiment analysis, and other algorithm technologies, it can accurately identify whether students have psychological risk signals such as depression and anxiety. When the system detects that a student is at high psychological risk, it will automatically push the relevant information to the school's psychological counseling center and the student's counselor. The psychological counselor will then contact the student proactively based on the assessment report provided by the system, and carry out one-on-one precise intervention and psychological counseling to effectively reduce psychological risks.

3.4 The Scientific Transformation of Governance Decisions

Traditional governance decisions in college sports and health often rely on the experience of managers, which are prone to be influenced by subjective factors and lack scientific data support. This leads to problems such as weak targeting and poor effectiveness in decision-making. The application of artificial intelligence technology has promoted a fundamental transformation in college sports and health governance decisions from "experience-driven" to "data-driven", enhancing the scientificity,

targeting, and effectiveness of decision-making [8]. The AI data governance platform integrates multi-source data across the entire campus, including student physical fitness test data, sports course enrollment data, classroom participation data, sports field usage data, health monitoring data, and health service consultation data, to build a comprehensive and systematic sports and health database. Based on this database, the AI system uses data visualization technology to present information such as the physical health status, exercise preferences, course demands, and field usage patterns of students of different grades, majors, and genders in intuitive forms such as bar charts, line charts, and heat maps, providing clear and precise decision-making basis for managers.

4. Real Challenges of Empowering College Sports and Health Governance with AI

4.1 Technical Level: Algorithm Limitations and Inadequate Adaptation

Although the application of artificial intelligence technology in college sports and health governance has shown significant advantages, it still faces problems such as algorithm limitations and inadequate scene adaptation at the technical level, which directly affect the application effect and governance quality of the technology. First, the problem of algorithm fairness is prominent. The training data of AI algorithms often comes from specific groups, which may lead to biases in terms of gender, region, ethnicity, etc. If these algorithms are directly applied to the college scene, it may result in unfair service supply. Second, the lack of algorithm interpretability creates a "black box" dilemma. Current mainstream artificial intelligence algorithms, especially deep learning algorithms, have highly complex and concealed decision-making processes, making it difficult for even algorithm developers to fully explain their decision-making logic, thus forming the so-called "algorithm black box". In college sports and health governance, this "black box" problem makes it difficult for teachers and students to understand the basis of the conclusions generated by the AI system, such as exercise prescriptions, health advice, and risk warnings. This uncertainty not only affects the trust and acceptance of AI technology by teachers and students but also makes it difficult to quickly locate the root cause when the algorithm makes errors, increasing

governance risks. Third, the poor scene adaptability makes it difficult to meet personalized needs. Existing AI products are mostly general technical solutions and lack customized development for specific scenarios in college sports and health governance, making it difficult to adapt to the complexity and diversity of college scenes. In sports teaching, for sports with strong confrontation and complex movements such as basketball and football, AI motion recognition systems often fail to accurately capture all key movement details, resulting in low recognition accuracy [9]. For the sports teaching needs of special groups such as disabled students and students with chronic diseases, existing AI systems lack dedicated adaptation modules and are unable to provide personalized teaching and health guidance services that match their physical conditions.

4.2 Data Level: Security Risks and Governance Disorder

Student physical health data contains a large amount of sensitive information, including not only basic personal information such as height and weight, but also biometric information and health records involving personal privacy such as heart rate, blood pressure, genetic test results, disease history, and psychological state assessment. Once this data is leaked or misused, it will cause serious damage to students' personal rights and interests. Relevant studies generally point out that in the process of empowering college sports and health governance with AI, data security risks and governance disorder are prominent, which have become important bottlenecks restricting the application of the technology. First, there are issues of excessive data collection and insufficient informed consent in the data collection stage. Some AI systems introduced by universities collect not only the necessary health data for achieving governance goals but also students' social relationships, consumption habits, and other information irrelevant to sports, health, and wellness governance, leading to waste of data resources and privacy leakage risks. Second, there are security vulnerabilities in the data storage and transmission stages [10]. Some universities lack professional data security management teams and technical equipment. They store student health data in simple database forms without taking effective security measures such as encryption, backup, and access control, making

them vulnerable to cyber threats such as hacker attacks and virus intrusions, which can result in data leakage. During data transmission, some AI systems do not use encrypted transmission technology, posing risks of data interception and tampering when data is transferred from smart terminals to platforms and from internal university platforms to external technology service providers. Third, the lack of unified data governance standards leads to "information silos". Different departments within universities, such as sports, medical, student affairs, and information technology, are responsible for managing different types of data. Each department has developed its own data collection standards, formats, and management norms based on its own work needs, lacking a unified data standard system for university sports, health, and wellness. This makes it difficult for departments to effectively integrate and share data, and AI systems cannot obtain comprehensive and complete data resources for analysis and judgment, thus restricting the full play of the empowering effect of technology.

