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APPLICATION OF MOTION CAPTURE TECHNOLOGY IN BIOMECHANICAL RESEARCH OF MASSAGE TECHNIQUES

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Abstract: Massage manipulation is a commonly used clinical treatment method, but there is a lack of simple, intuitive, and highly visual research methods. There are various forms of operation of the same technique, with varying effects. Motion capture technology can track the motion trajectory of marked objects in three-dimensional space, and analyze their motion patterns by collecting, recording, and measuring the kinematic and biomechanical parameters of the objects. The emergence of this technology makes it possible to quantify factors such as the size, direction, time, and speed of force in manual operations. It also makes the research on massage techniques shift from subjectivity and experience to standardization, visualization, and objectification, and becomes the basis for massage techniques. It has laid an extremely important foundation for its clinical promotion and inheritance.
Keywords: Massage; Manipulation, Orthopedics; Motion capture technology; Biomechanics

1 OVERVIEW OF MOTION CAPTURE TECHNOLOGY

The human body is a complex and delicate system, with a level of sophistication and coordination unmatched by any other biological machinery. This also makes it extremely difficult to obtain human body motion parameters. With the advancement of science and technology, biomechanical technology is used to study detailed mechanical information during human movement or movement, and combining experimental measurements with theory makes it relatively simple to obtain various movement parameters of the human body. Motion capture technology, also known as motion capture technology in China, refers to a process of recording biological motion by tracking the motion of some key points in the time domain, and then converting it into a usable mathematical expression and synthesizing a separate 3D motion [1]. Motion capture technology has been widely used in biomechanical research on the physiology and pathology of human skeleton and other systems. Massage manipulation is one of the commonly used and effective clinical treatment methods. However, many of these manipulations lack simple, intuitive, and highly visual research methods. Most clinicians only rely on personal experience to grasp the direction, intensity, time and other factors of manipulation, resulting in The same technique is used in various ways, with varying effects. The emergence of motion capture technology makes it possible to quantify the force, direction, time, speed and other factors in manual operations, and also lays the foundation for the standardization of manual operations. This article provides an overview of the research progress of motion capture technology in the field of massage manipulation biomechanics. The summary report is as follows.

Motion capture technology was proposed by psychologist Johansson in the Moving Light Display experiment in the late 1970s [2]. Subsequently, the technology continued to develop and improve, and was gradually used in many fields. There are many types of motion capture technology, which can be classified according to real-time performance, location, application angle, working principle, etc. Currently, the more commonly used classification methods are based on working principles, which can be divided into five types: mechanical motion capture, electromagnetic motion capture, acoustic motion capture, optical motion capture and video-based motion capture. Among them, the optical motion capture system uses a high-resolution infrared camera to capture the motion information of key points on the surface of the research object at high speed, and through real-time or post-processing, the digital motion trajectory of the research object can be accurately obtained. With its advantages of flexibility and efficiency, motion capture systems have currently been applied in research in biomechanics, ergonomics, simulation training and other fields [3-4].

Motion capture technology can track the motion trajectory of marked objects in three-dimensional space, and analyze their motion patterns by collecting, recording, and measuring the kinematic and biomechanical parameters of the objects. When the motion capture system obtains the parameters of the human skeletal system, the human body is usually understood to be composed of 15 to 20 joint points [5]. It is measured by placing marking points on the subject's body surface and capturing the marking points on the subject's body surface. The position and movement direction of the human body in space. After real-time or post-processing of this movement information, the movement parameters of the described object can be obtained. This provides favorable conditions for in-depth study of the biomechanical mechanism of manipulation and assessment of the safety of the manipulation [6].

2 APPLICATION OF MOTION CAPTURE TECHNOLOGY IN BIOMECHANICAL RESEARCH ON CERVICAL SPINE AND UPPER LIMB MANIPULATION

Guo Xin et al. [7] used a high-speed infrared motion capture system and a force plate to obtain the kinematics and motion mechanics parameters of the operator's manual therapy during the cervical spine extension and traction maneuver on subjects. Through research, they believed that The kinematics and motion mechanics parameters of the

cervical spine extension technique have certain regularities, which plays an important role in the clinical promotion and standardization of this technique. When Feng Minshan et al. [8] studied Professor Zhu Liguo's cervical spine rotation lifting technique, they used motion capture technology to conduct dynamic capture and recording, and obtained the important motion mechanics and kinematic parameters during the implementation of the technique, and used the obtained rotation lifting technique. The movement trajectory of the manual operation is displayed in the form of an animated video. The results show that: the pulling direction of the cervical spine rotation lifting method is mainly vertical and upward, provided that the neck muscles are fully relaxed, and the key points of the pulling action are "fast speed and small amplitude". Ryu et al. [9] used 3D motion capture technology and pressure sensors to study the pressure pattern and finger movement trajectory of the operator's hand when massaging the neck and shoulders (trapezius, levator scapulae and deltoid muscles). The results showed that: During the massage process Each muscle is subject to different pressures, and the movement trajectories of the surgeon's fingers are also different. The trapezius muscle bears greater pressure, longer massage time, and greater pressure time integration than other muscles. Deng Zhen et al. [10] studied the cervical spine rehabilitation procedures in Shi's Department of Traumatology. By analyzing and summarizing the motion data of the shoulder, elbow, knee and ankle joints collected by the three-dimensional motion capture system, they believed that during the manipulation process The patient's lower limb joints need to remain stable. If the ipsilateral knee joint flexion and extension can be used to coordinate the upper limb to exert force, better results can be achieved. When Zhu Liguo et al.[11] studied the cervical spine rotation technique, they used body mechanics technology to obtain a series of data such as the preload force, maximum force, and pulling force of the technique, and also used a motion capture system to obtain the operation of the technique. Motion trajectories and motion mechanics parameters. After analysis, it is believed that there is no significant difference in the force characteristics of the operation between the left and right hands, and the difference in the cervical spine rotation operation technique is related to the body mass index; there is a correlation between the size of the preload force and the size of the pulling force. With the preload As the force increases, the pulling force also needs to increase accordingly. Geng Nan et al. [12] conducted a preliminary quantitative and objective study on the operating characteristics of the cervical spine positioning and rotational pull method, and used a motion capture testing system to collect the kinematic parameters of the operator and subjects during the manual operation. The results showed that: In the pulling phase, the average forward flexion angle of the subjects was about 3.73°, the average lateral flexion angle was about 0.5°, the average rotation angle was about 10.2°, and the instantaneous pulling time was about 0.101 6 s. It is considered that This technique is a comprehensive process of forward flexion, lateral flexion and rotation of the cervical spine. Wang Pingping[13] studied the motion trajectory characteristics of the frozen shoulder joint under the intervention of the three -dimensional dynamic stretch and rotation method, and used a motion capture system to quantify the average angular velocity, maximum angular velocity, maximum angular acceleration of the glenohumeral joint and the amplitude of the frozen shoulder. Analysis, the results show that: compared with the across-body adduction-external rotation method and the abduction-internal rotation method, the average angular velocity, maximum angular velocity, and maximum angular acceleration of the frozen glenohumeral joint under the intervention of abduction-stretching method are smaller; when limiting humeral rotation When the ligament is tense, the rotation angle of the humerus on the affected side is within the range of angles that can be achieved by humeral rotation. Lu Jie et al.[14] studied the one-finger meditation technique through motion capture technology combined with the FZ-1 Traditional Chinese Medicine Massage Technique Dynamometer Analyzer. They collected the kinematic parameters during the operation of these two techniques, and based on the characteristics of these parameters, they successively A 4-member, 5-node one-finger meditation biomechanical model and a simple biomechanical model including the hand, ulna and radius were established. At the same time, the force of each force-bearing part during the manual operation was calculated.

3 APPLICATION OF MOTION CAPTURE TECHNOLOGY IN BIOMECHANICAL RESEARCH ON LUMBAR SPINE MANIPULATION

Triano et al. [15] used a motion capture system to study mechanical parameters such as preload force, pulling time and speed during manual operation, and proposed the mechanical parameters of the "high-speed and low-amplitude impact technique" for the lumbar spine. In order to explore the mechanical mechanism of rotational manipulation on intervertebral discs, Zhang Jun et al.[16] used the Motion motion capture system to collect the left-right rotation, flexion -extension, and lateral bending angular displacement of the vertebral body in 12 cases of lumbar intervertebral disc pathological conditions. The results showed that rotational manipulation is used to treat lumbar disc herniation. The mechanical mechanism of the disease is the conjugate motion of the spine, and rotation techniques have inconsistent effects on the forces acting on different vertebrae. When Wang Wei et al. [17] studied the kinematic rules and mechanisms of Wei's traumatology techniques of "suspended foot pressure knee" and "waist lift" in the treatment of lumbar disc herniation, a three-dimensional motion capture system was used to collect the subjects' movements during the operation of the techniques. Based on the scientific data, the relative movement angles of the hip, knee and ankle joints, as well as the flexion (extension), abduction (adduction) and axial rotation of each joint are calculated, and the average movement angle and trajectory pattern of the joints are calculated. When studying the seated lumbar rotation technique, Gao Chunyu [18] used motion capture technology to obtain more detailed kinematic parameters, and believed that the preload force, maximum force, rotation force and other kinematics of the left and right hands when performing the seated lumbar rotation technique There is no significant difference in the parameters, and there is a positive correlation between the preload force and the turning force during the operation of this technique.

4 CONCLUSION

In short, the application of motion capture technology in the biomechanical research of massage techniques has solved the problem of kinematic analysis of massage techniques and accelerated the progress of biomechanical research on massage techniques. It has also transformed the research on massage techniques from subjectivity and experience to standardization, visualization and objectification, laying an extremely important foundation for the clinical promotion and inheritance of massage techniques.

Although motion capture technology has been widely used in the study of human biomechanics, there are still many problems with this technology: ① The sample sizes of existing studies are small, and they fail to strictly follow the basic principles of clinical trials and fail to control Good at non-processing factors such as gender, age, race, height, body mass, etc.; ②The motion capture system and data analysis and collection system are relatively complex, the processing speed of high-dimensional data is slow, and there are perspective occlusions and skin marks in modeling, simulation and motion analysis. Movement errors and other factors that affect the research results [19]; ③ In complex and diverse scenes, the problem of automatic separation of people and backgrounds will occur, and multi-person motion capture technology is still not perfect [20]. However, I believe that with the development of modern technology, motion capture technology will definitely break through many limitations, continue to improve, and solve more problems in the biomechanical research of massage techniques.

COMPETING INTERESTS

The authors have no relevant financial or non-financial interests to disclose.

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AN EXAMINATION OF THE SUSTAINABLE ENHANCEMENT OF MIGRANT WORKER SPORTS

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Abstract: This paper mainly uses literature and survey methods to describe and analyze the current situation of migrant workers' sports in China. The results show that migrant workers have weak physical health awareness, monotonous forms of physical exercise, strong randomness in physical exercise, and poor integration of physical exercise. This phenomenon has both internal and external reasons. Recommendations: Give full play to the functional role of government departments, strengthen the sports awareness of migrant workers, mobilize social forces to care for migrant workers' sports, coordinate the development of migrant workers' sports, and pay attention to the sports of the new generation of migrant workers.
Keywords: Migrant workers' sports; Current situation; Countermeasures

1 CURRENT STATUS OF MIGRANT WORKERS' SPORTS DEVELOPMENT

As the largest and most complex group that has moved from rural areas to cities in the process of social change, migrant workers have attracted more and more attention from all walks of life. The National Statistics Department pointed out in the "2017 Migrant Workers Monitoring Survey Report" released in early 2018 (hereinafter referred to as the "Survey") that the total number of migrant workers throughout the motherland in 2017 reached 286.52 million. [1] Roughly calculated, accounting for approximately 20% of the country's total population. In today's China, driven by the Beijing Olympics, the sports industry is booming and its influence around the world is growing. However, there are still many imbalances, and migrant workers' sports are one of them. Under the current social reality in our country, migrant workers have been wandering between rural and urban areas for a long time, and their mobility is high. Therefore, their sports status is also in a blind spot, which is also a shortcoming in the development of mass sports and national fitness. Building our country into a democratic, civilized, modern and powerful country is the development strategy of the new century, and migrant workers are both builders and witnesses, and they should be beneficiaries.
The number of migrant workers across the country is constantly increasing, and migrant workers in most areas are in a stable export state. This is the general trend of social development. Improving the physical and intellectual level of migrant workers is not only beneficial to migrant workers, but also conducive to the construction of beautiful cities. As a Chinese citizen, everyone enjoys the right to sports, which is also a basic health right. However, the survey found that the reality is quite different from the ideal.

