Research Article

Construction of Intelligent Service System for Adolescent Students’ PE Based on Big Data Analysis

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Received 28 February 2022; Revised 22 March 2022; Accepted 25 March 2022; Published 23 April 2022

Academic Editor: Kuruva Lakshman

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As an important gateway to talent training, a university should monitor the physique of college students in real time and effectively cultivate their physical quality. Under the background of big data, it is necessary to construct the intelligent service system of students’ physical health (PE) in time, realize unified management, provide strong support for improving decision-making at all levels, ensure the orderly development of physical examination, and find and solve related problems in time. In this paper, the adolescent students’ PE is taken as the research object, and driven by big data, the intelligent service system of Chinese adolescent students’ PE is studied. Students’ PE test system based on data mining makes use of modern computer technology, breaks through many limitations of traditional manual test, transfers the traditional test form to computer, and uses IT to complete test and data analysis efficiently and accurately with the advantage of computer. This not only improves college students’ health awareness, health status, and participation enthusiasm but also significantly improves the work efficiency of health management institutions.

1. Introduction

Due to the continuous progress of social productive forces and the continuous progress of science and technology, all walks of life have higher and higher requirements for the ability level of talents and gradually change from single ability dominated by simple intellectual factors to diversified ability [1]. Due to the rapid economic development, people spend more and more time on work, and great changes have taken place in their lifestyle. People have less and less time for physical exercise. The busy study of teenagers also leads to a significant reduction in the time for physical exercise [2]. In this transformation process, the physical quality based on health status is called an important basis for employers to judge whether talent ability can be brought into full play. National physique monitoring is an important part of the healthy China strategy and the national fitness strategy [3]. Intelligent management and data acquisition system is a new management mode to meet the needs of social efficient information processing [4]. The acceleration of social rhythm leads to a sharp increase in work pressure, which also makes people pay more attention to the management of basic physical quality. How to combine big data theory and technology with factors such as school physical education and teenagers’ physical condition has become the research direction of the educational circles [5]. Building a big data-driven system can accurately improve the physical health (PE) of teenagers and solve the PE problems of Chinese teenagers in time [6].

With the high-speed operation of modern society, the pace of people’s life is becoming faster and faster, and the work pressure faced by all levels of society is increasing [7]. People are often busy with work, ignoring the maintenance of PE and the improvement of physical quality. With the continuous progress of IT and the rapid growth of data scale, big data, as a new generation of IT, is gradually bringing significant changes to the world economic operation mechanism, social living habits, and national governance level [8]. On the macro level, health management for college students is the essence of the country’s adherence to sustainable development. On the micro level, it is the choice of everyone’s healthy life. By using the health management
mode of college students, the defects in the traditional health management mode are avoided, such as passive management, weak health awareness of students, and unreasonable behavior [9]. The effective combination of health education, sports activities, family and social health, and other factors has built a new situation of comprehensive college students’ health management [10]. As an important gateway for talent training, a university should monitor the physique of college students in real time, effectively cultivate the physique of college students, and transport high-quality talents for the society, so as to promote the continuous development of the society [11]. This paper takes the PE of young students as the research object and studies the Chinese young students’ PE intelligent service system driven by big data.

In order to achieve better management and deliver high-quality talents to the society, it is necessary to realize the standardized collection and centralized processing of physical information, which is inseparable from the efficient analysis and scientific network management based on system algorithm and data mining [12]. In the context of big data, it is necessary to timely build the intelligent service system for students’ PE, realize unified management, provide strong support for improving decision-making at all levels, ensure the orderly development of physical testing, and timely find and solve relevant problems [13]. The organization and management of students’ PE test must be standardized and scientific, otherwise it will affect the accuracy, objectivity, and credibility of the evaluation work [14]. The manual operation of data requires a lot of manpower, material, and time, and many errors may occur due to human factors, which brings some difficulties to the PE test of students [15]. Entering the information age, we need to help people complete traditional work with the help of computers. The student PE test system based on data mining uses modern computer technology to break through many limitations of traditional manual test, transfer the traditional test form to the computer, adopt IT, and use the advantages of computer to complete the test and data analysis efficiently and accurately [16, 17]. With the application of health management system, it can more conveniently manage the health information of college students, such as the electronization of health information, the automation of health assessment, and the interaction of health education. It provides a useful tool for statistical analysis of health information, collection and sorting of assessment results, and implementation of health management.

