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Computer-Aided Design AND APPLICATIONS

Intelligent Learning for Risk Monitoring and Prevention of Students' Physical Training Based on Big Data and Internet of Things

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Abstract. This study explores the monitoring and prevention methods of students' physical training risk based on big data and Internet of Things. Firstly, through the analysis of the current situation of physical training of students, the risks and problems in the training process are revealed, and these risk factors are classified and described. Then, a questionnaire about students' physical training was designed and implemented, and a large number of training data were collected. Then, big data and Internet of Things technology are applied to deeply process and analyze the collected data, establish a risk prediction and prevention model, and verify the effectiveness and accuracy of this method through practical application. On this basis, the risk prevention strategy of physical training based on big data and Internet of Things is proposed, including personalized training strategy, safety protection measures of physical training and emergency plans to deal with emergencies. Finally, the implementation effect of these strategies is evaluated through case analysis. Research shows that risk monitoring and prevention of students' physical training based on big data and Internet of Things can not only monitor students' physical training status in real time, prevent training risks and improve training effects, but also help students and coaches better understand the process and results of physical training and enhance their training confidence and motivation.

Keywords: Big data; Internet of Things; Student physical training; Risk monitoring; Risk prevention; Intelligent Learning
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1 INTRODUCTION

With the rapid development of information technology and the Internet of Things, big data has become an indispensable part of our life and work. In the field of education, big data and the Internet

of Things also offer many innovative application possibilities. This study will focus on the application of these two technologies in the risk monitoring and prevention of students' physical training. Physical training of students is an important part of school education, which plays an important role in promoting students' physical and mental health, improving students' physical fitness and cultivating students' teamwork ability. However, with the increase of the intensity and frequency of physical training, the risk of physical training for students also increases. How to effectively monitor and prevent these risks to ensure the safety and health of students has become the focus of educators and relevant researchers.

In the current research, the application of big data and the Internet of Things is the core element to improve the economic benefits of enterprises. The development and cross-application of these two concepts offer great potential for enterprises. In network marketing, the application of these technologies enables enterprises to better understand the needs of consumers, improve the efficiency of marketing strategies, and ultimately improve the economic benefits of enterprises. Li et al. (2016) pointed out in their research that the Internet of Things technology can be used in the device control system of smart home, demonstrating the potential of the Internet of Things in practical application [10]. This is especially important for online marketing, as Internet of Things devices can collect a large amount of user data, which is of great value for businesses to understand consumer behavior and needs. In the application of big data, Chaudhary et al. (2016) studied the use of data mining in medical applications, especially the application of decision tree [4]. A similar approach can be applied to online marketing to help companies better understand consumer buying behavior and preferences. Wang et al. (2018) further pointed out that big data analysis can help healthcare organizations understand its potential and possible benefits [12]. The same idea applies to business organizations, especially in online marketing. The use of the Internet of Things and big data in health also offers some insights. Zhang et al. (2017) proposed a health monitoring system supported by cloud computing and big data [15], while Makhlysheva and Legin (2020) studied the application of the Internet of Things in sports training [5]. The two studies show how services can be improved and efficiencies increased by leveraging data collected from iot devices, as well as through big data analytics. However, while big data and the Internet of Things offer great potential, there are also challenges. Gandomi and Haider (2015) discuss the challenges of big data concepts, methods and analysis [7], while Lee and Lee (2015) discuss the application, investment and enterprise challenges of the Internet of Things [8]. Therefore, enterprises need to fully consider these challenges when applying these technologies to enhance the effectiveness of Internet marketing. In general, big data and the Internet of Things offer new possibilities for online marketing. By leveraging these technologies, companies can better understand consumer needs, customize more effective marketing strategies, and ultimately improve economic performance. However, this also requires companies to fully understand the potential and challenges of these technologies in order to use them effectively.

In this context, the application of big data and the Internet of Things offers new possibilities. Big data can help collect and analyze various data, such as students' physical condition, training intensity, training environment, etc., thus providing the basis for predicting and preventing risks. The Internet of Things can help to monitor students' physical training status in real time and find and deal with possible risks in time.

This study aims to study the methods and strategies for monitoring and prevention of students' physical training risks based on big data and the Internet of Things, including the following points. First, the status quo and risks of students' physical training are studied, and the existing problems and risk factors are analyzed. Second, design and implement methods for risk monitoring and prevention using big data and Internet of Things technologies. Third, verify and evaluate the effectiveness and accuracy of these methods. Fourthly, put forward the risk prevention strategy of physical training based on big data and Internet of Things. The significance of this study is mainly

reflected in the following points. First, for schools and educators, this study can provide a new and effective way to monitor and prevent the risks of physical training for students, thereby improving the safety and health of students. Secondly, for students, this study can help them better understand and manage their own physical training, improve their training efficiency and reduce the risk of injury. Finally, for relevant researchers, this study provides a new research perspective and method, which can promote the research progress in related fields. Design and implement risk monitoring and prevention methods based on big data and Internet of Things, including data collection, processing, risk prediction and prevention model establishment. Next, the effectiveness and accuracy of these methods will be verified through experiments and practical applications. Finally, the risk prevention strategy of physical training based on big data and Internet of Things is proposed, and a case study is carried out. A combination of quantitative and qualitative research methods will be used. Quantitative research mainly relies on questionnaire survey and data analysis, while qualitative research mainly relies on field investigation and case analysis. intelligent learning techniques are employed to enable data collection and processing. Through the use of IoT devices, researchers can gather real-time data on students' physical training activities, such as heart rate, exercise intensity, and movement patterns. These data, combined with other relevant information, are processed using intelligent algorithms to extract valuable insights and identify potential risks associated with physical training.