1.1 Migrant Workers have Weak Sports and Health Awareness

The body is the capital of revolution, but migrant workers have weak sports awareness. The long-term working style in rural areas has caused migrant workers to lack the awareness of exercise and a life philosophy of working and resting with the sunrise and sunset. Even in their free time, they will not engage in physical exercise. When migrant workers face the new urban environment, they will not regard sports as a habit.

1.2 The Form of Physical Exercise for Migrant Workers is Monotonous

Studies have shown that most of the new generation of migrant workers participate in equipment and consumer sports activities, while the older generation of migrant workers are accustomed to doing bare-handed exercises. On the whole, not spending money or spending less money is also the basic principle of physical exercise for migrant workers. Especially for older migrant workers, their exercise always lacks scientificity and rationality. In terms of sports form, there is no organization or discipline, technical movements are irregular, and there is a lack of passion and motivation. It is more like playing to kill time rather than promoting physical health.

1.3 Migrant Workers' Physical Exercise is Highly Arbitrary

The "Survey" pointed out that due to the constraints of overtime and shifts, coupled with the huge labor load, instability has been brought to migrant workers' sports. Migrant workers are always on the edge of the city. Although they are large in scale, it is difficult to organize large-scale sports activities due to different commuting times and scattered living areas. Randomness has become a major feature of migrant workers' sports. Some migrant workers only participate in sports once every few months or even half a year, and some exercise for several hours at a time. They lack reasonable control over the load and the correct selection of projects. This kind of arbitrariness It will bring about a series of safety hazards and even cause physical damage.

1.4 Migrant Workers have Poor Integration into physical Exercise

The poor integration of physical exercise among migrant workers is mainly due to the following reasons: First, due to economic constraints, as migrant workers, their own income is low and they can no longer afford non-essential sports consumption; secondly, their lower educational level makes them less interested in physical exercise. Low attention to health and lack of attention to health naturally restricts the development of sports; finally, the lack of acceptance in cities is also the biggest obstacle to the development of sports for migrant workers. Sports in cities are mostly group-based, disciplined and organized activities., and it is difficult for migrant workers to participate. Although there are some free sports resources, identity issues still restrict their sports participation [2].

2 ANALYSIS OF THE REASONS FOR THE CURRENT SITUATION OF MIGRANT WORKERS' SPORTS

The Olympic Games, Asian Games, World Championships and other large-scale events have been held in our country one after another, which not only increased people's enthusiasm for participating in sports, but also changed people's traditional understanding - sports are not only about competing for gold and silver on the field, but also in daily life. component. Our country is currently in a period of rapid economic growth. After people have become accustomed to a rich material life, they begin to pay attention to their health. "Buying health" and "giving health" have gradually become popular. In the face of the people's surge in sports enthusiasm, the national administrative department has also promulgated a number of policies and regulations to protect the people's sports rights. However, the sports status of migrant workers who contribute to urban construction is very different from the current sports development [3].

2.1 Obstacles from National Systems

Starting from the "Household Registration Regulations" promulgated in the 1950s, our country's government strictly controlled the urbanization development of the rural population, thus forming an urban-rural binary system. Under such a system, the economic level, welfare benefits and public resources between urban and rural areas A growing gap has arisen. Among public resources, the government has long provided preferential expenditures to urban residents who account for 37% of the population, with numerous explicit and covert fiscal subsidies. The same is true for public sports facilities. Cities are rich in resources, but rural areas are quite lacking in equipment, venues, funds, etc. The living environment of villagers generally lacks sports facilities, and their cultural level is generally low, resulting in their weak sports awareness and information acquisition ability. There are few methods and ways to participate in exercise. Even if they enter the city, they lack the ability to rationally utilize the abundant sports resources, and the household registration system is the basis for residents to enjoy public resources. Compared with urban residents, migrant workers lack the right to enjoy public resources [4].

2.2 Deviations in Urban Policies

Due to various policy reasons, the rural economy lags far behind that of the city, and the income gap between urban and rural areas is large. Stimulated by high income and a better life, villagers choose to develop in cities, hoping to change the status quo. As migrant workers continue to enter the city, more and more public resources are occupied, but resources are limited, and urban resources are difficult to improve in the short term. Therefore, the emergence of migrant workers has increased the burden on the city and may bring The quality of life and happiness of urban residents are reduced. For the benefit of urban residents, urban administrative departments will promulgate a series of policies to raise the entry threshold and reduce the number of migrant workers to alleviate the strain on public resources caused by the increase in the number of migrant workers.

2.3 Discrimination among Urban Residents

With the development of urbanization, many migrant workers move out with their families, not only their spouses, but also their children and parents. This migration takes up a lot of urban space and resources, and has an impact on the lives of urban residents. This impact Will lead to reduced social welfare. The cultural differences between urban residents and migrant workers have led to a lack of effective communication between the two, creating a gap between them. Therefore, migrant workers are often discriminated against by urban residents, and they are restricted from using public resources such as sports facilities.

2.4 Indifference of Business Units

Although the country currently vigorously advocates a harmonious society, there are still some companies that lack a sense of responsibility. They purely pursue economic interests, regard migrant workers as money-making machines, and ignore their basic rights. Studies have shown that the monthly and daily workload of migrant workers exceeds the legal working hours, and this phenomenon has no tendency to alleviate, which also results in migrant workers having no time to exercise. Moreover, migrant workers are mostly engaged in long-term, high-intensity industries, such as construction and manufacturing, so they are unable to do physical activities.

2.5 Weakness of Own Culture

The higher a person's educational level, the deeper his understanding of sports will be. Previous research has also proven that participation in physical exercise is highly correlated with academic qualifications. In rural areas, due to the lack of various conditions and the lack of rural physical education, migrant workers lack sports knowledge and skills. Even when they face a variety of fitness facilities in the city, they lack the consciousness to participate.

2.6 Lack of Professional Skills

Most of the migrant workers who go out to make a living only have a junior high school education, and few have a high school degree or above. This is an important reason why migrant workers lack vocational skills. This also leads to the fact that most of them can only engage in manual labor, such as construction, services, manufacturing, etc. The industry requires little mental labor and requires low professional skills, and the remuneration they receive is also relatively low. Although the administrative departments have formulated relevant policies in recent years and the wages of migrant workers have increased, this increase is far lower than the increase in urban prices. The purchasing power of migrant workers has not increased but declined. The reality is that migrant workers spend their basic living expenses Consumption on basic necessities (food, clothing, housing and transportation) is still high, while other consumption expenditures (medical care, sports) are relatively low. In addition, many cities currently adopt a point settlement system, and the lack of vocational skills of migrant workers makes it difficult for them to obtain urban household registration. This point system usually includes a series of indicators, mainly the number of years of participating in social security, the number of years of residence in the city, real estate and Jobs, etc., migrant population must meet a certain score in this series of conditions before they can apply for urban household registration. However, most migrant workers are unable to achieve this, because this reform plan is mainly aimed at highly skilled and highly educated talents, and the cultural level and vocational skills of migrant workers Therefore, it is very difficult for them to "register", which also leads to the inability to enjoy public resources equally.

3 ANALYSIS ON THE DEVELOPMENT STRATEGIES OF MIGRANT WORKERS' SPORTS

3.1 Give Full Play to the Functions of Government Departments

Since the 1990s, the country has promulgated a number of policies and regulations related to national fitness. Especially after Beijing's successful bid for the Olympics, the Chinese government's support for sports activities has reached an unprecedented level. For migrant workers' sports, the government defines them as "migrant workers" and "vulnerable groups" in some articles. However, in actual implementation, due to the issue of attribution of responsibilities, migrant workers' sports rights cannot be guaranteed. This flaw is serious. Restricting the construction process of national fitness. Xi Jinping once pointed out in the two sessions that "we should work in areas where the people feel unhappy and unhappy." In the process of building socialism with Chinese characteristics in the new era, one of the government's responsibilities is to pay attention to and protect the sports rights of migrant workers.. During the organization and implementation process, the government's sports services should be extended to migrant workers, and relevant departments should clarify and standardize migrant workers' sports laws and policies to safeguard the vital interests of migrant workers; the units where migrant workers work should formulate specific physical exercise content, time, units and individuals that fail to perform should be severely punished and held criminally responsible. Continuously improve the relevant systems of migrant workers' sports, and with the joint efforts of the government and sports administrative departments, put migrant workers' sports on the right track, promote the comprehensive development of national fitness, and contribute to the early realization of our country's dream of becoming a sports power [5].

3.2 Strengthen the Sports Awareness of Migrant Workers

Weak self-awareness is a major obstacle restricting the development of migrant workers' sports. A good body can not only improve the quality of work, but also help improve work efficiency. From a macro perspective, it can create greater benefits for enterprises, promote economic growth, and create a good living environment; from a micro perspective, it can increase the income of migrant workers, which is conducive to personal development and family stability. The health of migrant workers is of great significance to the country and the well-being of their families. Studies have shown that the health status and educational level of migrant workers largely determine their sports awareness and needs. When conditions (time, economy) permit, the higher the health level and educational level, the greater the sports demand. The stronger. However, the "Survey" pointed out that the education level of migrant workers in my country is low, which directly affects their attitude towards health and sports awareness, leading to a self-isolated status quo, which leaves both body and mind in a sub-healthy state. To change this, first, break through ideological bottlenecks, give migrant workers maximum humanized care, pay attention to their emotional needs, let migrant workers have more access to health knowledge, get rid of the misconception that migrant workers do not need sports, and establish " Secondly, the sports administration department should work with business units to provide migrant workers with free subscriptions to sports magazines and newspapers. If possible, electronic reading rooms can be provided for migrant workers to stimulate migrant workers through reading. to meet their sports needs and improve their cultural accomplishment; thirdly, regularly conduct sports skills training for migrant workers to help them master

certain fitness methods and methods; finally, regularly organize migrant workers' sports activities every year, such as basketball games and football games. Games, badminton games, track and field games, etc., through competitions to increase the enthusiasm of migrant workers to participate in sports and enable them to consciously develop the habit of exercising [6].

3.3 Use Social Forces to Care for Migrant Workers' Sports

Reasonable physical activities can not only strengthen the body and enrich spiritual life, but also release people's mental pressure and enhance the relationship between people. Migrant workers have worked hard for the construction of the city. They are also part of the city and should enjoy all reasonable sports rights. However, in the process of urbanization of migrant workers, due to differences in industry, behavior, culture, etc., they have suffered from indifference from many "city dwellers", unfair treatment from employers, and even wage arrears. In the process of creating a harmonious society and In the process of building a beautiful city, they worked hard and overdrafted their health. However, after all their hard work, they were still on the edge of urban sports. This is a fatal flaw in the development of harmonious China. To solve this problem, social obstacles must be overcome and the integration of migrant workers into cities must be promoted. Therefore, we must mobilize all available forces, whether official or private, public or collective, corporate or unit, to protect migrant workers' sports. For example: the administrative department has formulated laws and regulations to reduce the working hours of migrant workers, built sports facilities near migrant workers' rental houses, and provided conditions for migrant workers' sports; established clubs among migrant workers, and organized colorful and interesting sports activities at appropriate times to provide opportunities for migrant workers. Migrant workers' sports provide opportunities.

3.4 Coordinate the Development of Migrant Workers' Sports

Multiple groups in the same area have more or less symbiotic relationships, sometimes explicit and sometimes implicit, and group divisions or uneven distribution will cause damage to interests. Whether they are in cities or rural areas, the health of migrant workers will affect the health status of certain groups within the spatial range. This includes hiring units that have significant interests with migrant workers, colleagues who work together, and migrant workers. Family etc. Due to historical reasons, the urban-rural duality has existed for a long time, and many factors that widen the distance between rural and urban areas cannot be effectively controlled. These factors have contributed to the formation of their own characteristics in rural and urban areas, resulting in different outlooks on life and health in rural and urban areas. same. Although most rural people have solved their food and clothing problems and have convenient transportation and developed communications, they are still unable to integrate into urban sports. In the new era when everyone is pursuing a happy life, the development of migrant workers' sports must be coordinated. Migrant workers have contributed to national development and urban construction. This is not only a reward for fellow migrant workers, but also promotes the construction of new rural areas and cultivates qualified talents. The needs of urban workers and the construction of national spiritual civilization. To coordinate this development, the government and sports authorities should allocate sports resources rationally, so that migrant workers can also enjoy sports rights under the principle of balancing supply and demand. By coordinating the development of migrant workers' sports, we will maximize the intermediary role of sports in transforming migrant workers' lifestyles, values, ways of thinking, etc., so that sports can truly become an integral part of migrant workers' lives and let migrant workers realize the benefits of sports. Be happy, enjoy sports and health, lead them to establish a correct outlook on life and values, develop a healthy and civilized lifestyle, and improve the quality of life and overall quality. This is of great significance not only to building beautiful countryside, but also to building a harmonious society, building socialism with Chinese characteristics and realizing the great rejuvenation of the Chinese nation.