2. Related Work

At present, China’s IT has achieved rapid development, which has greatly affected the lives of more and more people. Therefore, more information systems have attracted people’s attention. Literature [18] holds that a person’s physique itself is a relatively stable feature of the human body in terms of shape and body function under the combined effect of innate acquisition and acquired learning. Literature [19] holds that the health evaluation report is equivalent to the report card of adolescent students’ PE test, which includes the results and analysis of various evaluation indexes. Through the vertical comparison, that is, the comparison of current scores and previous scores, accurate analysis can be made, so as to put forward targeted opinions and suggestions. The research of big data is the analysis and induction of statistical search and comparison, clustering, and classification of huge amount of data. The application of big data refers to the process of using the characteristics and methods of data analysis to mine effective information from huge data to provide users with corresponding auxiliary decisions to realize the value of big data. Literature [20] research shows that by using IT and computer to manage the test, the disadvantages of manual management can be fundamentally eliminated, and the data storage cost is low, the storage quantity is large, the query and retrieval are convenient, the data security is high, the data confidentiality is good, and the data reliability is high. Literature [21] holds that, from a limited point of view, information system is to collect, further process and process data, and provide some help to decision makers in all walks of life. Literature [22] believes that in order to achieve the efficient use of resources, it is necessary to realize data sharing. By adopting this method, it is possible to realize more smooth mutual communication among various departments in the industry and to apply the system management ideas in technology, so that the system can have stronger technical support in the future work process. Literature [23] pointed out that in the application of big data, jumbled data itself makes it difficult for people to make decision-making, so it is easier for users to accept and make use of the analyzed results only by showing them in a relatively friendly way.

A person’s athletic ability and physical condition are the main indexes to evaluate his physique and also the key to evaluate his health condition. IT wants to be used more efficiently in the industry, which is directly related to the sharing of IT and resources. In this paper, the adolescent students’ PE is taken as the research object, and driven by big data, the intelligent service system of Chinese adolescent students’ PE is studied. The system formats and marks every medical record, which is convenient for users to inquire and exchange information through the Internet in real time.

3. Construction of College Students’ PE Intelligent Service System under the Background of Smart Campus

3.1. Demand Analysis and Model Architecture. Demand is a very important aspect in the school’s smart campus PE testing system, which determines the effectiveness of this system. Demand in PE is divided into user demand and functional demand. Every university is trying every means to manage students’ PE more scientifically and conveniently and improve students’ PE level. In order to better build the intelligent service system for students’ PE, a unified, standardized and easily expandable information platform can be established, which can be used to store, summarize, and analyze data, so as to realize modern management. Using the popular platform development tools and technologies and based on the smart campus platform, a new intelligent
service system for PE based on smart campus is developed, which realizes a new model of university’s PE management for students [24]. Schools began to strengthen their own sports management development, not only formulated corresponding development policies but also increased the implementation. In the process of implementation, supervision and management are carried out, and at the same time, the students’ PE indexes are quantitatively analyzed, and then, decisions are made according to the actual situation.

The operability of the construction of smart campus PE platform is divided into several aspects. First is the strong support of the Ministry of Education and the school. The construction of PE platform is approved by the Ministry of Education and supported by funds. At the same time, the school has also given various material, personnel and policy support. Many institutions of higher learning only emphasize testing and reporting test indicators, ignoring their follow-up management and dynamic intervention, thus failing to improve students’ PE thoroughly. Therefore, in the implementation, we need to innovate ideas and realize that health test is only the beginning, and the focus of work should shift from physical fitness to physical activity promotion and we will try our best to help students develop a healthy, active, and energetic lifestyle. For example, Table 1 is a survey of the urgent problems of adolescent sports health.