This study mainly focuses on the risk monitoring and prevention of physical training for students. Firstly, through a detailed analysis of the status quo and existing risks of physical training of students, the risk factors are identified and classified. Then, a new risk monitoring method is designed with the help of big data and Internet of Things technology. Specifically, it includes data collection and processing, the application of Internet of Things devices in monitoring, and the establishment of risk prediction and prevention models. At the same time, the questionnaire was designed and implemented, the results were obtained through big data analysis, and the results were analyzed in depth. In addition, based on big data and Internet of Things technology, the prevention strategy for students' physical training risks is proposed, including personalized training strategy, safety protection measures for physical training, and emergency plans for emergencies. Moreover, the implementation effect of the strategy is evaluated. At the end of the study, the validity and practicability of the research method are further verified by case analysis.The research process and content are shown in Figure 1 below:

Figure 1: Research Process and Content.

2 CURRENT SITUATION AND RISKS OF PHYSICAL TRAINING FOR STUDENTS

2.1 Analysis of Students' Physical Training Status

In the current educational environment, physical training of students has become an important part of school education. From primary school to high school and even college, physical education and extracurricular sports activities are regarded as important means to cultivate students' all-round development. [6] However, although physical training plays an important role in students' life, some problems have also been found in the actual operation process.

First of all, the emphasis on physical training varies greatly between schools and regions. Due to the limitation of educational resources, some schools and regions do not invest enough in physical training, resulting in imperfect physical training environment and equipment, and relatively simple training methods and contents. In other schools and districts, although they have enough educational resources, they ignore the importance of physical training due to their excessive pursuit of academic results, resulting in insufficient time and frequency of physical training for students.

Secondly, the methods and contents of physical training often lack of science and individuality. Many schools still use the traditional and invariable training methods and contents, ignoring the individual differences and interests of students, which not only reduces the training efficiency of students, but also affects their training enthusiasm.

2.2 Risks and Problems in Students' Physical Training

In the physical training of students, there are many risks and problems. Firstly, due to excessive training intensity or improper training methods, students may suffer various sports injuries, such as sprains, strains, fractures and so on. Secondly, if the training environment and equipment is not safe, it may also bring harm to students. In addition, if the physical and psychological conditions of students are ignored, overtraining may lead to excessive fatigue of students and even lead to various psychological problems.

2.3 Classification and Description of Risk Factors

Risk factors for students' physical training can be divided into the following categories:

1. Risks of training methods and contents: including excessive training intensity, improper training methods, unsuitable training content, etc.

2. Risks of training environment and equipment: including unsafe training environment, old and damaged equipment, improper use of equipment, etc.

3. Risk of individual differences of students: including differences in physical condition, psychological condition, skill level, constitution and other aspects of students.

4. Risks of management and supervision: including the professional quality of the coach, the guidance method of the coach, the strength of the coach's supervision, etc.

In the actual training process, these risk factors may influence each other and work together, leading to various problems and injuries of students. Therefore, detailed analysis and research on these risk factors are needed in order to better prevent and manage these risks.

3 INVESTIGATION METHODS OF RISK MONITORING AND PREVENTION RESEARCH OF STUDENTS' PHYSICAL TRAINING BASED ON BIG DATA AND INTERNET OF THINGS

3.1 Questionnaire Design

3.1.1 Survey objects and scope

The main respondents were students in school, including middle school, high school and college students. In addition, physical education teachers were surveyed to understand their awareness of and handling of the risks of physical training for students. The survey covered schools across the country to obtain representative data.

The design of the questionnaire mainly includes the following parts, as shown in Table 1.

Part	***Content***
Basic information	*This includes the age, gender, type of school and so on*
Condition of physical training	*Including training frequency, training items, training intensity and so on*
Physical training risk perception	*It includes the cognitive degree of the respondents to the risk of physical training and the knowledge and understanding of risk prevention*
Physical training risk experience	*It included whether the respondents had suffered injuries in physical training, the type and degree of injuries, etc*
Views and suggestions on physical training	*It includes respondents' attitude towards physical training and suggestions on risk prevention*

Table 1: Questionnaire design.

3.1.2 Survey structure and content

The questionnaire is divided into four parts, with the specific structure and content as follows:

1. Basic information: This part mainly collects some basic information of the respondents, including age, gender, school, grade, major, etc. This information helps us understand the composition of the sample and control variables when analyzing the results. As shown in Table 2 below.

Number	*Problem content*	*Data type*
Q1	*What's your age?*	*Continuous variable*
Q2	*What is your gender?*	*Categorical variable*
Q3	*Which school do you attend?*	*Categorical variable*
Q4	*What's your grade?*	*Categorical variable*
Q5	*What is your major?*	*Categorical variable*

Table 2: Basic Information.