3.5 Pay Attention to the New Generation of Migrant Workers' Sports

Compared with the older generation of migrant workers, working in cities to earn money to support their families is no longer the sole purpose of the new generation of migrant workers. They have shown their yearning for urban life and have strong citizen aspirations. They are young and energetic, have a higher cultural level than their predecessors, and their sports awareness can perfectly connect with the city. The "Survey" shows that migrant workers born in the 1980s account for nearly 50% of the total. This huge social group is gradually growing into a pillar force for urbanization and industrialization. The party's basic line states: To build our country into a powerful socialist country and ultimately realize the great rejuvenation of the Chinese nation, facing the dream of a powerful country, the new generation of migrant workers shoulder a more important mission than the older generation of migrant workers. They are the main force in building a new China. The military is the foundation for building a healthy China and a strong sports country. In January 2018, multiple departments jointly issued the "Youth Sports Promotion Plan". The health of teenagers directly affects national prosperity, social civilization and family harmony. The great rejuvenation of the Chinese nation must be based on the healthy physique of teenagers. Therefore, one of the focuses of sports in the new era is to pay attention to the sports issues of the new generation of migrant workers and their children. This is not only a care for migrant workers, but also reflects the country's fairness and justice in treating sports [7].

4 CONCLUSION

Migrant workers are an important force in urban construction and the driving force behind economic development. Whether migrant workers are healthy or not directly affects the city's happiness index, and will also have an impact on the development of the national economy. In the current sports industry, migrant workers' sports are relatively backward and are a weak link in the development of national fitness sports. In the new era when people across the country are constantly pursuing a happy life, migrant workers' sports will receive more and more attention from the society. will play a more important role in social development. Developing sports for migrant workers is an important link in developing mass sports, which is also in line with the basic requirements of sustainable development; it is an important foundation for moving from a big sports country to a strong sports country; it is an inevitable requirement for the great rejuvenation of the motherland; it is also the pursuit of national economic development and the people Intrinsic requirements for happiness.

COMPETING INTERESTS

The authors have no relevant financial or non-financial interests to disclose.

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COMPREHENSIVE ANALYSIS OF THE KNOWLEDGE, ATTITUDES, AND BEHAVIORS EXHIBITED BY MEDICAL STUDENTS DURING THEIR HEALTH AND PHYSICAL EDUCATION ASSESSMENTS

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Abstract: This study took 972 undergraduate students from the 2014, 2015 and 2016 classes of Shanxi Medical University as the research subjects to study the knowledge, attitudes and behaviors of medical students in Shanxi Medical University in sports health testing, and to gain an overall understanding of the medical students' Physical health quality level. The analysis results show that senior students pay more attention to physical education tests than students in lower grades, but the number of people who exercise daily is low, and students' physical fitness and awareness of exercise need to be improved.
Keywords: Medical students' health; Physical education; Education assessments

1 INTRODUCTION

With the development of science and technology, competition for talents has become increasingly fierce. College students will face multiple pressures from society, work and life. The physical fitness of college students will be an important basis for withstanding various pressures. The college stage is a critical period for the healthy development of physical and mental qualities. The strong physique, strong will and vitality of college students are not only a reflection of a nation's strong vitality and social progress, but also the material basis for healthy social development and an important measure of a country's comprehensive national strength. index. In August 2002, the Ministry of Education and the State Sports General Administration jointly issued Document [2002] No. 12, requiring "all colleges and universities to implement the "Student Physical Health Standards" starting from the new academic year in 2003, and the new version began to be implemented in 2014. "National Student Physical Health Standards", during this process, problems such as college students' inability to correctly understand the significance of physical health tests, the lack of effective feedback channels for sports health test monitoring results, and the lag in the publicity and education of college students' physical health continue to emerge. In addition, multiple studies have shown that college students' physical fitness is showing an overall downward trend, and they do not have enough understanding of the significance of college students' physical fitness tests. A considerable number of students are bored, anxious and even fearful. When conducting surprise training, the emphasis on physical fitness testing is generally low. Qin Lisong et al. studied the physical fitness test of Jiangsu University college students and found that 11.35% of students rarely participated in or occasionally participated in extracurricular physical exercise. In a week, students who participated in extracurricular physical exercise three or more times accounted for only 1% of the total number. A third of the students were divided into gender groups to analyze differences in the frequency of physical exercise. The study found that boys' physical exercise habits are significantly better than girls, and more than a quarter of the students participated in extracurricular physical exercise for insufficient duration each time. Half an hour, more than half of college students last between half an hour and one hour, and less than a quarter of students take more than one hour of physical exercise in a single session. Li Jianhui and others analyzed the current situation of the implementation of the "Physical Health Standards for College Students" in colleges and universities and found that 98.46% of students in Aba Normal College did not understand the test content, indicators, and methods of the "Standards", and 97.08% of students had vague concepts about testing procedures and testing instruments. The physical condition of students is very worrying. Medical students are the main force of the country's future medical and health team. The physical quality of medical students is related to the overall quality of our country's future medical and health team, to the level of national medical and health services, and to the physical and mental health of every citizen. However, due to medical The learning tasks for students are extremely heavy and can be used
There is too little time for physical exercise, and the physical health quality of medical students is showing an overall downward trend, and the situation is not optimistic. Through the investigation of medical students' knowledge, attitude and behavior of physical fitness testing, we can comprehensively understand medical students' mastery of physical fitness testing and sports-related theoretical knowledge, their attitudes towards physical fitness testing and participation in physical exercise, and their attitudes towards physical exercise and physical exercise. Behavioral changes in physical fitness testing. This study will help improve the theoretical level of medical students' physical fitness testing and related sports, improve medical students' attitudes towards physical exercise and physical fitness testing, and help promote

medical students to actively participate in various sports activities organized by the school. Overall Improve the physical fitness of medical students and make participation in various sports a common practice in higher medical schools.

2 RESEARCH OBJECTS AND RESEARCH METHODS

2.1 Research Object

There are 972 undergraduate students in the 2014, 2015 and 2016 classes of Shanxi Medical University, covering 6 majors, including 464 non-clinical majors in preventive medicine, biopharmaceuticals and public utility management; the first clinical department, anesthesia and stomatology 508 in three clinical specialties of medicine.

2.2 Questionnaire Recovery Status

Integrating relevant literature and opinions and suggestions from all parties, the "Questionnaire on Medical Students' Physical Health Testing Knowledge, Attitudes and Behaviors" was compiled, which mainly includes: basic personal information: gender, grade, major, etc.; theoretical knowledge of physical health testing: such as tests The passing line, the excellent line, the rules and standards of each test; attitude towards sports health testing: understanding and importance of sports health testing; behavior of sports health testing: whether there is active preparation before the sports test, whether you usually participate in sports , participating in physical exercise projects, and the intensity of participating in sports without food; relevant opinions and suggestions on the "National Student Physical Health Standards" and the reform of school physical education teaching models.
A multi-stage stratified cluster random sampling method was used, stratified according to grade (2014 grade, 2015 grade, 2016 grade), and then divided into two tiers according to clinical majors and non-clinical majors, and 2 classes were randomly selected from each stratum. All students in the selected classes were surveyed. A total of 1,000 questionnaires were distributed and 1,000 were recovered. After the reliability and validity test of the recovered questionnaires, 972 qualified questionnaires were obtained.

2.3 Analysis Method

Descriptive analysis was conducted on the level of physical fitness test, participation in physical exercise, theoretical level of physical fitness test, emphasis on physical fitness test, etc., and test analysis was used for comparison between groups. All statistical tests are two-sided, and the test level is $\alpha=0.05$. The above analysis was completed through SPSS18.0 software.

3 FINDINGS

3.1 Knowledge Level Analysis of Sports Fitness Testing

The health and sports test for college students is divided into body mass index, vital capacity, 50-meter run, 800-meter (female)/1000-meter (male) endurance run, seated forward bend, standing long jump and sit-ups (female)/pull-ups (male) There are seven standard items in total, and different items reflect different body functions. The results of this study on medical students' understanding of knowledge related to health sports tests showed that only 0.90% of students did not know what the test items were, and 30% of students did not know about the 800-meter (female)/1000-meter (male) endurance run. Essentials. There are only 138 college students who know and understand the theory and content of the National Fitness Plan Outline, accounting for 14.20% of the total, which is a relatively low proportion.

3.2 Analysis of Attitudes Toward Sports Fitness Testing

The results of the survey on attitudes towards physical fitness tests show that girls are more anxious than boys before the test ($x2=15.002$, $P<0.001$); senior grades pay more attention to physical fitness tests than lower grades ($x2=12.571$, $P<0.05$); clinical Majors care more about their physical education test scores than non-clinical majors ($x2=18.054$, $P<0.05$). 47.53% of students believe that the policy of failing to pass the physical education test will affect graduation is unreasonable, and 36.78% of students hope to cancel the physical fitness test for college students. 39.33% of students do not pay attention to their physical education test scores and think that as long as they pass, they will be fine.

3.3 Behavioral Analysis of Sports Fitness Testing

The daily exercise situation of different genders is different. It can be seen that boys generally exercise more frequently and for longer time than girls. As shown in Table 1 & 2 below.

Table 1 Frequency of exercise for students of different genders

	exercise every day	3-6 times	1-2 times	never exercise
men and women	10.44%	32.12%	27.01%	30.43%
	9.87%	2.25%	39.22%	48.66%

Table 2 Exercise time for students of different genders

	0-30min	30-60min	>60min
men and women	20.09%	61.88%	8.03%
	72.36%	22.08%	5.56%

The frequency and duration of exercise for senior students are higher than those for junior students, and only 34 students in the class of 2014 developed daily exercise because of the physical fitness test. When they fail a test, 23.15% of people will strengthen training in their usual exercise, and 41.37% of people think that as long as the overall result is passing, it will be fine. Only 12.55% of students will actively sign up to participate in school sports events.

4 DISCUSS THE CURRENT STATUS OF MEDICAL STUDENTS' PHYSICAL HEALTH AWARENESS AND PHYSICAL ACTIVITY BEHAVIORS

4.1 Lack of Physical Health Awareness and no Emphasis on Physical Exercise

Due to changes in modern lifestyles, especially the popularization of the Internet and the use of various electronic products, many students like to surf the Internet, play games, play with mobile phones, etc., and rarely go outdoors to participate in physical exercise. They lack awareness of sports and health, and their physical fitness is generally poor. Difference. There are many students who are addicted to the Internet, which easily consumes too much energy and affects their mental health. College is an important period for students to keep fit. Neglecting sports is not conducive to study and work. Many students have low awareness of taking the initiative to participate in sports activities and lack the awareness of lifelong sports. Most of them participate in sports activities just to cope with the curriculum and have no clear sports purpose.

4.2 Lack of Mental Health Awareness

Students' physical development has matured, but they often do not necessarily mature psychologically. Due to the influence of various factors, such as social factors, physiological factors, etc., students are prone to psychological imbalances and unhealthy mental problems. Newly admitted students are not adaptable to the environment and are prone to psychological problems. Students who are about to graduate will encounter difficulties in finding a job and may also suffer from psychological imbalance. Interpersonal problems in college life, etc., will cause students to have psychological problems. Students cannot adjust their mentality in time, which is not conducive to their healthy development.

4.3 Lack of Good Living and Eating Habits

In addition to not paying attention to physical exercise, students often do not develop good living habits and eating habits, which is not conducive to students' physical health. Staying up late has become a common phenomenon among students nowadays. Failure to arrange sleep time properly not only affects students' physical health, but also affects students' learning. Many students have unbalanced diets, unreasonable diet structures, nutritional problems, and lack of awareness of sports and health, leaving their bodies in a sub-healthy state.

5 COUNTERMEASURES FOR CULTIVATING MEDICAL STUDENTS' PHYSICAL AND MENTAL HEALTH

5.1 Establish Correct Sports and Health Awareness

In physical education teaching, attention should be paid to guiding students' physical health awareness so that students can establish a correct physical health awareness. College physical education courses should make full use of favorable conditions to cultivate students' sports values and interests, and cultivate their awareness of lifelong sports. It is necessary to cultivate students' sports hobbies and make students change their dependence on the Internet, mobile phones and other electronic products. Although students are not proficient in sports projects, they generally have projects that they are interested in. Students should be encouraged to actively participate and choose the correct exercise methods. At the same time, university physical education should pay attention to the cultivation of students' good living habits, popularize basic health knowledge among students, and enable students to establish correct health concepts.

Cultivating students' social interaction and cooperation abilities, and cultivating students to develop the habit of independent physical exercise, not only improves students' attention and cognitive attitude towards their own physical health, but also changes students' attitudes towards physical education classes, and also cultivates It has improved students' love for sports and finally corrected students' attitudes and understanding of physical fitness tests; at the same time, teachers have developed a rigorous sports work attitude through curriculum reform, so that their personal scientific research abilities and professional qualities have also been improved simultaneously, so that they can better devote themselves to their careers. The school conducts student physical health tests every year.