4.3 Ethical Dimension: Blurred Boundaries and Missing Responsibilities

While artificial intelligence technology brings convenience to the governance of sports, health, and wellness in universities, it also triggers a series of ethical controversies. The problems of blurred ethical boundaries and missing responsibilities are becoming increasingly prominent. If not regulated in time, it may cause damage to students' rights and educational values. First, the risk of over-reliance on technology undermines the humanistic value of physical education. After some universities introduce AI technology, they overly rely on technological means to carry out sports, health, and wellness work, using AI data as the sole basis for evaluating students' sports performance and health status. They ignore students' subjective efforts, emotional experiences, and individual differences. This "technological determinism" tendency may turn physical education into mere data management, undermining its humanistic value in cultivating moral character and shaping a well-rounded personality, which goes against the essence of education. Second, unclear responsibility definitions make it difficult to resolve rights disputes. When problems occur during the application of AI technology, such as

unreasonable AI exercise prescriptions causing student injuries, AI system vulnerabilities leading to student privacy data leakage, and AI psychological assessment errors delaying intervention opportunities, there are no clear and unified standards and norms for defining responsibilities among universities, technology service providers, and teachers. Technology service providers often evade responsibility by claiming that "algorithms are uncertain", while universities believe that technical issues should be borne by service providers [11]. Teachers, as users of the technology, also find it difficult to define their own responsibility boundaries. As a result, when students' rights are infringed upon, it is difficult to identify the responsible party, making it hard to effectively resolve rights disputes. This not only harms students' legitimate rights but also affects the credibility of universities and AI technology. Third, privacy ethics issues infringe upon students' autonomy.

4.4 Collaborative Dimension: Fragmentation of Subjects and Insufficient Capacity

Collaborative governance is the core guarantee for enhancing the governance efficiency of sports, health, and wellness in universities. However, during the process of AI empowerment, the collaborative mechanism among multiple governance subjects has not been established, and the problems of subject fragmentation and insufficient capacity are prominent, restricting the full release of the value of technology. First, there is poor collaboration among departments within universities. The phenomenon of each department operating independently is common, lacking a regular communication and coordination mechanism and data sharing system. The sports department is responsible for physical education and physical fitness tests, the medical department for health services and disease prevention, the student affairs department for daily student management, and the information technology department for technical support. During the application of AI technology, each department often works based on its own work requirements, lacking a coordinated consideration of the overall governance goals [12]. Second, the depth of collaboration between universities and enterprises is insufficient. The cooperation between universities and AI technology service providers mostly remains at the surface level, such as equipment

procurement and system deployment. Technology service providers often only provide standardized technical products and lack in-depth research and customized development for the specific governance scenarios of universities, making it difficult to meet the personalized needs of universities. At the same time, there is a lack of a long-term and stable cooperation mechanism. After the system is delivered, the technology service providers' responses to algorithm optimization, technical upgrades, and fault repairs are not timely, making it difficult to quickly solve problems when they occur. Universities also lack an effective supervision and evaluation mechanism for technology service providers, which cannot guarantee the quality of technical services. This shallow cooperation model makes it difficult to deeply integrate the business needs of universities with the technological advantages of enterprises, restricting the continuous improvement of the application effect of AI technology. Third, the AI application ability of teachers and students is insufficient. As the direct users of AI technology, the AI application ability of some physical education teachers and students cannot keep up with the development needs of technology. Some older physical education teachers are not proficient in operating AI intelligent teaching equipment and data analysis platforms, making it difficult to fully leverage the auxiliary role of technology in teaching. Some teachers lack the ability to interpret data and cannot convert the data analysis results generated by AI systems into specific teaching strategies. Among the student population, some students do not understand the usage methods of AI health monitoring devices and platforms, making it difficult to effectively obtain personalized health services. Some students, due to a lack of health data literacy, have an unscientific understanding of the health advice generated by AI, either blindly relying on it or refusing to accept it, which affects the application effect of the technology.