The school has abundant sports resources, including sports human resources, sports facilities resources, leisure time resources, and sports information resources. Therefore, schools are in the most basic and important position in enhancing students’ PE. Figure 1 shows the basic element structure of the integrated service system for adolescent PE.

The structure of the student physique test system is shown in Figure 2.

In university management, the most important content is the management of students. In recent years, with the state’s emphasis on the PE of university students, the status of students’ PE management in university management has gradually emerged. The healthy big data processing platform should be a unified one, each section is an independent platform, and each user has an account and permission system and can expand the project in time. Therefore, it is necessary to share the project data, so that the physical quality of teenagers can be reflected, and a comprehensive system of health records can be established for students. The functional requirements of college students’ PE test depend on users’ needs, because the system functions are designed to meet students’ needs, which are fully collected and considered by students’ needs [25]. At the same time, it also takes into account the differences between different regions and different schools and formulates the user requirements according to the actual situation. Building a platform of intelligent service system for adolescent students’ PE can help schools integrate sports, health, data, and resources and improve the utilization rate of information. Using big data to process information can effectively reduce work errors caused by man, reduce workload, improve work efficiency, ensure that managers can analyze and control data, and make teenagers’ physical conditions converge in a large system.

3.2. Build a Big Data Management Platform. China cannot build without teenagers. Teenagers must have healthy bodies, so we must reform and strengthen the sports work for teenagers in time. Due to the continuous progress of the times, how to innovate the youth sports work is a problem that educators are facing at present. To improve the PE of teenagers by using big data in schools, we should change the traditional physical education teaching methods, innovate, and improve the research methods of PE. Many students do not like to play sports. When they take part in

Table 1: Investigation of urgent problems to be solved in social sports.

| Urgent problem to be solved                      | Select the number of people | Proportion (%) |
|-------------------------------------------------|----------------------------|---------------|
| Building sports venues and facilities           | 7058                       | 78.4          |
| Organize regular sports activities              | 4124                       | 45.8          |
| Establish various sports organizations          | 3511                       | 39            |
| Strengthen sports publicity and mobilization    | 2825                       | 31.4          |
| Carry out sports skill training                 | 2907                       | 32.3          |
| Other                                           | 316                        | 3.5           |

Figure 1: The basic element structure of the integrated service system for adolescent PE.

Figure 2: The structure of the student physical fitness test system.
sports, they are just spectators. Many students have single sports and irregular exercise time, which leads to the decline of students’ physical quality. The smart campus PE platform has solved this problem [26]. Students’ physical fitness test data will be sorted and analyzed after being uploaded to the platform and finally uploaded to the platform in the form of charts. Students can see the distribution map of their achievements and see which type of students they belong to and what aspects need to be strengthened and improved. If universities want to build an information platform for students’ PE management in the construction of smart campus, they should set up corresponding organizations according to their own specific conditions, be responsible for the management and operation of the platform, and do a good job of liaison and coordination among students, teachers, and administrators. Figure 3 shows the relationship between diversified governance subjects of adolescents’ PE services.

The application of the new-generation IT in the PE detection of young students can provide effective management for students’ health data, because the new-generation IT such as big data, Internet of Things, and smart devices can make the data more transparent. The intelligent service system of college students’ PE based on smart campus effectively combines sports health, sports behavior, physical evaluation, exercise prescription, physical education, extracurricular exercise, personalized guidance of teacher-student interaction, etc. in college students’ PE management and realizes a coherent, unified, and dynamic scientific management mode with advanced technologies of Internet and Internet of Things. In order to realize the unified organization and management of students’ physical conditions and health data, we can build an interactive school intelligent service ecosystem; create courses that meet the PE of young students; integrate the courses of PE test, data analysis, sports report, and sports prescription through online feedback and offline communication; and provide more development space. The intelligent service system of adolescent students’ PE based on big data is shown in Figure 4.