5.2 Encourage Students to Participate in Sports Activities

Students should be encouraged to actively participate in sports activities. In physical education teaching, we should focus on cultivating students' sports theoretical knowledge and sports skills, improve students' sports abilities, and guide students to correct sports behaviors. In physical education activities, we should not only cultivate students' sports skills, but also cultivate students' self-exercise ability and self-evaluation ability. Schools should actively carry out a series of sports competitions, or class collective sports competitions, so that every student can participate in sports activities. During physical exercise, pay attention to the way you exercise to avoid excessive exertion and damage to the body. Schools and departments need to increase publicity efforts, use school-related media, and increase the importance of students' physical examination through the correct guidance of teachers and head teachers. Only when students themselves change their attitude and understanding of the physical fitness test and encourage students to establish fitness awareness and active exercise habits can we ensure that the physical fitness test can be carried out better.

5.3 College Students must Learn to Self-Regulate

Students should have a positive and optimistic attitude and maintain their enthusiasm and interest in learning. It is necessary to eliminate negative psychological problems in a timely manner, actively participate in sports activities, relieve psychological pressure, and at the same time communicate better with teachers and students. Students should have their own plans and goals, pay attention to physical exercise, correctly understand themselves, actively learn new knowledge, and integrate into collective life. We must be aware of the importance of sports health awareness and sports behaviors, have the concept of physical health and mental health, express and vent negative emotions in a timely manner, actively enter into interpersonal interactions, and maintain good communication and cooperation with classmates. Make full use of various ways to learn knowledge, improve your overall quality, and better adapt to university life.

5.4 Improving Infrastructure and College Sports Courses

Schools should attach great importance to the construction of sports infrastructure and improve students' physical education courses. College physical education courses should center on health education and use lifelong physical education as the guiding ideology of course teaching. Students' physical education courses should be rich and colorful, including some emerging projects, sports appreciation classes, sports health practice classes, health care classes, etc. Sports clubs can also be set up to cultivate students' interest in learning sports and performing sports activities. Schools should increase capital investment, improve infrastructure construction, and build gyms, professional ball sports halls, etc. At the same time, in the process of the physical examination, only by ensuring the standardization of all aspects of the physical work can the school and the physical examination staff ensure that the data of the physical examination are more accurate and the students' physical examination results can be more guaranteed. The school should ensure that the side examination venue is closed and unified, keeping the venue clean, flat, and open; ensure that the equipment is uniform and accurate, and check and proofread the equipment before and during the side examination, and use the equipment correctly and pay attention to the equipment. The update time is to avoid the adverse impact of equipment aging on the physical test work; in addition, the physical fitness test teacher should use the equipment correctly according to the requirements of the physical test items, and strictly supervise and control the entire physical test process to ensure the standardization of the test.

6 CONCLUSION

Medical students' motivations for participating in physical exercise are scientific and healthy, and they are all for the purpose of hobbies, fitness needs, and enriching their spare time life. In short, cultivating medical students' physical health awareness and sports behavior has positive significance and can promote the future development of medical students and play their role in national construction. Good physical quality is the foundation of a good life. College students must have healthy mental and physical qualities in order to promote their own better development.

COMPETING INTERESTS

The authors have no relevant financial or non-financial interests to disclose.

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THE DEEP IMPACT AND OPTIMIZATION PATHWAYS OF SPORTS INDUSTRY DEVELOPMENT IN THE DIGITAL ECONOMY ERA

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Abstract: Against the backdrop of the rapid rise of the digital economy, the sports industry, as an emerging engine of economic growth, is currently undergoing a crucial period of digital transformation. This study aims to explore the profound impact of the digital economy on the sports industry and its optimization pathways. By analyzing the current development status of the sports industry in the context of the digital economy era, we aim to understand the challenges and opportunities faced by the sports industry in the digital economy era. Subsequently, through an analysis of the impact of digital technology on the business models, consumer behavior, and value chains of the sports industry, we reveal the critical role of the digital economy in the sports industry. By examining successful cases, we summarize the key success factors and propose optimization pathways for the sports industry in the digital economy era.
Keywords: Sports industry, Digital economy, Deep influence, Optimization path

1 RESEARCH BACKGROUND

The digital economy, as an emerging economic form, revolves around harnessing digital information and communication technology to reshape traditional economic models, thereby enhancing productivity and economic dynamism. Central to its framework is the utilization of data resources as a pivotal factor in production, facilitating the digitization transformation of economic activities through the widespread adoption of modern information technologies such as the internet, big data, cloud computing, and artificial intelligence [1]. The integration of digital technologies not only revolutionizes the operational landscape of the sports industry but also cultivates fertile ground for innovation in sports products and services.

Amidst the global wave of digitization, the sports industry, as a crucial component of the national economy, confronts unparalleled opportunities and challenges [2]. With its attributes of efficiency, convenience, and intelligence, the digital economy fundamentally reshapes the traditional models of the sports industry, injecting robust impetus into its high-quality development. Firstly, the digital economy era offers a broader market scope and a diverse array of business models for the sports industry [3]. Leveraging advanced technologies such as big data, cloud computing, and artificial intelligence enables the sports industry to accurately discern market demands, optimize resource allocation, and enhance operational efficiency [1]. Moreover, digital technologies engender novel formats such as sports e-commerce, online fitness, and virtual events, ushering in fresh growth avenues for the sports industry.

The digital economy era catalyzes innovation and upgrading within the sports industry [4]. Driven by digital technology, the sports industry achieves breakthroughs in product design, manufacturing, marketing, and other facets, thereby enhancing its overall competitiveness and value-added. Furthermore, digital technology contributes to elevating the internationalization level of the sports industry, fostering the optimal allocation and mutually beneficial utilization of sports resources both domestically and internationally. Nevertheless, the digital economy era imposes heightened demands on the sports industry. Confronted with intense market competition and swiftly evolving market landscapes, the sports industry must continually bolster its innovation and adaptability to withstand the tide of digitization. Hence, delving into the pathways and strategies for leveraging the digital economy era to propel the high-quality development of the sports industry holds paramount theoretical significance and practical importance.

This study aims to undertake an in-depth analysis of the profound impact of the digital economy era on the sports industry and to explore optimization pathways for its high-quality development. Through a systematic review of

pertinent literature and case studies, this research will uncover the current status, challenges, and opportunities of sports industry development in the digital economy era, as well as the profound influence of the digital economy era on the sports industry. Additionally, this study will analyze successful cases within the sports industry, identify their key success factors, and propose a series of targeted and actionable optimization pathways. These pathways will facilitate the transformation and upgrading of the sports industry in the digital economy era, furnishing robust support for the sustainable and healthy development of China's sports industry.

2 LITERATURE REVIEW

The sports industry is at a critical juncture of digital transformation amidst the flourishing development of the digital economy. A thorough review and analysis of relevant literature reveal the profound impact of the digital economy on the development of the sports industry and the pathways for optimization.

The integration and development of the digital economy with the sports industry have become an irreversible trend. According to Wang Yingying and Deng Wanjing, the high-quality development of the leisure sports industry is crucial for implementing the national fitness and Healthy China strategies [5]. They believe that the development of the digital economy serves as a new engine and driving force for promoting the high-quality development of the sports industry [6].

Wang Yingying analyzed the deficiencies in the high-quality development of China's leisure sports industry in the era of the digital economy and, considering the national context, constructed a theoretical framework for the high-quality development of the leisure sports industry while exploring the developmental trends of the industry [7]. Li Yanli et al. utilized the entropy method to establish an evaluation index system and a coupling coordination model for the digital economy and the sports industry, systematically examining the bidirectional interaction and dynamic relationship between the digital economy and the sports industry [8]. Ruan Yu et al., based on the analysis of the current status of China's sports industry, constructed evaluation index systems for the development of the digital economy and high-quality development of the sports industry, and applied the entropy method to measure the level of development of the digital economy and the sports industry in each regions [9].

However, at present, the digital economy's support for the development of the sports industry also faces various challenges. Wang Xuan and Shen Keyin believe that the current promotion of high-quality development of the sports industry by the digital economy is confronted with complex and changeable development environments, imbalanced regional development of the digital economy, weak technological application capabilities, and associated risks in the upgrading of sports consumption [10]. Li Rongri and Yu Diyang also argue that the digital economy's empowerment of the sports industry faces challenges in deep integration in terms of digital platforms, digital technology, digital infrastructure, and digital talent [11]. Therefore, the development of the sports industry in the digital economy era is profoundly influenced by digital technology, and digital transformation has become the key path to enhancing the competitiveness of the sports industry and promoting high-quality development. However, digital transformation also faces many challenges, requiring concerted efforts from governments, enterprises, and all sectors of society to seek innovative development paths.

3 RESEARCH OBJECTIVES

With the rapid development of digital technology, the sports industry is facing numerous challenges and opportunities. Therefore, this study aims to address the following questions:

Firstly, in the era of the digital economy, what are the new opportunities and challenges facing the sports industry? And what kind of impact do they have on the development of the sports industry?

Secondly, in the face of the transformation brought about by the digital economy, what are the optimization pathways for the sports industry?

4 RESEARCH METHODS

In this study, qualitative research methods were primarily employed. Firstly, through a literature review approach, past research findings were analyzed to construct the theoretical framework of the study. Secondly, the case study method was utilized to delve deeply into successful cases of digital transformation, summarizing key success factors. Lastly, the expert interview method was employed to supplement and validate the research results, obtaining first-hand information on the current state of digitalization in the sports industry and the profound impact of the digital economy era on the sports industry. Qualitative research methods enable in-depth exploration of case details and expert insights, providing a richer and deeper understanding of the research topic. Through this approach, we are able to comprehensively grasp the current development status, opportunities, and challenges faced by the sports industry in the era of the digital economy, as well as the optimization pathways for future development.

5 RESEARCH RESULT

5.1 Development Status of the Sports Industry in the Era of the Digital Economy

5.1.1 Current development status of the sports industry

With the rapid advancement of digital technology, the sports industry is gradually breaking free from the constraints of traditional models and shifting towards more flexible and efficient operational methods. Digital transformation not only provides new platforms and channels for the dissemination of sports events but also greatly enriches the forms of sports products and services, thereby attracting more consumers to participate. Furthermore, the application of digital technology has made aspects such as sports training, competition organization, and athlete health management more scientific and precise. However, despite the numerous benefits brought by the digital economy to the sports industry, its development still faces a series of challenges. For instance, the uneven development of digital infrastructure has led to the lagging development of the sports industry in some regions [10]. Additionally, disparities in the application capabilities of digital technology among sports enterprises have affected the overall competitiveness of the industry [11]. Moreover, the lack of high-quality digital sports talents has also become a significant factor hindering further industry development [6]. Therefore, while the sports industry demonstrates a flourishing development trend amidst the wave of the digital economy, it also exposes some significant issues that cannot be ignored. In order to promote the high-quality development of the sports industry, efforts must be made across various dimensions, including strengthening infrastructure construction, enhancing the level of digital application by enterprises, and fostering professional talents. This multi-dimensional approach aims to ride the wave of the digital economy, achieve sustainable prosperity for the sports industry, and address the challenges it faces.

5.1.2 Challenges and opportunities for the sports industry in the digital era

With the continuous progress and widespread application of information technology, digital transformation has become a significant driving force for the development of the sports industry. This transformation process not only brings unprecedented development opportunities for the sports industry but also faces significant challenges, forcing traditional sports industries to adapt to new trends in order to maintain competitiveness and sustainable development in the future. Observing the current status of digital transformation in the sports industry, several prominent features can be identified.

On one hand, the application of digital technology is profoundly changing the operational and business models of the sports industry. For example, through techniques such as big data analysis, cloud computing, and artificial intelligence, real-time monitoring and analysis of athlete training data can optimize training plans and improve competitive performance. Additionally, digital ticketing systems, online broadcasting platforms, and various smart wearable devices enhance consumer experiences while opening up new revenue streams. These innovations not only enhance the core competitiveness of the sports industry but also provide consumers with a more diverse range of sports consumption options.

However, digital transformation also brings challenges. While the sports industry embraces the convenience and efficiency brought by digitization, it must also address various issues arising from it. For example, the rapid development of digital technology requires professionals in the sports industry to possess higher skill levels, and the

current shortage of such talent is one of the bottlenecks restricting development. Furthermore, with the increasing threats to cybersecurity in the online space, ensuring the security of digital sports products and user data has become an urgent issue. Additionally, while digital technology facilitates the dissemination of sports events, it also brings challenges in terms of copyright protection and combating illegal broadcasting.