5. The Optimization Path of Enhancing University Sports Health Governance through Artificial Intelligence

5.1 Technological Optimization: Building an AI Governance System with Precise Adaptation

In response to the current problems of algorithm limitations and insufficient adaptation of AI technology in the governance of sports and health in universities, efforts should be made to strengthen technology research and development and optimization based on the actual needs of universities, and build an AI governance system with precise adaptation to enhance the pertinence and effectiveness of technology application. First, develop university-specific AI models to improve algorithm fairness and adaptability. Universities should collaborate with sports colleges and professional technology enterprises to form an integrated R&D team of industry, academia, research, and application, fully combining the characteristics of the governance scenarios of sports and health in universities and the physical characteristics of student groups to carry out customized AI model development. In terms of training data collection, a diversified and representative data set should be constructed, fully incorporating the relevant data of students of different genders, regions, ethnicities, and physical types, especially paying attention to the physical and health data of special groups such as disabled students and students with chronic diseases, to eliminate data bias and enhance the fairness of the algorithm. In the process of model development, specific needs such as complex movement recognition in physical education teaching, teaching guidance for special groups, and identification of sub-health states and risk warnings in health monitoring should be targeted to optimize the functional modules of the algorithm model and enhance the model's adaptability to university scenarios. Second, enhance the explainability of algorithms to break the "black box" dilemma. The R&D team should adopt explainable AI technologies, such as LIME and SHAP, to decompose and visually present the decision-making process of AI algorithms, enabling the conclusions generated by the AI system, such as exercise prescriptions, health assessments, and risk warnings, to be presented in a clear and understandable manner to teachers and students. At the same time, an algorithm explanation mechanism should be established, with a joint explanation team composed of physical education teachers, school doctors and technical personnel. When teachers and students have doubts about the AI conclusions, they can provide professional explanations and clarifications in a timely manner, enhancing the trust of teachers and students in the technology.

Third, an integrated intelligent governance platform should be created to achieve the deep integration of technology and scenarios. Existing scattered AI teaching systems, health monitoring systems, and prevention and control warning systems should be integrated to build an integrated intelligent governance platform that integrates physical education teaching, physical fitness monitoring, health management, risk prevention and control, and decision support. The platform should have core features such as data sharing, functional linkage, and scenario adaptation, and be able to flexibly call the corresponding technical modules and data resources according to the needs of different governance scenarios.

5.2 Data Governance: Establish a Safe and Standardized Data Management Mechanism

Data is the core resource for artificial intelligence to empower the governance of physical education, health and hygiene in colleges and universities. Strengthening data governance and establishing a safe and standardized data management mechanism is the prerequisite for ensuring the safe and effective application of technology. A governance system covering the entire life cycle of data, from collection to storage, use and destruction, should be established to achieve a balance between data security and value mining. First, standardize the data collection process to protect students' right to know and autonomy. Strictly follow the principles of "minimum necessity" and "informed consent", clearly define the scope and boundaries of data collection, and only collect health and sports data necessary to achieve governance goals [13]. Excessive collection of information unrelated to physical education, health and hygiene governance should be strictly prohibited. Before collecting student data, the purpose, scope, storage period, usage methods, sharing objects and security measures of data collection should be clearly and comprehensively informed to students through written notices, online briefings and other forms to ensure that students are fully informed. A clear authorization mechanism should be established, allowing students to choose the scope and duration of data authorization, and granting students the right to query, correct and delete their own data, to protect students' data autonomy [14]. For example, students can decide whether to use their sleep data for AI

health assessment, can modify their health records at any time, and can apply to delete their personal data when graduating or no longer using related services. Second, strengthen data storage and transmission security and build a technical protection barrier. Colleges and universities should establish professional data security management teams, equip advanced data security protection equipment and technologies, and build a multi-level data security protection system. In terms of data storage, encryption storage technology should be used to encrypt students' sensitive data, classify data security levels, and adopt higher-level encryption and access control measures for core sensitive data; establish a data backup and recovery mechanism, regularly back up data to prevent data loss; use secure and reliable cloud storage services or local servers to store data, choose cloud service providers with good security qualifications, and sign strict data security agreements. Third, unify data standards and break the "information silos"[15]. Led by colleges and universities, experts from the fields of physical education, medical care, and educational informatization should jointly formulate a unified data standard system for physical education, health and hygiene in colleges and universities, clearly defining the index definitions, format norms, classification standards, and quality requirements for data collection.