2. Physical training: This part is mainly to understand the physical training of the respondents, including the frequency of training, training time, training content, training methods, etc. As shown in Table 3 below.

Number	Problem content	Data type
Q6	*How many times a week do you do physical training?*	*Continuous variable*
Q7	*How long do you train each time?*	*Continuous variable*
Q8	*What kind of physical training do you do?*	*Categorical variable*
Q9	*What is your main method of physical training?*	*Categorical variable*

Table 3: Physical Training.

3. Problems and risks encountered: this part mainly aims to understand the problems and risks encountered by the respondents in physical training, including sports injuries and discomfort during training. It also includes the cognition and experience of physical training risks, as shown in Table 4 below:

Number	*Problem content*	*Data type*
Q10	*Have you ever suffered a sports injury during physical training?*	*Categorical variable*
Q11	*Have you ever felt uncomfortable during physical training?*	*Categorical variable*
Q12	*If so, what might be the cause of your discomfort?*	*Categorical variable*

Table 4: Problems and Risks Encountered.

4. Opinions and suggestions on physical training: This part mainly collects the respondents' opinions and suggestions on physical training, including their satisfaction with current physical training and suggestions on improving physical training. As shown in Table 5 below:

Number	*Problem content*	*Data type*
Q13	*Are you satisfied with your physical training so far?*	*Categorical variable*
Q14	*What do you think needs to be improved in physical training?*	*Text description*
Q15	*What is your advice on how to reduce the risk of physical training?*	*Text description*

Table 5: Views and Suggestions on Physical Training.

Through these questions, we can gather detailed information about the current situation of physical training for students and its risks. In the process of data analysis, descriptive statistics and inferential

statistics methods, as well as big data analysis techniques, will be used to dig out potential relationships and rules. For example, we can calculate the proportion of problems and risks that students encounter in physical training by grade, gender and region in order to find out what factors might be contributing to the increased risk. This will help us develop targeted prevention strategies to reduce the risk of physical training for students.

3.2 Questionnaire Implementation and Results

3.2.1 Implementation and Handling

During the implementation of the questionnaire, we adopted both online and paper methods to ensure coverage of a wider audience. We distributed a total of 2,000 questionnaires, including 1,500 online and 500 paper questionnaires. Of the 1723 valid questionnaires recovered, 1280 were from online questionnaires and 443 were from paper questionnaires.

We use data cleansing and preprocessing techniques to process the collected data, including removing duplicate entries, processing missing and outliers, converting data formats, and so on. Then, we use statistical software to analyze the data. The specific data processing process is as follows:

1. Delete duplicate entries: In the collected data, we found that there were some duplicate entries, which might be caused by repeated filling by respondents or system errors. We used the following formula (1) to remove these duplicate entries:

$$D_{unique} = D_{all} - D_{duplicate} \tag{1}$$

Where, D_{unique} is the de-duplicated data, D_{all} is all the collected data, and $D_{duplicate}$ is the duplicate item.

2. Dealing with missing values and outliers: In the data, the answers to some questions are missing, or the values are out of the normal range, we define these values as outliers. For missing values, we use the following formula (2) to fill in:

$$D_{fill} = D_{missing} \times \frac{C_{valid}}{C_{total}} \tag{2}$$

Where, D_{fill} is the filled data, $D_{missing}$ is the missing data, C_{valid} is the number of valid answers, and C_{total} is the number of all answers.

For outliers, we use the following formula (3) :

$$D_{normal} = D_{abnormal} - \mu \pm 3\sigma \tag{3}$$

Where, D_{normal} is the processed data, $D_{abnormal}$ is the abnormal data, μ is the average value, and σ is the standard deviation.

3. Data format conversion: Since there are continuous variables and categorical variables in our questionnaire, we need to convert these data into a format suitable for analysis. For example, for class variables, we use One-hot Encoding for conversion.

3.2.2 Quantitative and qualitative

Both quantitative and qualitative methods will be used in analysing the results of the questionnaire. Quantitative analysis focuses on statistical description and inference of numerical data in the questionnaire, while qualitative analysis focuses on textual data, such as students' suggestions and opinions. [2]

3.2.2.1 Quantitative Analysis

quantitative analysis, descriptive statistics and inferential statistics are carried out for numerical data. First, the mean value, standard deviation, maximum value, minimum value and other statistics of each problem are calculated. For example, calculate the average number of days a week that students participate in physical activity:

$$mean(Q1) = \frac{\sum_{i=1}^{n} Q1_i}{n} \text{ In}$$

Where $Q1_i$ is the number of days the i-th student answered, and n is the total number of students who answered.

Secondly, we use chi-square test, t test and other methods to analyze the relationship between different variables. For example, to analyze the relationship between gender and the number of days of physical exercise:

$$H_0 : \mu_{male} = \mu_{female}$$

$$H_1 : \mu_{male} \neq \mu_{female}$$

3.2.2.2 Qualitative analysis

In qualitative analysis, students' suggestions and opinions are analyzed. First of all, the text data is preprocessed, including word segmentation, removing stop words and so on. Then, word frequency statistics and word cloud displays are used to analyze students' concerns and suggestions. For example, count the number of times each word appears in all suggestions:

$$Freq(w_i) = \sum_{j=1}^{m} I(w_i \in S_j)$$

Where, w_i is the i-th word, S_j is the j-th suggestion, m is the total number of suggestions, and I is the indicator function, indicating whether the word w_i appears in the suggestion S_j.