5.2 In-Depth Analysis of the Impact of the Digital Era on the Sports Industry

5.2.1 Impact of digital technology on the business model of the sports industry

Digital Transformation of Sports Products and Services: Digital technology has propelled the digitization of sports content, allowing sports events and related content, which were originally confined by physical space and time constraints, to be widely disseminated through online platforms. For example, the online broadcasting of sports events has not only significantly expanded the audience base but also provided sponsors with broader exposure opportunities, thereby creating new sources of revenue.

Data-Driven Business Decision-Making: The application of big data analytics and artificial intelligence enables sports organizations and businesses to more accurately analyze consumer behavior and optimize product and service offerings. Through real-time analysis of large volumes of data, sports enterprises can better understand market demands, formulate personalized marketing strategies, and improve operational efficiency. Furthermore, these technologies can also be used for athlete performance analysis, injury prevention, and other aspects, further enhancing the quality and competitiveness of sports products.

Interactive and Immersive Consumer Experiences: Advancements in augmented reality (AR) and virtual reality (VR) technologies have provided sports enthusiasts with entirely new viewing experiences. Through these technologies, consumers can immerse themselves in virtual environments to experience sports events firsthand, and even interact with athletes. This immersive experience not only increases audience engagement but also creates opportunities for sports brands to establish deeper connections with consumers.

Intelligent Supply Chain Management and Retail Innovation: Digital technology plays a crucial role in the manufacturing, distribution, and retailing of sports goods. Through intelligent systems and Internet of Things (IoT) technology, companies can achieve real-time monitoring and management of the supply chain, improving response times and inventory efficiency. Additionally, the rise of e-commerce platforms has transformed the sales of sports goods, providing consumers with more convenient shopping channels while also offering sports brands opportunities for direct engagement with consumers.

5.2.2 The impact of digital technology on consumer behavior

The rise of digital technology has not only reshaped the way sports events are viewed but also rewritten the interaction patterns between consumers and sports products and services. Specifically, the impact of digital technology on consumer behavior is manifested in several aspects. First is the diversification of information acquisition channels. With the prevalence of social media and mobile applications, consumers can instantly receive the latest updates, data statistics, and in-depth analyses of sports events. The immediacy and diversity of this information greatly enrich consumers' decision-making basis, making them more precise and efficient in choosing to watch events or purchase related products.

Second is the deepening engagement of consumers. Digital technology enables consumers to interact more frequently and deeply with the sports industry. For example, through online communities and forums, fans can share viewpoints, discuss events, and even participate in management decisions of sports teams. This enhanced sense of participation not only deepens consumers' identification with sports brands but also drives them from passive recipients to active participants.

Third is the innovation of consumption patterns. The application of digital technology has given rise to new consumption models, such as pay-per-view and membership subscription services, providing consumers with more flexibility and choice. Meanwhile, the integration of e-commerce platforms allows consumers to complete the entire process from information gathering to product purchase on one platform, greatly enhancing consumption convenience.

5.2.3 The impact of digital technology on the value chain of the sports industry

The integration of digital technology has not only improved the distribution of sports products but also enhanced consumer experiences and opened up new revenue models. In terms of distribution, digital technology has broken geographical barriers, enabling sports content to be disseminated rapidly and widely across the globe. The prevalence of online streaming platforms allows events to reach millions of households in real-time, while social media serves as an essential tool for promoting sports brands and attracting fans. Meanwhile, the development of e-commerce platforms has simplified the process of purchasing goods and provided personalized recommendations, thereby increasing sales and consumer satisfaction.

In the consumption phase, digital technology has greatly enriched user experiences. Taking mobile applications as an example, they not only provide convenient functions such as real-time scores, data statistics, and event replays but also deepen user loyalty through interactive features such as community exchanges and gamification elements. Digital technology has had a profound impact on the revenue models of the sports industry. In addition to traditional ticket sales, advertising sponsorship, and copyright transfers, precision marketing driven by big data and algorithms enables sponsors to reach target audiences more effectively. Furthermore, the emergence of digital currency and blockchain technology provides transparent and secure solutions for ticketing and copyright management, reducing costs and improving transaction speeds.

5.3 Successful Case Studies of Digital Transformation in Sports Enterprises or Projects

In examining the profound impact of the digital economy on the development of the sports industry and the optimization paths, it is essential to consider successful cases of digital transformation in sports enterprises or projects. Their case studies can provide valuable lessons and future guidance for the entire industry.

One typical example is a leading domestic sports goods manufacturer that has successfully integrated online and offline sales channels and utilized big data analysis of consumer behavior to achieve rapid customization and market promotion of personalized products. The company has established a comprehensive database covering user exercise habits, purchasing preferences, and social interactions, enabling precise market positioning and timely adjustments to product lines and marketing strategies. This transformation has not only enhanced user experience but also significantly increased the company's market share and brand influence.

Another case involves an innovative enterprise focusing on the development of smart fitness equipment with technology at its core. The company's products combine advanced technologies such as the Internet of Things, artificial intelligence, and cloud computing, making traditional fitness equipment intelligent and networked. Users can monitor their exercise data in real-time and receive customized training plans through virtual coaches. This highly digitized fitness solution quickly gained favor among fitness enthusiasts and promoted deep cooperation between the enterprise and partners such as gyms and sports venues.

These cases demonstrate that digital transformation has brought new vitality to sports enterprises, whether in product manufacturing or service provision. By introducing innovative technologies and models, they have not only optimized business processes and improved operational efficiency but also strengthened connections with consumers and enhanced market competitiveness. However, digital transformation is not achieved overnight; it requires enterprises to have forward-thinking strategic vision, continuous technological investment, and keen insights into market dynamics.

5.4 Summary of Key Success Factors in Digital Transformation

5.4.1 Clear strategic positioning and efficient execution

Successful digital transformation relies on clear strategic positioning and efficient execution. Sports entities must first establish the central role of digitization and view it as a key driver of business development. Building a digital strategy framework that aligns with organizational goals and operational models is fundamental to ensuring smooth transformation. For example, a professional basketball team optimized player training and game strategies by establishing a data analytics system, gaining a competitive advantage.

5.4.2 Advanced technology and wide application

The advanced nature of technology and its widespread application are crucial factors in measuring the success of digital transformation. Leading digital technologies can provide more efficient operational processes, more precise decision support, and richer user experiences. Several cases in the sports industry, from ticketing systems to the application of smart fitness equipment, have significantly improved operational efficiency and user satisfaction.

5.4.3 Data-driven decision making

Data-driven decision-making is increasingly becoming the key to winning markets. In the sports industry, this means collecting and analyzing large amounts of user behavior data to better understand needs, predict trends, and personalize services. A typical example is a football club using big data to analyze fan consumption habits, thereby launching more precise marketing campaigns and products.

These factors collectively contribute to the success of digital transformation in the sports industry. By prioritizing strategic alignment, leveraging advanced technology, and embracing data-driven decision-making, sports entities can navigate the digital landscape effectively and achieve sustainable growth.

5.5 Optimization Paths for the Sports Industry in the Digital Economy Era

5.5.1 Utilizing big data to optimize sports service provision

Under the wave of the digital economy, big data technology has fundamentally reshaped the service provision model in the sports industry. By precisely analyzing vast amounts of data, sports service providers can gain deep insights into consumer needs and achieve innovative breakthroughs in personalized services. However, realizing the optimization role of big data in sports service provision requires addressing challenges related to data integration and analysis capabilities. The sports industry should strengthen its data management system, enhance technical capabilities for data collection, storage, processing, and analysis. Additionally, there should be a focus on data security and protection of personal privacy by establishing robust legal regulations and industry standards to provide a conducive policy environment for big data application.

5.5.2 Utilizing cloud computing to enhance user experience

The robust computing capabilities and flexible resource allocation mechanism of cloud computing enable sports service providers to rapidly expand service capacity during peak demand periods, ensuring smooth user access. For applications such as online fitness classes and virtual sports events that require large-scale data processing, cloud computing platforms can provide stable data storage and high-speed information processing, greatly enhancing user interaction experience and satisfaction. Furthermore, the application of cloud computing can optimize the operation and management of sports venues. Venues can utilize cloud services for ticket management, equipment maintenance, energy monitoring, and other tasks, improving operational efficiency and reducing management costs. This efficient operating model will ultimately benefit consumers, providing them with more favorable prices, more convenient services, and a more comfortable experience environment while enjoying sports services.

5.5.3 Utilizing artificial intelligence to enhance operational efficiency and market competitiveness

With the continuous evolution and deepening application of artificial intelligence (AI) technology, improving operational efficiency and enhancing market competitiveness in the sports industry is no longer an unattainable ideal. AI technology, through algorithm optimization, big data analysis, and machine learning, can intelligently upgrade various aspects of the sports industry.

By intelligently analyzing large amounts of match data, coaching teams can formulate more accurate tactical strategies, thereby increasing the chances of winning games. Sports marketing and fan interaction platforms can also make leaps forward with the power of artificial intelligence. Utilizing natural language processing and user behavior analysis, sports brands can design more personalized marketing campaigns, attracting and maintaining the enthusiastic participation of fan communities. Additionally, AI-driven analysis tools based on social media can provide powerful data support for brand image management and market trend prediction.

6 CONCLUSIONS AND SUGGESTIONS

6.1 Conclusion

This study aims to explore the profound impact and optimization paths of the sports industry in the era of the digital economy. Through in-depth analysis, we have revealed the multidimensional effects of the digital economy on the sports industry, identified key factors driving high-quality development, and highlighted the current challenges and opportunities. We found that the sports industry is undergoing a profound transformation in the wave of digitalization, where the application of digital technology has not only improved the existing business models but also reshaped the interaction between consumers and sports products and services. This has enhanced the sales methods of sports products, improved consumer experiences, and opened up new revenue models. However, we also recognize that the integration process of the digital economy and the sports industry is not without obstacles. Challenges such as complex development environments, uneven regional development of the digital economy, insufficient technological capabilities, and the lack of high-quality digital sports talent have all to varying degrees constrained the pace of high-quality development in the sports industry.

6.2 Suggestions

In exploring the profound impact and optimization paths of the sports industry in the era of the digital economy, we recognize the crucial roles played by policymakers and industry decision-makers [12].Therefore, policymakers should focus on building a sound digital infrastructure to support the digital transformation of the sports industry. This not only includes upgrading traditional hardware facilities but also involves improving software and service systems. At the same time, to promote the deep integration of digital technology with the sports industry, relevant policies need to encourage innovation, provide research and development funding, and offer incentives such as tax breaks for startups.

Furthermore, for industry decision-makers, the key lies in how to utilize digital tools to enhance operational efficiency and improve user experience. This requires integrating digital technology into every aspect of enterprise internal management and marketing, realizing a data-driven decision-making process. Based on this foundation, companies should actively explore innovative models of digital products and services to meet the diverse needs of consumers.

Finally, considering the existence of problems such as digital platform monopolies and weak digital infrastructure, policymakers need to introduce corresponding regulatory measures to ensure fair market competition. At the same time, they should encourage sports enterprises to increase investment in digital infrastructure and enhance the overall level of digitization in the industry.

COMPETING INTERESTS

The authors have no relevant financial or non-financial interests to disclose.

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STUDY ON THE SURVIVAL STATUS OF WUSHU INTANGIBLE CULTURAL HERITAGE INHERITORS IN ANHUI PROVINCE

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Abstract: In order to understand the survival situation of the inheritors of martial arts intangible cultural heritage and to enhance the inheritance effect of the inheritors, the article uses the field interview method as well as the questionnaire survey method to investigate 12 inheritors of martial arts intangible cultural heritage in Anhui Province. The results show that: (1) there are 6 people over 50 years old and 6 people under 50 years old; all the inheritors are married, there are 5 people with a family size of 4 or more, and 7 people with a family size of 3 or less; there are only 2 people with a university degree, and 7 people are engaged in agriculture. (2) The most common illnesses among the inheritors are joint and stomach diseases, and no one is terminally ill. (3) Eight of them have a sense of self-fulfilment and are satisfied with their work, and none of them said they could not have a sense of self-fulfilment. (4) Two people have a monthly income of $4,000 or more, and 10 people have a monthly income of less than $4,000. (5) Six people have administrative positions or part-time social jobs.
Keywords: Intangible cultural heritage; State of existence; Inheritors

1 INTRODUCTION

Intangible cultural heritage is the product of cultural memory and survival wisdom of the peoples of the world [1]. It records the production methods, customs and cultural concepts of human society, and contains the cultural genes, spiritual qualities, temperament and emotions of the peoples of the world, etc. It is the common valuable wealth of all mankind and plays a very important role in the inheritance and development of human civilisation. China's martial arts intangible cultural heritage is an important and unique part of the intangible cultural heritage, and is one of the manifestations of Chinese national culture [2]. It realises human interaction across language differences in the form of body language and fully embodies the common sports aesthetics and sports culture of human beings. The inheritor is one of the important subjects for the protection of the intangible cultural heritage of wushu, shouldering the important mission of inheriting skills and spreading culture. As an important bearer and transmitter of intangible cultural heritage [3], the inheritor has a very important status and role in the inheritance process. The advantages and disadvantages of the survival status of the inheritors are directly related to the effect of the protection of martial arts intangible cultural heritage.