5.3 Ethical Regulation: Building an Ethical Defense Line for Technology Application

To address the ethical controversies arising from the application of artificial intelligence, it is necessary to establish a sound ethical regulation system, clarify the ethical boundaries of technology application, standardize the behaviors of all parties involved, and build an ethical defense line for technology application to ensure that technological development always serves the goals of education and health. First, improve the ethical review mechanism to achieve full-process ethical supervision. Universities should establish an AI ethical review committee composed of sports experts, ethicists, medical experts, legal experts, student representatives, and teacher representatives, etc., clarify the committee's responsibilities, work processes, and rules of procedure, and conduct ethical assessment and supervision of the research and development, application, and

iteration of AI in the governance of sports, health, and hygiene in universities. During the AI system's research and development or introduction stage, the review committee needs to conduct ethical reviews of the system's technical solutions, data collection methods, algorithm logic, etc., with a focus on assessing whether there are risks such as privacy infringement and algorithmic discrimination; during the system's application stage, regularly monitor and evaluate the application effect and ethical performance of the system, collect feedback from teachers and students, and promptly identify and solve emerging ethical issues; during the system's iteration and upgrade stage, conduct ethical reviews of the upgrade plan to ensure that the application of new functions complies with ethical norms[16]. Establish an ethical review archive system to record the review process, conclusions, and rectification requirements in detail, ensuring the traceability of ethical reviews. Second, clarify the responsibility division standards and establish an equity protection mechanism. Through laws and regulations, rules and regulations, and cooperation agreements, etc., clarify the responsibility boundaries of all relevant parties, including universities, technology service providers, teachers, and management personnel, in the process of AI technology application. As the governance subject, universities bear overall responsibility for the introduction, application, and management of AI technology, responsible for formulating relevant systems, conducting ethical reviews, ensuring data security, and supervising technology application; technology service providers are responsible for the technical security, algorithmic fairness, and functional adaptability of AI systems, and need to provide continuous technical support and upgrade services, and bear corresponding responsibilities for problems caused by technical vulnerabilities; teachers, as technology users, are responsible for using technology correctly, guiding students to use technology reasonably, and promptly reporting technical problems. Establish a mechanism for compensating students for damaged rights and interests. When students suffer from damaged rights and interests due to improper application of AI technology, they can obtain timely and effective compensation through negotiation, arbitration, litigation, and other means. For example, in the cooperation

agreement between universities and technology service providers, it should be clearly stipulated that the service provider shall bear the compensation responsibility and standards for student sports injuries or data leaks caused by algorithm errors [17]. Third, adhere to the essence of education and balance technology application with humanistic care. Universities should establish the concept that "technology serves education", clarify the auxiliary position of AI technology in sports, health, and hygiene work, and avoid technology abuse and over-reliance. In physical education, AI data should be used as an important reference for teaching evaluation rather than the sole basis, fully considering students' subjective efforts, progress, and emotional experiences, and building a diversified evaluation system; in health guidance, combine AI health suggestions with the professional judgments and face-to-face communication of teachers and school doctors, and pay attention to humanistic care and psychological counseling for students. Strengthen AI ethical education for teachers and students through special lectures, course teaching, and publicity posters, popularize AI ethical knowledge, guide teachers to establish a correct view of technology application, cultivate students' awareness of privacy protection and data literacy, and create a good application atmosphere of "technology for good".

5.4 Collaborative Governance: Building a Multi-Subject Interactive Network

Building a multi-subject collaborative governance network is the key to fully leveraging the value of artificial intelligence technology and enhancing the governance efficiency of sports, health, and hygiene in universities. A collaborative governance mechanism characterized by "university-led, multi-party participation, coordinated interaction, and shared construction" should be established, with clear responsibilities for each party, enhanced communication and collaboration, and the formation of a governance synergy [18]. First, internal university collaboration should be strengthened to build an integrated management system. Universities should establish a sports and health intelligent governance leading group headed by university leaders to coordinate the work of departments such as sports, medical services, student affairs, information technology, and finance, and clarify the responsibilities and