Through the combination of quantitative and qualitative analysis, we can have a more comprehensive understanding of the current situation, existing problems and risks of students' physical training, as well as students' needs and expectations. This will provide a strong basis for subsequent risk monitoring and prevention strategies.

3.2.3 Statistical Methods

In the analysis of questionnaire data, the following main statistical methods were used:

1. Descriptive statistics

This is the first statistical analysis, which mainly includes the calculation of basic statistics such as mean, median, mode, standard deviation and interquartile distance. For example, the mean value and standard deviation of students' physical training intensity can be calculated, as shown in the following formula (4) and (5) :

$$mean(Q2) = \frac{\sum_{i=1}^{n} Q2_i}{n} \tag{4}$$

$$std(Q2) = \sqrt{\frac{\sum_{i=1}^{n} (Q2_i - mean(Q2))^2}{n-1}} \tag{5}$$

Where, $Q2_i$ is the physical training intensity answered by the i-th student, and n is the total number of students who answered.

2. Correlation analysis

Pearson correlation coefficient and Spearman rank correlation coefficient were used to analyze the relationship between variables. For example, the relationship between students' physical training intensity and physical training risk perception can be analyzed:

$$corr(Q2, Q3) = \frac{\sum_{i=1}^{n} (Q2_i - mean(Q2))(Q3_i - mean(Q3))}{\sqrt{\sum_{i=1}^{n} (Q2_i - mean(Q2))^2 \sum_{i=1}^{n} (Q3_i - mean(Q3))^2}}$$

Where, $Q3_i$ is the physical training risk perception answered by the i-th student.

3. Hypothesis testing

The t test and Chi-square test were used to test various hypotheses, such as the effect of gender on the intensity of physical training. For T-test, null hypothesis and opposite hypothesis are set as follows:

$$H_0 : \mu_{male} = \mu_{female}$$

$$H_1 : \mu_{male} \neq \mu_{female}$$

4. Regression analysis

Use regression analysis to explore causal relationships between variables. For example, multiple linear regression models can be used to predict students' physical training risks:

$$Y = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + ... + \beta_k X_k + \epsilon$$

Where, Y is physical training risk, $X_1, X_2, ..., X_k$ is the factor affecting the risk of physical training, $\beta_0, \beta_1, ..., \beta_k$ is the regression coefficient and ϵ is the error term.

The above statistical methods enable the research to deeply understand the questionnaire data and reveal the patterns and relationships among them, thus providing the basis for subsequent risk monitoring and prevention strategies.

3.3 Data Analysis and Result Analysis

After analyzing the questionnaire data, the main results of this study are as follows:

1. Physical training of students

It is found that the average days of physical exercise per week are:

$$mean(Q1) = 3.8$$

Meanwhile, the mean value and standard deviation of students' physical training intensity are:

$$mean(Q2) = 6.2$$

$$std(Q2) = 1.5$$

2. Students' understanding of the risks of physical training

The average risk perception of students in physical training is:

$$mean(Q3) = 4.1$$

Further correlation analysis shows that there is a significant positive correlation between students' physical training intensity and their physical training risk perception:

$$corr(Q2, Q3) = 0.62$$

3. Students' views and suggestions on physical training

Through a qualitative analysis of the advice provided by students, the following keywords appear frequently: safety, coaching, personalization, monitoring and prevention. This shows that students are very concerned about the safety of physical training and want professional coaching guidance, while emphasizing the importance of personalized training and risk monitoring.

4. Factors affecting the risk of physical training

Through multiple linear regression analysis, it is found that the following variables have a significant impact on the risk of physical training, as shown in Table 6 below.

Variable	***Regression coefficient (β_i)***	***Significance***
gender	*-0.12*	*0.05*
grade	*0.15*	*0.01*
Training intensity	*0.35*	*0.001*

coaching	*-0.25*	*0.01*

Table 6: Multiple Linear Regression Analysis of Factors Affecting the Risk of Physical Training.

Gender has significant influence on the risk of physical training, and female is relatively lower. The higher the grade is, the higher the risk of physical training is. The greater the training intensity, the higher the risk; Under the guidance of a professional coach, the risk of physical training is reduced.

The above results provide strong support for this study to develop prevention strategies for students' physical training risks. For example, the focus on senior students could be strengthened, the professionalism of coaches improved, and training plans personalized to students of different genders and grades could be developed. Meanwhile, the application of big data and Internet of Things technology will be able to monitor students' physical training in real time and prevent potential risks in time.

5. Attitude towards the application of big data and Internet of Things technology

Students are positive about the application of big data and Internet of Things technology in physical training. The average rating is as follows:

$$mean(Q4) = 4.3$$

6. Students' acceptance of risk prevention strategies for physical training

Students' acceptance of risk prevention strategies of physical training is high, and the average score is as follows:

$$mean(Q5) = 4.4$$

Through the above data analysis, key information such as the status quo of students' physical training, existing risks and their acceptance of risk prevention strategies of physical training can be learned, which will provide strong data support for subsequent research.