2 RESEARCH METHODS

2.1 Field Interview Method

Go deep into the living environment of the inheritors to get a comprehensive and complete understanding of the survival status of the inheritors of the intangible cultural heritage of wushu in Anhui Province, which provides a good foundation for the smooth progress of this study. In addition, visit the person in charge of the protection department of intangible cultural heritage in each city of Anhui to investigate and understand the relevant situation of the inheritors of the intangible cultural heritage of wushu in Anhui Province, to provide reliable information for this study.

2.2 Questionnaire Survey Method

Questionnaire design: according to the research objectives and research content, on the basis of reviewing a large amount of literature, design a questionnaire for the inheritors of the intangible cultural heritage of martial arts in Anhui Province. The content of the questionnaire includes the demographic characteristics of the inheritors, physical health status, mental health status and so on.
Validity test of the questionnaire: In order to ensure that the content of the questionnaire can truly reflect the survival status of the inheritors, after the completion of the questionnaire design, five experts were asked to test the validity of the questionnaire. Two experts think that the content of the questionnaire is ‘very suitable’, two experts think that the content of the questionnaire is ‘suitable’, and one expert thinks that the content of the questionnaire is ‘basically suitable’. According to the experts' opinions, the questionnaire was further improved, and finally the “Questionnaire on the Survival Status of Inheritors of Wushu Intangible Cultural Heritage in Anhui Province” was completed.
Reliability test of the questionnaire: The reliability of the questionnaire was tested by retesting method. After the first distribution of the questionnaire, two weeks after the interval, for the same survey object, the questionnaire is distributed again, the test results of the two questionnaires related reliability coefficient is $r = 0.81$, indicating that the

questionnaire reliability meets the requirements, the questionnaire is credible.

3 RESEARCH RESULTS AND ANALYSES

3.1 Demographic Characterisation of Wushu Intangible Cultural Heritage Bearers in Anhui Province

3.1.1 Age and gender

In terms of age, the results of the survey showed that among the 12 Wushu intangible cultural heritage bearers in Anhui Province, one was under 30 years old, two were between 30 and 40 years old, three were between 40 and 50 years old, two were between 50 and 60 years old, and two were over 60 years old (Table 1).

Table 1 Age Statistics of Wushu Intangible Cultural Heritage Inheritors in Anhui Province

Age range	Below 30 years old	30-40 years old	40-50 years old	50-60 years old	Above 60 years old
Number of persons	1	2	3	4	2
proportion（%）	8.33	16.67	25	33.33	16.67

The age of the inheritor is a reflection of the inheritor's experience and length of inheritance. Older inheritors are relatively more experienced in inheritance, and their innovation results are relatively better; young inheritors are not as experienced in inheritance, but they are relatively more passionate, with better innovation consciousness and ability, and they can inject new vitality into the process of inheritance. A reasonable team of inheritors should be reasonably distributed among all age groups, with both older and younger inheritors. From the results of the survey, the age of the inheritors of the intangible cultural heritage of martial arts in Anhui Province is on the high side in general, with 75% of the inheritors above 40 years old and only 25% of the young inheritors. This result should attract the attention of the relevant departments, otherwise we will face the development dilemma that there is no one to carry on the intangible cultural heritage of Wushu.

In terms of gender, of the 12 inheritors of the intangible cultural heritage of the martial arts in Anhui Province, 10 are male and 2 are female, with the proportion of female inheritors significantly lower than that of males. The reason for this result may be that women have no opportunity to inherit and promote the Wushu intangible cultural heritage due to the traditional concept of ‘passing on the tradition to men but not to women’. With the development of society, the status of women has become more and more prominent, and women have been given their due status. Therefore, from the survey results, it can be seen that there are two women among the inheritors of Wushu Intangible Cultural Heritage in Anhui Province, which also reflects the progress of the society to a certain extent. However, female inheritors are still relatively rare, and further attention should be paid to the status and role of women in the inheritance and development of Chinese outstanding traditional culture.

3.1.2 Family and marriage

The survey results show that among the inheritors of the Wushu intangible cultural heritage in Anhui Province, there are three people with a family size of two, four with a family size of three, three with a family size of four, and two with a family size of five (Table 2). In addition, the marital status of the inheritors of the Anhui Wushu Intangible Cultural Heritage was all married, none unmarried or widowed.

Table 2 Statistics on the number of family members of the inheritors of the intangible cultural heritage of martial arts in Anhui Province

Number of family members	2	3	4	5
Number of persons	3	4	3	2
proportion（%）	25	33.33	25	16.67

Most Chinese people advocate that one should start a family before establishing a career, and that it is only after having a stable family that one is able to put one's main energy into one's career. From the results of the survey, all of the Wushu ICH inheritors in Anhui Province have established families, which is conducive to the inheritor's career of passing on the Wushu ICH. In addition, the survey results also show that the proportion of inheritors with a family size of three is the highest, which indicates that there are more inheritors with a family of three, and the family composition is relatively simple, which is also conducive to the inheritors focusing their attention on their inheritance career. However, as China encourages families to have multiple births, there is a possibility that the inheritors may have further

children, which requires the inheritors to deal with the relationship between their families and their careers, and to reasonably allocate the time between their families and their careers.

3.1.3 Education and occupation

In terms of education, the survey results showed that among the 12 Wushu intangible cultural heritage inheritors in Anhui Province, there were two with university education, three with high school education, four with junior high school education, and three with primary schools education (Table 3).

Table 3 Statistics on the educational qualifications of the inheritors of the intangible cultural heritage of martial arts in Anhui Province

Academic qualifications	No schooling	Primary School	Junior high school	High School	University
Number of persons	0	3	4	3	2
proportion（%）	0	25	33.33	25	16.67

To a certain extent, academic qualifications reflect the comprehensive quality of the inheritor. Although academic qualifications can not be evaluated as a person's hard indicators, but it can not be denied that the higher the education of the person, the more knowledge to accept, the broader the field of vision. From the results of the survey, the educational level of the inheritors of the Wushu intangible cultural heritage in Anhui Province is generally low, with only two people having university degrees, and most of the inheritors no longer pursue further education after graduating from junior high school or high school, but choose to go out to work. The reason for this fact may be related to the era in which they lived at that time. Most of the inheritors of Wushu Intangible Cultural Heritage in Anhui Province are in the rural areas, and they do not have good conditions to receive high-level education. However, this fact can be improved through subsequent efforts, and the inheritors can continue to improve their abilities through continuing education and professional training to promote the continuous development of the inheritance business.

In terms of occupation, the survey results showed that among the 12 Wushu intangible cultural heritage bearers in Anhui Province, one was a public official, two were teachers, and seven were farmers (Table 4).

Table 4 Occupational Statistics of Wushu Intangible Cultural Heritage Inheritors in Anhui Province

Occupation	Public official	Teacher	Farmer	Other
Number of persons	1	2	7	2
proportion（%）	8.33	16.67	58.33	16.67

People have the impression that bearers of intangible cultural heritage are a profession. However, ICH bearer is only a title, they all have their own occupations and use their leisure time to carry out ICH transmission work only after completing their own work. According to the survey results, most of the inheritors make a living by farming or working, and only a very small number of them are teachers or public officials. Although there is no distinction between high and low professions, teachers or public officials will, to a certain extent, be conducive to the preservation and transmission of ICH. This is because they have richer resources and wider contact with society, and have greater opportunities to promote intangible cultural heritage.

3.2 Physical Health of Martial Arts Intangible Cultural Heritage Inheritors in Anhui Province

Survival state is a variety of states that people show in the process of life [4], and physical health is the most important part of people's survival state. Healthy body is an important prerequisite for people to work, study and live. The physical health of the inheritors is a necessary condition to carry out the inheritance of intangible cultural heritage, and if the body has problems, it will greatly affect the inheritance effect of the inheritors. This study investigates the physical health of the inheritors by investigating their illnesses (Table 5).

Table 5 Statistics on common diseases among the inheritors of the intangible cultural heritage of wushu in Anhui Province

Diseases	Number of persons	proportion（%）	Diseases	Number of persons	proportion（%）

High blood pressure	4	33.33	Respiratory Diseases	4	33.33
Diabetes	2	16.67	Lung Diseases	0	0
Hyperlipidaemia	2	16.67	Kidney Disease	0	0
Heart Disease	0	0	Joint Diseases	5	41.67
Hepatobiliary Disease	0	0	Neurological Diseases	4	33.33
Stomach Disease	5	41.67	Skin Diseases	1	8.33
Others	2	16.67	None	2	16.67

The survey results show that among the 12 inheritors of the intangible cultural heritage of wushu in Anhui Province, 5 of them suffer from joint disease and stomach disease, which is the disease that affects the largest number of people, and it may be related to their practice of wushu since childhood. Because wushu is a physical exercise sport, long-term practice in large quantities can leave behind sports injuries including arthropathy. In addition, due to the lack of time control in their training, their diet and routine are also irregular, which may be the main factor leading to their stomach problems. The results of the survey also showed that some of the inheritors suffered from hypertension, neurological diseases, diabetes, high blood cholesterol and other 'old age diseases', which may be related to the age of the inheritors as a whole. On the whole, although some of the inheritors are suffering from diseases, the diseases they are suffering from are not fatal, their physical condition is basically normal, and their health condition will not affect their work of inheritance.

3.3 Mental Health of Wushu Intangible Cultural Heritage Inheritors in Anhui Province

Self-achievement is a psychological feeling resulting from the balance between desire and reality, which refers to an individual's pride and satisfaction in his or her own achievements. It is an internal, self-evaluation-based emotional experience, which can stimulate the individual's enthusiasm, self-confidence and motivation, and promote their self-development and growth. Whether the inheritor can achieve a sense of achievement in the process of inheritance plays a very important role in the development of inheritance work. Therefore, this study investigates the inheritors' sense of self-achievement in the process of inheritance in order to judge the psychological health of the inheritors.

Table 6 Statistics on the sense of achievement of the inheritors of the intangible cultural heritage of wushu in Anhui Province in the process of inheritance

	Very much so	Yes	Average	No	Not at all
Number of persons	3	5	4	0	0
proportion（%）	25	41.67	33.33	0	0

The results of the survey show that among the 12 inheritors of the Wushu intangible cultural heritage in Anhui Province, three were very able to gain a sense of self-achievement, five were able to gain a sense of self-achievement, four gained an average sense of self-achievement during the inheritance process, and zero could not or were very unable to gain a sense of self-achievement (Table 6). This shows that most of the inheritors are satisfied with the achievements made in the inheritance work. This is conducive to further enhancing the inheritors' sense of mission, sense of responsibility and work enthusiasm, which is of great significance to the further development of the inheritance work of the Wushu intangible cultural heritage inheritors in Anhui Province.

3.4 Physical Living Status of Martial Arts Intangible Cultural Heritage Inheritors in Anhui Province

The economic base determines the superstructure. In the rapid development of commercialisation and globalisation, the level of economic income significantly affects people's material standard of living. For the group of inheritors,

economic income not only determines whether or not they can solve the problem of food and clothing, but also determines whether or not the work of inheritance is carried out well or badly. In this study, the economic income level of the inheritors is used to investigate the material living status of the inheritors, so as to understand the survival status of the inheritors from the side. (Table 7)

Table 7 Statistics on the economic income of the inheritors of the intangible cultural heritage of martial arts in Anhui Province

	0 yuan	Below 2000 yuan	2001-4000 yuan	4001-6000 yuan	Over 6000 yuan
Number of persons	3	4	3	2	0
proportion（%）	25	33.33	25	16.67	0

The results of the survey show that among the 12 inheritors of martial arts intangible cultural heritage in Anhui Province, there are three who have no income, four who earn less than 2,000 yuan per month, three who earn between 2001 yuan and 4,000 yuan per month, two who earn between 4,001 yuan and 6,000 yuan per month, and zero who earn more than 6,000 yuan per month. Generally speaking, the income level of the inheritors of martial arts intangible cultural heritage in Anhui Province is low, which may be related to the fact that the inheritors are mostly farmers. Through the visit, we learnt that most of the inheritors rely on odd jobs to make a living and their income is not stable, and some of them need to go out to work to make a living. Through the visit also learned that the state although the inheritors issued some subsidies, but this is far from being able to meet the needs of the inheritance work, in order to do a good job of the inheritance work, you need to pour money into it.