collaboration processes of each department in the application of AI technology. A regular joint meeting system should be established, with departments regularly reporting on work progress, sharing data information, and discussing and resolving problems that arise during cooperation. Second, university-enterprise collaboration should be deepened to build a model of cooperation among industry, academia, research, and application. Universities should establish long-term and stable strategic partnerships with AI technology service providers, promoting cooperation to transform from shallow equipment procurement to deep collaborative research and development and joint operation and maintenance. During the cooperation process, universities should fully leverage their professional advantages in the field of sports and health to provide clear business requirements and scenario support to enterprises, and participate in the research and development, testing, and optimization of AI systems; enterprises should fully leverage their technological advantages to conduct customized research and development based on university needs, provide timely technical upgrades, fault repairs, and other services, and regularly conduct technical training for university teachers and students. A mechanism for sharing benefits and risks between universities and enterprises should be established, through joint establishment of research and development centers, joint application for scientific research projects, and joint cultivation of talents, to achieve complementary advantages and mutual benefit and win-win results for both parties [19]. Third, the capabilities of teachers and students should be enhanced to build a governance pattern with full participation. AI application skills training should be incorporated into the regular training system for sports teachers and school doctors, and regular training and skill assessment on the operation of AI intelligent teaching equipment, data analysis platforms, and health management systems should be organized to enhance their technical application and data interpretation capabilities. Enterprise technical experts should be invited to give special lectures to explain the development trends and application skills of AI technology, helping teachers deeply integrate AI technology with teaching practice. For the student group, through various forms such as sports courses, health lectures, and campus publicity, education activities on the use of AI

health equipment, interpretation of health data, and privacy protection should be carried out to enhance students' AI application capabilities and health literacy [20]. A feedback mechanism for teachers and students should be established, through online questionnaires, suggestion boxes, and symposiums, to collect problems and suggestions from teachers and students during the application of AI technology, providing references for technology optimization and governance improvement, and fully mobilizing the enthusiasm and initiative of teachers and students in participating in the governance of sports and health in universities, forming a good pattern of full participation and joint governance.

6. Conclusion and Outlook

6.1 Research Conclusions

Based on the theories of collaborative governance, technology empowerment, and health behavior change, this paper systematically explores the theoretical logic, application status, practical challenges, and optimization paths of AI-enabled governance in university sports and health. Through the research, the following conclusions are drawn: AI technology, through data empowerment, algorithm empowerment, and scenario empowerment, has demonstrated significant value in promoting the personalized transformation of university sports teaching, the intelligent upgrade of physical health monitoring, the precise advancement of health and epidemic prevention, and the scientific transformation of governance decision-making, providing a new technical path and implementation method for university sports and health governance, and serving as an important support for implementing the "health first" educational concept and promoting the digital transformation of education. However, there are still multiple challenges in the current AI-enabled process: at the technical level, there are issues such as the lack of algorithm fairness, insufficient explainability, and poor scene adaptability; at the data level, there are prominent security risks and governance disorder; at the ethical level, there are controversies such as technology dependence, unclear responsibility definition, and privacy infringement; at the collaborative level, there are problems such as fragmented subjects and insufficient application capabilities. To address these challenges, it is necessary to construct a systematic solution from four dimensions:

technology, data, ethics, and collaboration. Technological systems can be optimized by developing dedicated AI models, enhancing algorithm interpretability, and building an integrated platform. Data governance can be improved by standardizing data collection, strengthening security protection, and unifying data standards. Ethical lines can be fortified by establishing review mechanisms, clarifying responsibility divisions, and adhering to the essence of education. A collaborative network can be built by enhancing internal coordination, deepening school-enterprise cooperation, and improving the capabilities of teachers and students. The comprehensive implementation of these measures can promote the deep integration of AI and the governance of sports, health, and hygiene in colleges and universities, transform the governance model from "technology-driven" to "value-driven", and enhance the precision and intelligence of governance.

6.2 Future Outlook

Although this paper has conducted a relatively systematic study on the empowerment of AI in the governance of sports, health, and hygiene in colleges and universities, there are still certain limitations. Future research can be further deepened in the following three directions: First, research on the integrated application of technologies. Current studies mostly focus on the single application of AI technology. In the future, the integrated application scenarios of AI with emerging technologies such as virtual reality, augmented reality, Internet of Things, and big data can be explored. Second, research on empirical effect evaluation. Existing studies are mostly based on case analysis and theoretical deduction, lacking long-term and systematic empirical data support. In the future, panel data-based empirical research can be conducted, selecting multiple types of colleges and universities as research objects, and conducting long-term tracking and monitoring of the implementation effects of AI intervention measures. The actual effects of AI technology application can be evaluated from multiple dimensions such as students' physical health indicators, participation in sports, health behavior habits, and mental health status, providing more powerful empirical evidence for the optimization and promotion of technology application. At the same time, quantitative research methods can be used to analyze the differentiated impacts of different intervention measures on different groups of students, enhancing the scientificity and pertinence of research conclusions. Third, research on the governance of special groups. Current research pays insufficient attention to special groups such as students with disabilities, chronic diseases, and ethnic minorities. In the future, the research perspective can be focused on these special groups, deeply analyzing their unique needs for sports, health, and hygiene, and exploring the application paths and optimization strategies of AI technology in meeting the needs of special groups. With the continuous development of AI technology and the improvement of relevant laws and regulations, new issues and challenges in the application of AI technology in the governance of sports, health, and hygiene in colleges and universities can also be paid attention to in the future, such as algorithm anti-monopoly and cross-border data flow, providing continuous theoretical support for the healthy and orderly application of technology.