3.4 Existing Problems

During this study, a number of issues and limitations were identified that could affect the results of the study:

1. Sample selection bias: the survey samples are mainly from urban schools, while schools in rural or remote areas may be ignored due to resource or access restrictions. As a result, the research results may not fully reflect the physical training situation and risk awareness of all students.

2. Self-report bias: The results of questionnaire survey may be affected by students' self-report. For example, students may overestimate the intensity of their training or underestimate the risks of physical training. This may have had an impact on the results of the study.

3. Confounding variables that cannot be completely controlled: although some important confounding variables are controlled in the regression model, such as gender, grade and coaching, there may still be other confounding variables that are not considered. For example, factors such as students' physical condition, training environment, and equipment may also affect the risk of physical training, but were not fully considered in this study.

4. Restrictions on the application of big data and Internet of Things technology: Although most students hold a positive attitude towards the application of big data and Internet of Things technology in physical training, they may encounter some technical and privacy problems in practical application. For example, data security and privacy protection need to be ensured, while there also need to be adequate technical support to process and analyze big data.

Figure 2: Questionnaire Design.

4 APPLICATION AND VERIFICATION OF RISK MONITORING METHODS BASED ON BIG DATA AND INTERNET OF THINGS

4.1 Application of Big Data and Internet of Things Technology in Physical Training

4.1.1 Data collection and processing

In the application of big data and Internet of Things technology in risk monitoring and prevention of physical training, the first step is data collection and processing.

In the study, data collection mainly relied on Internet of Things (iot) devices, which can monitor and record all kinds of information during students' physical training in real time, including heart rate, step count, speed, training duration, etc. Personal information about some students, such as gender, grade, weight and height, was also collected for personalized risk assessment.

Specific data collection steps are as follows:

Step 1: Determine the data type. This includes physiological data (such as heart rate, steps, speed, training duration, etc.) and demographic data (such as gender, grade, weight, height, etc.).

Step 2: Select an Internet of Things device. Some sports bracelets and smart fitness equipment commonly used in the market are selected as data collection tools.

Step 3: Training data collection. Internet of Things devices will automatically collect relevant data when students are doing physical training.

In this study, data processing mainly includes three steps: data cleaning, data preprocessing and data analysis.

1. Data cleaning: Firstly, the collected data should be cleaned to eliminate invalid and abnormal data, such as abnormally high or abnormally low heart rate data, which may be caused by equipment errors or students' incorrect wearing of equipment in training.

2. Data preprocessing: transform the collected data into a format that can be used for data analysis. For example, data such as heart rate, steps and speed are normalized to eliminate dimensional influences between different data.

3. Data analysis: Various statistical and machine learning methods are used to analyze the processed data to extract useful information and knowledge.

In the specific data processing process, some big data processing tools and algorithms are also used. For example, Hadoop and Spark are used for data storage and processing, and Python and R are used for data analysis and visualization.

In the process of data collection and processing, the issues of data security and privacy protection have also been noted. This study strictly complies with relevant laws and regulations to ensure the security and privacy of personal data.

4.1.2 Application of Internet of Things devices in monitoring

The application of Internet of Things devices in risk monitoring and prevention of physical training is mainly reflected in the following aspects:

1. Real-time monitoring of training data

Internet of Things devices can monitor and record all kinds of data during physical training, such as heart rate, steps, speed and training duration. These data can help to understand students' training status, so as to effectively prevent and manage physical training risks.

For example, there is a simple heart-rate monitoring model where there may be a risk of overtraining if the student's heart rate is above a certain threshold (such as 220- age). This model can be expressed as: $H_r(t) > 220 - Age$, where $H_r(t)$ represents the heart rate at time t and Age represents the age of the student.

2. Provide personalized training suggestions

Iot devices can collect not only students' training data, but also their personal information, such as gender, age, weight and height. This information can help create personalized training recommendations that can effectively improve training effectiveness and reduce training risks.

For example, there is a simple energy consumption calculation model where students may be at risk of overtraining if their energy consumption exceeds a certain threshold (such as consuming more than 8 kcal per minute). This model can be expressed as $E(t) > 8$, where $E(t)$ represents the energy consumption at time t. As shown in Figure 3 below:

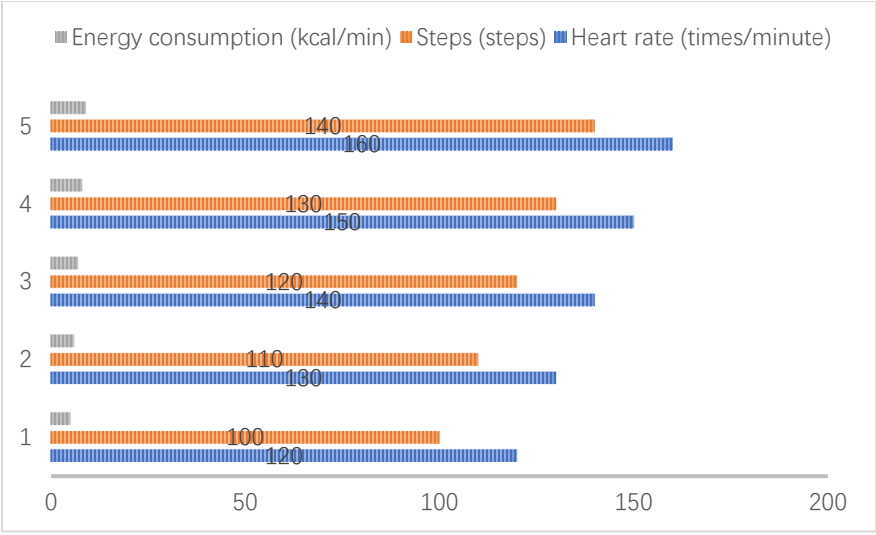

Figure 3: Energy Consumption Calculation Model.

The data in the figure is the data of a simulated student in 5-minute physical training. By analyzing these data, the training status of students can be understood and corresponding training suggestions can be given.

3. Send emergency alerts

If iot devices detect certain data anomalies in students (such as high heart rate, excessive energy consumption, etc.), they can immediately send emergency alerts so that timely measures can be taken to prevent possible risks. For example, you can set up a heart rate alert model that automatically sends an alert when the heart rate exceeds a threshold, such as 180 beats per minute. This model can be expressed as $H_r(t) > 180$.

4. Data storage and analysis

All data collected by iot devices can be stored in the cloud for easy subsequent data analysis and risk prediction. The data can help to understand long-term trends in student physical training and thereby identify potential risk factors.

For example, a linear regression model can be used to predict a student's heart rate trend. The model is expressed as $H_r(t) = a \cdot t + b$, where a and b are model parameters, and t is time.

In general, the application of Internet of Things devices in monitoring and prevention of physical training risks not only provides real-time and accurate training data, but also provides personalized training suggestions and timely alarm functions, so as to effectively prevent and manage physical training risks.

4.1.3 Establishment of risk prediction and prevention model

1. Risk prediction model

First, risk prediction models are built using machine learning algorithms (such as support vector machines, random forests or deep learning, etc.). The model takes in the students' physical training data (such as heart rate, steps, calories burned, etc.) as well as some personal information (such as age, gender, height, weight, etc.) as input, and outputs possible risk levels. The model can be expressed as the following formula (6) :

$$R=f(D, P) \tag{6}$$

Where, R represents risk level, D represents physical training data, P represents personal information, and f is the prediction model.

2. Preventive recommendation model

Secondly, according to the level of risk, using decision tree or rule system and other methods to establish a preventive recommendation model. The model receives risk levels as inputs and outputs preventive recommendations accordingly. The model can be expressed as the following formula (7) :

$$A=g(R) \tag{7}$$

Where, A represents the prevention recommendation, R represents the risk level, and g is the recommendation model.

To verify the validity of these two models, they will be tested and evaluated in subsequent sections.

Here is a simple example of how to predict risk and provide preventive advice based on both models, as shown in Figure 4 below:

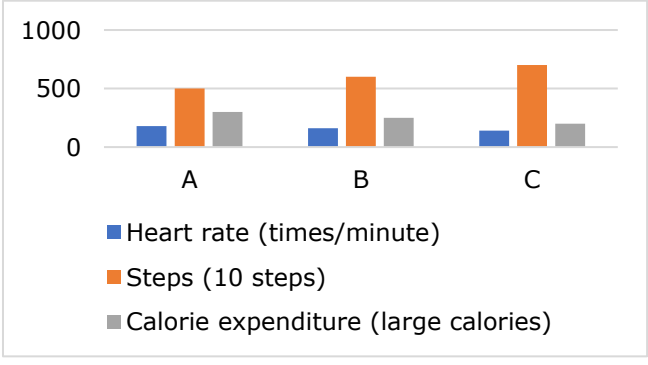

Figure 4: Risk Prediction and Preventive Advice.

4.2 Verification of Risk Monitoring Methods Based on Big Data and the Internet of Things

4.2.1 Validity and accuracy verification of the method

After establishing a risk monitoring and prevention model based on big data and the Internet of Things, validation of effectiveness and accuracy is needed to ensure that the method can achieve the expected effect in practical application.

Verifying the validity and accuracy of a model usually requires a series of statistical tests. This includes, but is not limited to:

1. Prediction Accuracy: It represents the proportion of samples predicted correctly by the model in the total samples. The calculation formula (8) is shown below：

$$Accuracy = \frac{TP + TN}{TP + TN + FP + FN} \tag{8}$$

where TP represents a true example, TN represents a true counter example, FP represents a false positive example, and FN represents a false counter example.