In the intelligent service system of PE, the standardization of data table is a difficult point, because this platform is made with reference to the national PE reporting platform. However, the data forms of the national PE reporting platform are strictly restricted, and the reported schools need to go through many procedures to modify and organize the data forms into the format required by the national PE reporting platform. This process is complicated and long, and it takes a long time and energy to do this. For the construction of school infrastructure, there should be material and technical support, and schools must have basic equipment such as computing network to view basic data [27]. In addition to the material basis, there must be technical support, such as Internet, Internet of Things, and artificial intelligence. Through data resources, the analysis of students’ physical quality can be strengthened, and data can be obtained from students’ physical development and PE and sports, so as to provide useful data for managers. The platform is interconnected with data student PE management system, PE research management system, student nutrition monitoring management system, and student

movement tracking management system, which can ensure the health of teenagers, supervise and manage them in time, pay attention to their health status, teach students in accordance with their aptitude, and improve students’ PE accurately.

4. Optimization Strategy of Intelligent Campus PE Intelligent Service System

Smart campus cannot be built and operated without the support from all sides. Before the platform is built, you must first apply for the support from the school and the support from the Ministry of Education. These two aspects of support will provide a broad construction environment for the smart campus PE platform, and the Ministry of Education will provide certain policies and funds to support the construction of the university PE platform. The daily operation of the system must have a perfect management system. With a perfect management system, there will be “laws to follow” in the daily operation of the information system. The most important factors that determine whether the information system works effectively are the system and standards and ultimately people. In order to manage this information well, Oracle XML DB is adopted as the basis of system completion. The powerful functionality of this technology determines that it can provide strong support and guarantee for the development of health information. It can automatically generate XML format, and the documents it generates can be used by the previously set mode. The database provided by Oracle XML DB can effectively avoid the limitations of various network protocols and manage the body data well. In addition, it can also support the transformation of XML, which can better display and output health information.

The variable parameter state space model is used to measure the dynamic effect of the intelligent service system of PE on the PE development of young students. The regression model of variable parameter state space model is expressed as

$$y_t = \beta_t x_t + \mu_t, \quad t = 1, 2, \Lambda, \Lambda.$$  \hspace{1cm} (1)

Among them, $y_t$ is the dependent variable, $x_t$ is the $1 \times m$ explanatory variable vector, $\beta$ is the $m \times 1$ unknown parameter vector to be estimated, and $\mu_t$ is the disturbance term.
Estimates are made using the ordinary least squares method, instrumental variable method, and other measurement models:

\[ y_t = \beta_t x_t + z_t \gamma + u_t, \quad t = 1, 2A, T. \]  (2)

Among them, \( \beta_t \) is a variable parameter, which reflects the change of the influence relationship of the variable on the dependent variable at that time. It is assumed that \( \beta_t \) can be described by AR(1) as

\[ \beta_t = \phi \beta_{t-1} + \xi_t. \]  (3)

It is further extended to the AR(\( p \)) model, assuming

\[ (\mu_t, \xi_t)' \sim N \left[ \begin{bmatrix} 0 \\ 0 \end{bmatrix}, \begin{bmatrix} \sigma^2 & g \\ g & Q \end{bmatrix} \right], \quad t = 1, 2A, T. \]  (4)

Among them, \( \mu_t \) and \( \xi_t \) are not necessarily independent of each other but obey the normal distribution with covariance matrix \( Q \), \( \text{cov} (\mu_t, \xi_t) = g \), and mean 0 and variance \( \sigma^2 \).

The overall coefficient of the health status evaluation index system is 0.65, indicating that the overall evaluation index system has high internal consistency. The dimensions and overall reliability coefficients of the health-related index field evaluation system are shown in Table 2.

Figure 5 shows the relationship between the clustering coefficient and the average path length of the model with the reconnection probability.