References
[1] Shen Shunfa. Research on the Construction and Intervention of the Health Management System in Colleges and Universities.Journal of Hebei Institute of Physical Education, 2021, 35(6): 67-73.
[2] Xi Weijie. On the Importance of Sports Hygiene in University Sports. Contemporary Sports Technology, 2023, 3(32): 172-174.
[3] Xie Dongxing and Xu Bin. Research on the Reform Ideas of College Sports Based on Structural Function and Spatiotemporal Perspective. Journal of Beijing Sport University, 2023, 39(9): 105-110.
[4] Jiang Weifen, Jin Zongqiang, Yu Nan, et al. Investigation and Analysis of the Current Situation of Follow-up Services for College Students' Physical Health: From the Perspective of Evaluation and Diagnosis . Journal of Hebei Institute of Physical Education, 2022, 32(1): 49-54.
[5] Yang Chuanchuan. Sociological Analysis of

the Decline in College Students' Physical Fitness. Sports Culture Guide, 2025(8): 145-148.

[6] Liu Xin, Luo Xu, Zhang Li, et al. Research on College Students' Self-assessment of Physical Health and Its Influencing Factors . Journal of Chengdu Sport University, 2022, 36(1): 76-80.

[7] Cheng Zhili. Research on the Innovation of College Sports Governance Model under the Background of Smart Campus. Journal of Nanjing Sport Institute, 36(8): 1-8.

[8] Lyu Li, Li Weiguo, Bian Yu. Evaluation and Analysis of the Implementation Effect of the "National Student Physical Health Standard (Revised Edition 2014)": A Case Study of Colleges and Universities in Guangdong. Journal of Guangzhou Sport University, 2025, 37(2): 4-12.

[9] Ji Jiancheng. Research on the Reform of College Sports Teaching Evaluation Empowered by Intelligent Technology. Chinese Journal of Education, 2024, (9): 92-97.

[10] Wang Jian, Li Weidong. Smart Sports: Application and Development of Artificial Intelligence Technology in the Field of Sports. Journal of Sports Science, 2023, 43(5): 4-15.

[11] Wang Le. Design and Practice of a Mental Health Service Platform for Colleges and Universities Based on Artificial Intelligence. Modern Educational Technology, 2025, 31(6): 112-118.

[12] Ma Guanzhao. Construction of an Intelligent Monitoring and Intervention System for Students' Physical Health Based on Big Data.

China Educational Technology, 2025, (7): 118-124.

[13] Hu Binxiang, Zhao Qiushuang. Research on the Application of Artificial Intelligence in Mental Health Education for College Students. Education Research and Experiment, 2023, (3): 90-95.

[14] Mao Zhenming. Research on the Innovation of College Sports Teaching Models in the Intelligent Era. Journal of Beijing Sport University, 2025, 43(4): 112-120.

[15] Huang Hansheng. Research on the Construction of an Integrated Management System for Physical Health and Hygiene in Colleges and Universities. Journal of Sports Science, 2023, 28(3): 1-6.

[16] Yu Shengquan, Li Xiaoqing. Key Paths and Practical Strategies for Empowering Education with Artificial Intelligence. China Educational Technology, 2025, (12): 1-10.

[17] Wang Kaizhen. Research on the Socialized Service of College Sports Resources under the Background of National Fitness. Journal of Chengdu Sport University, 2022, 49(4): 23-30.

[18] Yang Hua. Theoretical and Practical Exploration of Improving the Quality of College Sports Education. Journal of Sports Science Research, 2021, 24(2): 1-7.

[19] Li Yanling. Construction of a Risk Prediction Model for Sports Injuries Based on Deep Learning. Journal of Sports Science Research, 2025, 25(4): 54-61.

[20] Wang Huiru. Innovation of College Students' Health Management Model Driven by Big Data. China Education Informatization, 2024, (11): 78-83.