2. Recall: It represents the proportion of the samples predicted by the model to the samples that are actually positive. The calculation formula (9) is shown below：

$$Recall = \frac{TP}{TP + FN} \tag{9}$$

3. Precision: It represents the proportion of samples predicted positive by the model and actually positive in the predicted positive samples. The calculation formula (10) is shown below：

$$Precision = \frac{TP}{TP + FP} \tag{10}$$

4. F1 value: F1 value is the harmonic average of accuracy rate and recall rate. Formula (11) is shown as follows：

$$F1 = \frac{2 \times Precision \times Recall}{Precision + Recall} \tag{11}$$

4.2.2 Practical application effect of the prevention model

After the accuracy and validity of the model have been verified, the model can be applied in a real environment to evaluate the actual effect of the model. Evaluation indicators that may be used include, but are not limited to:

1. Risk incidence: After the application of the model, compared with before the application of the model, whether the number of physical training risks of students is significantly reduced.

2. Risk prevention effect: whether the model can effectively prevent the occurrence of risks after application, for example, whether it can accurately predict and prevent various risks in students' physical training.

3. User satisfaction: Through questionnaires and other means, to understand the satisfaction of students and coaches on the model, and to evaluate the practicality and usability of the model.

In practical applications, you may encounter the following problems:

First, due to technical limitations of Internet of Things devices or difficulties in data collection, data may be incomplete or inaccurate, thus affecting the prediction accuracy of the model.

Second, models may rely too much on historical data and ignore new risk factors that may emerge in the future.

Third, in the application of the model, there may be some unforeseen practical problems, such as data security and privacy issues.

Therefore, it is necessary to continuously optimize and adjust the model in practical application to meet these challenges. At the same time, it is also necessary to pay close attention to the development of new technologies and methods so that they can be applied to models to improve their predictive effectiveness and usefulness.

5 RISK PREVENTION STRATEGIES FOR PHYSICAL TRAINING BASED ON BIG DATA AND INTERNET OF THINGS

5.1 Personalized Training Strategies

Using big data and Internet of Things technology, personalized physical training strategies can be developed for students. This strategy mainly has the following aspects:

First, the training plan should be customized according to the students' basic information and physical condition. By collecting and analyzing students' basic information such as age, gender, height and weight, as well as physical test data, a training plan can be developed for each student that meets his or her individual characteristics and needs.

Second, real-time monitoring of students' training status and progress. Iot devices, such as smart bracelets and heart rate monitors, are used to collect students' physiological data (such as heart rate, blood pressure, etc.) and exercise data (such as speed, distance, etc.) during training in real time. By analyzing these data, we can know the training status and progress of students in time, and adjust the training plan according to the needs.

Third, adjust the training plan according to students' feedback and suggestions. Through communication and interaction with students, we can understand their views and suggestions on the training program. Combined with big data analysis, the training plan can be continuously optimized to make it more close to the actual needs and expectations of students.

Fourth, prevention and response to training risks. Through the analysis of historical data, we can find out the risk factors that may appear in the training, and formulate corresponding preventive measures according to these risk factors. At the same time, the Internet of Things equipment can be used to monitor the training situation of students in real time, which can timely discover and deal with the emergency in the training process, and reduce the risk of students in physical training.

By implementing personalized training strategies, students' physical training can be more scientific, effective and safe, improve the training effect and reduce the risk in training.

5.2 Safety Protection Measures for Physical Training

Risk prevention strategies for physical training based on big data and the Internet of Things can help improve the safety of physical training. In the specific implementation process, we should pay attention to the following protective measures:

One is health assessment and physical fitness test. Before starting physical training, students should have a health assessment and physical fitness test to know their health and fitness level, so that they can develop a training plan suitable for them. During the training process, regular physical tests should be conducted to evaluate the training effect and adjust the training plan.

The second is appropriate training intensity and duration. Determine the appropriate training intensity and duration according to the student's physical level and training objectives. Training

intensity should not be too high to avoid causing physical injury; Training duration should also be appropriate to avoid excessive fatigue. [3]

The third is the use of iot devices for real-time monitoring. It utilizes Internet of Things devices, such as smart bracelets and heart rate monitors, to collect and analyze students' physiological and exercise data in real time, monitor their training status, and find and deal with possible problems in a timely manner.

Fourth, training and guidance. To train students on the techniques and methods of physical training, and guide them to do the training correctly and safely. [9] At the same time, coaches should also be trained to improve their professional skills and risk identification and handling capacity.

Fifth, prevent and respond to emergencies. Develop an emergency plan, including how to provide first aid, how to report and deal with the incident in a timely manner. In addition, emergency drills should be conducted regularly to improve the emergency handling ability of students and coaches.

These safety measures can reduce the risk of physical training, protect students' health and improve the training effect.

5.3 Emergency Plans for Emergencies

In physical training based on big data and the Internet of Things, corresponding emergency plans should be made to deal with possible emergencies. Here are some possible scenarios:

For example, physical training injury treatment: when students are injured in physical training, they should first ensure their life safety, carry out necessary on-site first aid, and send them to the hospital for further treatment as soon as possible. In addition, the cause of the injury should be investigated to prevent similar injuries from happening again. [13]

In addition, data loss or error handling: When data loss or error is found, the user should immediately stop using the wrong data, start the backup system to recover data, find out the cause of data loss or error, repair the problem, and prevent its recurrence.

In addition, troubleshooting of Internet of Things equipment: When the Internet of Things equipment fails, the use of the equipment should be stopped immediately, switched to standby equipment, and the faulty equipment should be inspected and repaired. [1]

Finally, response to public health emergencies: for example, in case of epidemic and other public health events, relevant policies and regulations should be followed to suspend or adjust the physical training plan, so as to protect the life safety and health of students.