3.5 The Social Status of Wushu Intangible Cultural Heritage Inheritors in Anhui Province

Social status refers to people's position and position in the social system. Social status is crucial for a person and can determine a person's behaviour, way of thinking and interpersonal relationships. A person's social status also determines the degree of respect an individual receives, the advantages and disadvantages of income distribution, the number of opportunities, the development of personal talents, and the level of self-realisation [5]. It can be said that a person's social status can affect the role of the community to which a person belongs to some extent. The social status of martial arts intangible cultural heritage inheritors in Anhui Province is shown in the following table.

Table 8 Statistics on the social status of the inheritors of the intangible cultural heritage of martial arts in Anhui Province

	Village Cadres	National People's Congress Deputies	CPPCC member	Heads of Associations	Others
Number of persons	1	2	1	3	5
proportion（%）	8.33	16.67	8.33	25	41.67

The survey results show that among the 12 inheritors of martial arts intangible cultural heritage in Anhui Province, one is a village cadre, two are deputies to the National People's Congress, one is a member of the Chinese People's Political Consultative Conference (CPPCC), and three are heads of associations. Village cadres have a high social status in the village and it is relatively easy to carry out inheritance work. Deputies to the National People's Congress and members of the Chinese People's Political Consultative Conference (CPPCC) have wider contact with people, and are able to put forward their opinions and suggestions directly to the relevant departments, and strive for more benefits for the inheritance work. The person in charge of the society has certain organisational ability, which is conducive to the exhibition and publicity of the inheritance work. On the whole, the inheritors of Anhui Wushu intangible cultural heritage have a certain social status, although the social status is not very high, but it can provide certain help for the smooth implementation of the inheritance work.

4 CONCLUSION

The inheritors of the Wushu Intangible Cultural Heritage of Anhui Province are generally older, mainly male, married, with low education and mostly farmers. The physical health of the inheritors is generally good, and the diseases they suffer from are common, which do not affect their daily life and work and the development of inheritance activities. Most of the inheritors have a good sense of self-achievement and are satisfied with their work, and their mental health is

good. The social status of the inheritors is average, with more than half of the inheritors holding certain positions or titles but not at a high level.

COMPETING INTERESTS

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RESEARCH ON THE DEVELOPMENT OF CAMPUS FOOTBALL UNDER THE BACKGROUND OF SPORTS EDUCATION INTEGRATION BASED ON SWOT-AHP ANALYSIS

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Abstract: Against the backdrop of actively promoting the construction of a sports powerhouse in China, as the foundation of Chinese football, the development of campus football has been elevated to the height of national strategy, and its development enthusiasm may continue for a long time. Therefore, the purpose of this study is to use a model combining SWOT and AHP to study the development of campus football in China. The results indicate that the advantages and opportunities of campus football in China's development are more important than weaknesses and threats, and it has a good development prospect.
Keywords: Campus football; Sports powerhouse; SWOT analysis; AHP Analytic Hierarchy Process

Against the backdrop of the China's vigorous development of football, in order to further promote the integration of sports and education, vigorously promoting campus football has become an important task at this stage. Campus football is a general term for football related activities that are comprehensively carried out among students with the goal of improving their physical and mental health and cultivating qualified talents with comprehensive moral, intellectual, and physical development. Carrying out campus football activities can start football skills from childhood, ensure the quality of youth training, and further improve the popularization of football, laying a solid foundation for the development of Chinese football.

The application of SWOT-AHP analysis method in the research of sustainable development of Chinese campus football can better understand the advantages and disadvantages, opportunities and challenges in the current development of Chinese campus football, and formulate appropriate strategic models based on development trends.

1 SWOT ANALYSIS

1.1 Advantages

Firstly, China is developing towards the goal of becoming a sports powerhouse. The release of the 2019 Outline for Building a Sports Strong Country has elevated the development of China's sports industry to a new height. As one of the world-renowned sports, football also holds a high position in sports. Whether or not the level of football in China can be improved affects the achievement of the goal of building a sports powerhouse. Campus football, as the foundation of its development, has also been gradually valued in recent years.

Secondly, the current situation of campus football development is good. As of 2019, 24126 schools with campus football characteristics have been selected from 380000 primary and secondary schools nationwide. The number of universities recruiting high-level football players in China has increased from 77 in 2015 to 181, an increase of 135%.

Thirdly, the construction of the site is also satisfactory. At present, the number of campus football fields and even football fields applied to society in China is increasing at a considerable rate year by year. As of September 2018, there are a total of 120960 campus football fields in schools of all levels and types across the country. In addition, many provinces, cities, and regions are actively promoting the opening of campus football fields and other sports venues tosociety, which is bound to further improve the popularity of football among the general public.

Finally, the competition system is relatively complete, with independent competition systems from universities to

primary schools. The forms of competition vary among different age groups, and students are encouraged to participate as much as possible, promoting the development of campus football.

1.2 Weaknesses

Although the country is increasing its budget every year, with a huge total amount, there will be very little evenly distributed, and it may even be unable to guarantee the demand for various types of equipment. In terms of venue, it is difficult for schools to build up to standard 11 player football fields within a limited land area.

The phenomenon of cultural deficiency is still quite serious in the development of campus football. For example, when carrying out campus football, more emphasis is placed on improving skills and achieving results in competitive competitions, while neglecting the implantation of ideas and the comprehensive development of students.

The current number of teachers in our country who can guide students to carry out football activities is completely insufficient, and many football teachers are part-time teachers specializing in other projects. This is mainly because in the past few years, football was not highly valued in China, and there were fewer football talents, and people with high football skills generally had poor learning.

1.3 Opportunities

Firstly, the country and local governments provide policy support. In January 2015, the establishment of the National Youth Campus Football Work Leading Group and the release of the Overall Plan for Chinese Football Reform and Development officially announced the important position of campus football in the development of football in China. Subsequently, various departments issued policy proposals such as the "Notice of the Ministry of Education and the Ministry of Finance on Issuing the Interim Measures for the Management of Special Funds for Supporting Youth Campus Football", the "Opinions of the General Office of the Ministry of Finance of the People's Republic of China on Improving the Financial Investment Mechanism for Football Reform and Development", and the "Notice on Organizing Applications for the Recruitment of Foreign Campus Football Teachers to Support Projects", which also provided strong financial support for the development of campus football.

Football has a high level of social attention in our country, and the ratings of football matches have always been among the top in various sports stations. Every day, many people go to the football fields open to the public for free in various universities to participate in football. A good public foundation can promote the development of campus football.

Youth training clubs are gradually developing. At present, the number of non professional youth training clubs in China is rapidly increasing. These clubs mainly focus on cultivating children's interests and exercising, rather than blindly pursuing competitive results. Due to the high fun of its training, more and more parents are willing to send their children to participate in this type of football training, which is also an opportunity for the development of campus football.

1.4 Threats

The development of campus football in our country is driven by national policies, so when it is implemented in schools at all levels, there will inevitably be a phenomenon of dealing with errands, and there is no sincere desire to develop campus football.

In the development of campus football, there may also be a phenomenon of seeking quick success and instant benefits. Schools only pursue competition rankings and athlete levels, rather than promoting football to students. This precisely goes against the true intention of the country to promote the development of campus football.

The focus of school work in our country is still on further education, and the idea of knowledge changing destiny is deeply ingrained in people's hearts. The phenomenon of occupying physical education class time to supplement cultural courses is still common, and many educators even believe that physical education courses are only delaying students' learning time.

2 SWOT-AHP MODEL

2.1 Construction of AHP Hierarchical Structure Diagram and Judgment Matrix

Based on a qualitative SWOT analysis of the development of campus football in China, establish a SWOT element table (Table 1). According to Table 2, the AHP scale was used to compare the elements in the SWOT group, and the specific scores of each group were obtained[1].

Table 1 SWOT Element Table

Advantages	Weaknesses
1. Building a strong sports country	1. Limited funding
2. The development is good	2. Lack of teaching staff
3. Good site construction	3. Cultural deficiency
4. Complete competition system	
Opportunities	**Threats**
1. Government provides support	1. Dealing with errands
2. Broad mass base	2. Urgent for quick success and instant benefits
3. Rapid development of youth training	3. Emphasize text over body

Table 2 AHP measurement scale

Importance	Definition
1	Compared to element b, element a is equally important
3	Compared to element b, element a is slightly more important than element b
5	Compared to element b, element a is more important than element b
7	Compared to element b, element a is more important than element b
9	Compared to element b, element a is extremely important
2, 4, 6, 8	The importance of two elements, a and b, between the above levels
reciprocal	Compare two elements a and b. If the latter is more important than the former, take the opposite number

2.2 Weight and Consistency Testing

The calculation method is based on the academic papers published by Professor Liu Fenghu and other authors[2,3]. The results are shown in Tables 3 to 6.

Table 3 Weights and Consistency Test of Group S

S	S1	S2	S3	S4	W_i
S1	1	2	3	4	0.4669
S2	1/2	1	2	3	0.2775
S3	1/3	1/2	1	2	0.1603
S4	1/4	1/3	1/2	1	0.0953

Consistency check: $\lambda_{\max} = 4.0310$, $\mathrm{CI} = 0.0103$, $CR = 0.0115 < 0.1$, passed consistency test.

Table 4 Weights and Consistency Test of Group W

W	W1	W2	W3	W_i
W1	1	2	1/4	0.2184
W2	1/2	1	1/3	0.1515
W3	4	3	1	0.6301

Consistency check: $\lambda_{\max} = 3.1078$, $\mathrm{CI} = 0.0539$, $CR = 0.0929 < 0.1$, passed consistency test.

Table 5 Weights and Consistency Test of Group O

O	O1	O2	O3	W_i
O1	1	4	3	0.6250
O2	1/4	1	1/2	0.1365
O3	1/3	2	1	0.2385

Consistency check: $\lambda_{\max} = 3.0183$, $\mathrm{CI} = 0.00915$, $CR = 0.0158 < 0.1$, passed consistency test.

Table 6 Weights and Consistency Test of Group T

T	T1	T2	T3	W_i
T1	1	3	1/4	0.2176
T2	1/3	1	1/6	0.0914
T3	4	6	1	0.6909

Consistency check: $\lambda_{\max} = 3.0536$, $\mathrm{CI} = 0.0268$, $CR = 0.0462 < 0.1$, passed consistency test.

2.3 Calculation of the Strength of Various Strategic Factors

The magnitude of the factor's effect is the intensity, and its actual level is the estimated intensity, represented by an intensity score of 0-5. Strength=intensity score x weight. S. O is represented by positive values, W and T are represented by negative values, with higher absolute values indicating greater intensity.

As shown in Table 7:$\sum Si = 4.1160 > \sum Oi = 4.1135 > \sum Ti = -3.5078 > \sum Wi = -3.4786$.

Table 7 Calculation Results of Each Element

Factor	Total strength	Subfactor	W_i	Intensity score	Strength
S	$\sum Si = 4.1160$	S1	0.4669	5	2.3345
		S2	0.2775	4	1.1100
		S3	0.1603	3	0.4809
		S4	0.0953	2	0.1906
W	$\sum Wi = -3.4786$	W1	0.2184	-3	-0.6552
		W2	0.1515	-2	-0.3030
		W3	0.6301	-4	-2.5204
O	$\sum Oi = 4.1135$	O1	0.6250	5	3.1250
		O2	0.1365	2	0.2730
		O3	0.2385	3	0.7155
T	$\sum Ti = -3.5078$	T1	0.2176	-3	-0.6528
		T2	0.0914	-1	-0.0914
		T3	0.6909	-4	-2.7636

3 CONCLUSION

This article uses the SWOT-AHP hybrid model to analyze the development of campus football in China. Firstly, it qualitatively analyzes its internal advantages, disadvantages, as well as external opportunities and threats in its development. After analyzing the SWOT elements using the Analytic Hierarchy Process (AHP), the results show that there are significant opportunities for the development of campus football in China, and its inherent advantages are also evident. Therefore, in the current situation of strong support from the country, active response from various regions, and rapid development of amateur club youth training, campus football should seize external development opportunities and choose the SO development strategy type that combines internal advantages with external opportunities.

COMPETING INTERESTS

The authors have no relevant financial or non-financial interests to disclose.

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EXPLORING SAFETY HAZARDS AND COUNTERMEASURES FOR SELF-ORGANIZED CYCLING ACTIVITIES AMONG UNIVERSITY STUDENTS

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Abstract: This study explores the safety hazards and countermeasures associated with self-organized cycling activities among university students, with a focus on intercity cycling events involving students from Zhengzhou and Kaifeng. The research identifies safety concerns related to traffic, physical fitness, and equipment through a review of literature and theoretical analysis. It examines key risk factors from perspectives such as safety management, risk identification, and behavioral analysis. By integrating response strategies from universities, government authorities, and bike-sharing companies, the study proposes collaborative safety management recommendations. Findings indicate that significant safety risks exist in self-organized cycling activities, primarily due to the lack of standardized management. The study concludes that safety education by universities, improved infrastructure by the government, and optimized equipment maintenance by companies can effectively mitigate risks, ensuring the healthy development of outdoor campus activities.
Keywords: University student cycling; Self-organized cycling; Safety hazards; Risk management; Safety education

1 INTRODUCTION

In recent years, with the promotion of green travel concepts and the increased freedom of individual activities, cycling has gradually become an integral part of campus life for university students. Through cycling, students not only enhance their physical fitness and relieve stress but also expand their social circles and enjoy the excitement of exploring new experiences. Recently, intercity cycling activities between Zhengzhou and Kaifeng organized by university students have drawn significant public attention. These self-initiated activities, often carried out at night, vividly display the enthusiasm and vigor characteristic of the youth. Cycling, as a healthy lifestyle, symbolizes the students' pursuit of freedom and self-challenge.