In the smart campus of university, the first thing to build the information platform of students’ PE management is to consider students’ needs in this respect, take PE test as the core content, and fully integrate the resources of various functional departments of university to meet students’ PE needs. PE classroom teaching is conducive to promoting students’ all-round development, and it is also an effective way...
Table 2: Dimensions and overall reliability coefficients of the health-related index field evaluation system.

| Dimension          | Number of indicators |
|--------------------|----------------------|
| Activity ability   | 16                   |
| Somatic function   | 9                    |
| Emotional character| 7                    |
| Memory function    | 6                    |
| Healthy behavior   | 5                    |

Figure 5: Relationship between clustering coefficient and path length.

Figure 6: Stepwise linear regression data results.

Figure 7: Comparison of system performance before and after storage optimization.

to cultivate students’ feelings and understanding of sports. The linear regression curve is calculated according to the stepwise multiple linear regression equation, as shown in Figure 6.

Relevant policy support of university students’ PE management platform is based on smart campus. In universities, policies around sports work are important guarantees to promote students’ PE. The related work of schools should be based on students’ PE status, and the core is to promote students’ PE. The operation and management system of data analysis and processing system for adolescents’ PE is formulated to strengthen the leadership and management of computer network system and promote the application and development of data analysis and processing system for adolescents’ PE. College students’ PE management must keep pace with the times and learn advanced technology and advanced theory, so as to keep up with the times. For students’ PE management, advanced network technology platform must be adopted to manage more efficiently and conveniently. The construction and operation of the smart campus PE platform are not the same. Every school needs to build the smart campus PE platform according to the actual situation of its own school, and each school can endow it with different characteristics. Figure 7 is the result of comparing the performance of students’ PE intelligent service system before and after storage optimization.

The system has strong performance in all aspects, basically meeting the needs of users, and the system pays more attention to details, and the interface has been optimized and improved. The intelligent campus PE platform is built and operated by specialized technical personnel, with the participation of many personnel and technological innovation. The promotion of technology is also a very important aspect in the promotion of the smart campus PE platform. Only by extending the technology to other universities can the platform be truly promoted, and it should be put into practice to better serve Chinese universities. During the operation of the system, the system functions are insufficient due to environmental changes or the functional requirements that cannot be found or solved in the development process may appear. When this happens, it is necessary to immediately modify, maintain, or make local adjustments to the system. The construction and operation of the smart campus PE platform cannot be separated from the creation of new features. Innovation is reflected in the innovation of technology, management methods, and PE data reporting. Only innovation can really promote the management level of college students’ PE and effectively manage the PE data of college students by using advanced technology and scientific methods.
5. Conclusions

As an indispensable and important component of modern medical information system, health information system really realizes everything from the patient, taking the patient as the starting point and foothold of all work. To a certain extent, the construction of smart campus PE platform saves manpower, material resources, and financial resources; integrates the PE systems under the management of different departments and personnel; and makes more use of the new technology of network platform, which makes the use of data more convenient and greatly improves the management efficiency of the school. Big data technology provides a new perspective and ideas for promoting students' PE and testing students' PE and also provides a basis for the reform of physical education, the management of students' PE, the construction of smart campus, and the development and application of sports science and technology products. It is suggested that schools at all levels should make full use of modern IT, monitor the physique of young students in time, grasp their sports status, guide them in time, and exercise students scientifically to improve their physical quality. The experimental results show that the student physical health intelligent service system optimized by this algorithm is 76.5% higher than that before optimization and is significantly better than other methods involved in the comparison, which can prove the effectiveness of this algorithm.

This system is a primary version of adolescent PE data analysis and processing system, which is mainly used to solve the data problems in physical examination and save the physical examination data and student data safely and completely to the platform by designing and implementing the system. In the later work, we still need to improve the current shortcomings of the platform, such as more beautiful interface, more convenient operation, complete connection with national data management system, and better optimization of sports physical examination workflow and operation.

Data Availability

The data used to support the findings of this study are included within the article.

Conflicts of Interest

The authors declare that they have no competing interest.

Acknowledgments

This paper is supported by the Humanities and Social Science Projects of Anhui Provincial Education Department (SK2021A0254) and Ministry of Education, Humanities and Social Science Projects (19YJAZ90035).

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