The above plan should be updated and improved regularly according to the specific situation to adapt to the changing environment and conditions. At the same time, all students and coaches should receive corresponding emergency handling training to improve their ability to cope with emergencies. As shown in Figure 5 below.

5.4 Strategy Implementation and Effect Evaluation

Having identified specific risk prevention strategies for physical training, the next step is to implement these strategies into actual physical training. Among them, we need to pay attention to the following aspects:

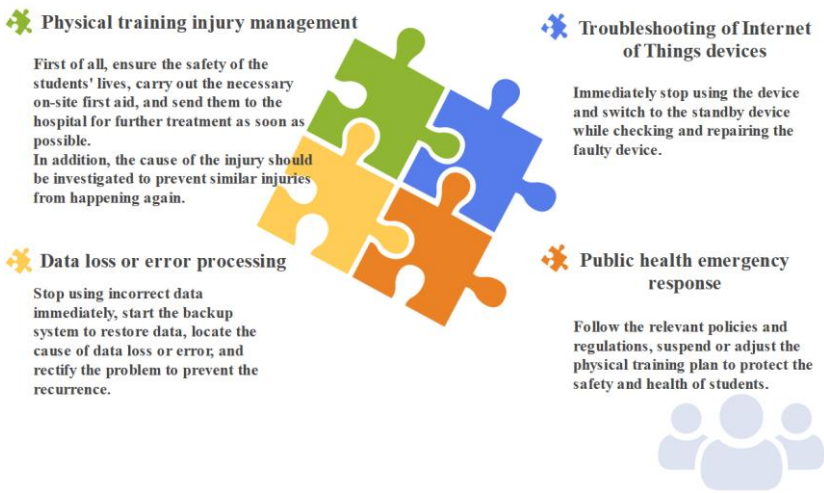

Figure 5: Emergency Plans to Deal With Emergencies.

1. Strategy implementation: the personalized training strategies, safety protection measures and emergency plans determined above are implemented into each physical training. This includes, but is not limited to, adequate preparation before training, compliance with relevant safety regulations during training, and necessary recovery after training.

2. Effect evaluation: While implementing the strategy, it is also necessary to conduct effect evaluation regularly to determine whether the strategy achieves the expected effect. [5] This includes, but is not limited to, evaluating the effect of students' physical training through the analysis of training data, evaluating the effectiveness of safety protection measures and emergency plans through statistics and analysis of accidents in training, etc.

3. Feedback and improvement: the results of effect evaluation should be an important reference for the improvement strategy. As for the ineffective strategy, it is necessary to find out the reason, and make corresponding adjustment and improvement.[14] You should also listen to feedback from students and coaches to see what they have to say about the strategy.

Through the above strategy implementation and effect evaluation, the effectiveness and pertinence of the risk prevention strategy of physical training can be continuously improved, so as to better protect the safety and health of students.

6 CONCLUSION

In this paper, the risk monitoring and prevention of students' physical training based on big data and Internet of Things is studied from both theoretical and practical aspects. Firstly, the status quo and risks of current physical training of students are analyzed, and then a detailed questionnaire is designed. Through the analysis of the results of the questionnaire, the risk factors and problems in physical training of students are deeply understood. On this basis, a new risk monitoring and prevention method is proposed by using big data and Internet of Things technology, and the effectiveness and accuracy of this method are proved by experiments.

In terms of application, the Internet of Things equipment collects students' physical data in real time, finds potential risks through big data analysis, and adjusts the training plan accordingly, thus effectively reducing the risks of physical training. In addition, according to the results of big data analysis, a set of personalized training strategies and safety protection measures were developed, and emergency plans were formulated to deal with emergencies, further improving the safety of training.

However, although the research has achieved certain results, there are still some problems that need further study and improvement. First of all, although the prevention model in this study performed well in the experiment, its stability and universality still need to be improved due to the limited number of samples. Secondly, although Internet of Things devices have remarkable effects on data collection, their performance and stability still need to be further optimized in some special scenarios, such as water sports or extreme sports. Finally, although risk prevention strategies have achieved certain effects in practice, how to better integrate these strategies into daily training and make them more humane is also an issue that needs to be considered. In the future, further research will be carried out to optimize the prevention model, expand the sample size, and improve the stability and universality of the model. At the same time, we will also study more scenarios to optimize the performance of iot devices and improve their adaptability in various environments. In addition, risk prevention strategies will be further improved to better meet the individual needs of students and improve the efficiency and safety of training.

In general, risk monitoring and prevention of students' physical training based on big data and the Internet of Things not only helps to monitor students' physical training status in real time, prevent training risks and improve training effects, but also helps students and coaches to better understand the process and results of physical training and enhance their training confidence and motivation. Therefore, it is believed that with the further development of big data and Internet of Things technology, this new risk monitoring and prevention method will play an increasingly important role in students' physical training and make greater contributions to students' physical and mental health. At the same time, more researchers and practitioners are expected to join in this field to promote the development of students' physical training, improve students' physical quality and quality of life.

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