However, while garnering attention, such self-organized long-distance cycling events have exposed notable safety hazards. First, the main routes often include public roads connecting cities. These roads are typically busy with nighttime traffic, and factors such as reduced visibility and cycling fatigue increase the risk of traffic accidents. Moreover, long-distance cycling requires substantial physical stamina and endurance. Studies have shown that stress conditions can affect physiological functions, such as variations in the performance of peripheral blood lymphocytes [1], providing theoretical support for understanding the potential health risks faced by students during prolonged cycling. Inexperienced cyclists may misjudge their physical limits, leading to overexertion or even injuries. For instance, irregular eating patterns during long-distance rides can cause gastrointestinal discomfort, a finding consistent with research emphasizing the role of physical constitution in gastrointestinal health [2].

Against the backdrop of widespread bike-sharing services, many students use shared bicycles for intercity rides. However, the quality and maintenance of these bicycles are often inadequate for long-distance requirements, increasing the likelihood of mechanical failures. Similar to the precision demanded in medical technologies like microwave ablation, the reliability of bicycle equipment forms the foundation of safe cycling [3].

This phenomenon highlights safety hazards inherent in university students' self-organized cycling activities and reflects deficiencies in related management and education. Many universities lack specific guidelines or safety protocols for cycling activities, leaving students without the necessary awareness or preparation [4]. Furthermore, local governments and bike-sharing companies fail to provide targeted support or safeguards for such activities [5].

Thus, balancing the encouragement of healthy student lifestyles with the regulation of outdoor activities has become a pressing issue in university safety management. This paper analyzes the safety hazards of self-organized cycling activities and explores potential countermeasures, aiming to provide scientific decision-making support for university administrators and practical references for promoting safe student cycling practices.

2 LITERATURE REVIEW

In recent years, cycling activities among university students have gained popularity, gradually becoming a campus cultural phenomenon. The underlying drivers include the promotion of healthy lifestyles, the growing appeal of low-carbon environmental awareness, and young people’s desire for freedom and exploration. Scholar Cui Heling suggests that cycling is widely embraced by university students because it not only offers a low-cost mode of transportation but also provides physical exercise and mental relaxation [6]. Research indicates that students are primarily motivated to cycle for three reasons: first, to adopt a healthier lifestyle, as cycling effectively improves physical fitness and mental health within the relatively sedentary campus environment; second, to expand their social networks through group cycling, fostering connections and a sense of community among peers; and third, to satisfy their curiosity and

adventurous spirit by exploring unfamiliar territories. Scholar Hou Shuai also argues that outdoor activities such as cycling help students fulfill their sense of adventure and exploration, which positively impacts their personal growth and campus culture [7].

With the rise of social media, cycling has evolved from being a simple physical activity into a "check-in" culture. Social media plays a crucial role in promoting cycling activities, as students frequently share their cycling routes, scenic spots, and experiences online. This process of online sharing reinforces a sense of participation and accomplishment, attracting more students to join. Social platforms further contribute to the growth of cycling activities by enabling students to quickly form cross-campus or intercity cycling groups, injecting new social elements into the activity. However, this increased scale and changing organizational structure also present challenges for safety management.

Despite the benefits of cycling, such as health improvements and enhanced social interaction, the associated safety risks cannot be overlooked. Existing studies highlight three primary areas of concern: traffic safety, physical challenges, and the suitability of cycling equipment [8].

Regarding traffic safety, the primary cycling routes often involve public roads connecting cities. These roads can be complex and pose challenges, particularly at night when visibility is reduced. Studies suggest that nighttime cycling is riskier than daytime cycling, not only due to poor visibility but also because of factors such as fatigue and unfamiliarity with road conditions [9].

Long-distance cycling also imposes substantial physical demands. While university students typically have a good physical foundation, many lack experience in cycling, making it difficult for them to accurately assess their endurance levels. This often results in overexertion or emergencies. Scholars have noted that outdoor accidents caused by fatigue and inadequate emergency response are common during long-distance cycling, and such incidents are particularly difficult to manage in outdoor settings [10].

As for cycling equipment, research points to several critical issues. With the widespread use of bike-sharing services, many students opt for shared bikes for intercity travel. However, these bikes are generally designed and maintained for short-distance use, making them unsuitable for long-distance rides. Prolonged use often leads to issues such as brake failures and tire wear, further increasing safety risks. The absence of professional cycling equipment means that students are ill-equipped to handle such failures, leaving them vulnerable. Additionally, some studies highlight inconsistencies in maintenance frequency and service standards among bike-sharing companies. To reduce costs, some companies cut back on maintenance, resulting in substandard bicycles. Since students often lack a clear understanding of the equipment's condition, this exacerbates the risks [11].

Various recommendations have been proposed to address these safety risks. For instance, in cycling safety education, scholars advocate for systematic training programs in universities. These programs could include topics such as basic traffic rules, nighttime cycling safety tips, self-assessment of physical endurance, and emergency responses to equipment failures [12]. Such training would enhance students' safety awareness, enabling them to better identify risks and make informed decisions during cycling activities. Universities could also implement additional safety measures for outdoor activities, such as installing prominent signs on campus cycling routes or distributing safety manuals to improve students' risk prevention capabilities.

Local governments also play a vital role in improving the cycling environment for students. Studies suggest that governments can optimize cycling conditions by establishing dedicated bike lanes and improving nighttime lighting along cycling routes to mitigate safety hazards such as traffic congestion and poor visibility [13]. Additionally, transportation authorities can promote awareness of safe cycling practices, helping students better understand traffic rules when participating in intercity cycling activities.

Bike-sharing companies are also regarded as key contributors to improving student cycling safety. Research suggests that these companies should increase the frequency of equipment inspections and maintenance, especially in high-demand areas such as university campuses and commonly used cycling routes, to ensure the reliability of their bicycles [14]. Companies could also introduce specialized bikes designed for long-distance cycling and equip their bikes with basic safety features, such as reflective stickers and helmets. Furthermore, bike-sharing companies could collaborate with universities to offer cycling training courses or insurance services, further enhancing students' sense of security during cycling activities.

In summary, the literature indicates that the safety risks of self-organized cycling activities among university students are multifaceted, involving individual factors, external environments, and equipment quality. Against this backdrop, a collaborative safety management mechanism becomes essential. Joint efforts by universities, governments, and companies can significantly reduce the risks associated with self-organized cycling activities.

3 THEORETICAL ANALYSIS

To address the safety hazards present in self-organized cycling activities among university students, theoretical analysis can be conducted from three perspectives: safety management, risk identification, and cycling behavior. These perspectives offer insights into the potential risk factors and corresponding countermeasures.

3.1 From the Perspective of Safety Management

The safety issues associated with cycling activities are closely tied to the structural organization of the events and participants' safety awareness. Unlike organized campus activities, self-organized cycling events lack standardized

management and guidance. According to safety management theory, group activities without clear rules or a structured management framework often lead to incomplete risk awareness among participants, resulting in uncontrollable hazards during the event. For instance, during long-distance nighttime rides, university students may face a higher risk of traffic accidents if there is no organized guidance on route planning, equipment checks, or safety awareness. Therefore, for self-organized cycling activities, interventions such as pre-event education, risk warnings, and organizational safety measures are particularly critical.

3.2 From the Perspective of Risk Identification

The primary risks in self-organized cycling activities include traffic hazards, physical health risks, and equipment-related risks [15]. Risk identification theory emphasizes that identifying and analyzing potential risk factors are prerequisites for effectively mitigating accidents.

Studies have identified three major contributors to accidents in university students' cycling activities: traffic risks, physical health risks, and equipment risks. Traffic risks are heightened by factors such as nighttime cycling, long-distance routes, and unfamiliar terrains, where inadequate lighting and challenging road conditions can impair cyclists' vision and reaction times, significantly increasing the likelihood of accidents. Physical health risks stem from the substantial stamina required for long-distance cycling, which many students, despite their basic physical fitness, may not accurately assess due to a lack of experience, leading to overexertion and potential injuries. Additionally, equipment risks arise from the quality and reliability of cycling gear; inadequate inspection or maintenance of shared bicycles, particularly their brakes and tires, can result in equipment failures during rides, posing severe safety hazards.

3.3 From the Perspective of Behavioral Analysis

The cycling behaviors of university students exhibit distinct group characteristics and tendencies toward imitation. Behavioral theory suggests that individual actions are influenced by group pressure and social media. The rise of cycling activities among university students is largely driven by the "check-in culture" popularized on social media. This trend has created a "herd effect," encouraging more students to participate in activities despite their lack of cycling experience [16]. The widespread sharing of “iconic routes” and “cycling challenges” on social media has fueled the growth of large-scale cycling events, inadvertently amplifying safety risks.

Furthermore, university students, known for their openness to new experiences, often lack a strong sense of risk awareness. This leads to insufficient consideration of potential safety hazards when engaging in cycling activities. The combined influence of group behavior and individual risk negligence makes safety management in these activities particularly challenging.

The above theoretical perspectives reveal that the safety hazards in university students' self-organized cycling activities are the result of multiple interacting factors. Enhancing the safety of these activities requires collaborative efforts from universities, governments, and bike-sharing companies.

Universities, governments, and bike-sharing companies each play vital roles in ensuring the safety of cycling activities among university students. As primary organizers, universities should incorporate safety education into students’ daily curricula to enhance their risk management and self-protection capabilities [17], such as by developing safety awareness programs within regular courses [18]. Governments should focus on improving cycling-related infrastructure and implementing targeted safety policies to provide a safer environment for student cyclists. Meanwhile, bike-sharing companies can contribute by optimizing equipment and increasing maintenance frequency to better accommodate the needs of intercity student cyclists.

4 CONCLUSION

An in-depth exploration and theoretical analysis of university students’ self-organized cycling activities reveal that while such activities hold significant benefits in terms of health, social interaction, and exploration, their inherent safety hazards cannot be ignored. The enthusiasm and interest of university students in cycling activities, fueled by social media, have led to a rapid increase in participation. However, the spontaneous nature of these activities, coupled with a lack of systematic safety management, has resulted in overlapping risks related to traffic, physical fitness, and equipment. The safety challenges of self-organized cycling extend beyond individual control and lack effective mechanisms for risk warning and management.

4.1 Universities Should Take Responsibility for Safety Education

Universities should conduct regular safety education programs, organize training sessions, and promote awareness campaigns to help students acquire essential cycling skills, knowledge of traffic regulations, and emergency response techniques for equipment failures. Additionally, universities can establish guidelines for outdoor activities, providing advice and consultation services for self-organized cycling events, including recommendations on routes, equipment, and timing.

4.2 Local Governments and Traffic Authorities Should Enhance Infrastructure

Local governments can mitigate safety risks by constructing dedicated bike lanes near university campuses and improving lighting and signage along cycling routes, particularly those used at night. Furthermore, government agencies can collaborate with universities to install safety warnings and reflective markers in high-traffic areas to enhance safety during nighttime cycling. Policymakers could also introduce regulations specifically tailored to long-distance cycling activities, outlining safety requirements to guide and support such initiatives.

4.3 Bike-Sharing Companies Must Optimize Equipment and Services

As key stakeholders in supporting cycling activities, bike-sharing companies should prioritize equipment maintenance and inspection, especially in high-demand areas near universities. Increasing maintenance frequency ensures the safety and reliability of shared bicycles. Companies could also introduce specialized bikes designed for long-distance cycling and equip them with safety features such as helmets and reflective stickers to meet students' intercity cycling needs. Additionally, companies might consider offering cycling insurance to reduce the financial risks students face during these activities.

Addressing the safety issues of self-organized cycling among university students requires collaborative efforts. Universities should focus on fostering safety awareness among students, while governments and companies must provide the necessary infrastructure and equipment support. These measures can gradually reduce safety hazards and create a secure environment for students to engage in outdoor exploration and adopt healthy lifestyles. Future research could further evaluate the effectiveness of specific interventions and identify the most impactful strategies to improve the safety of university cycling activities.

COMPETING INTERESTS

The authors have no relevant financial or non-financial interests to disclose.

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