Hindawi
Journal of Nanomaterials
Volume 2022, Article ID 9108458, 10 pages
https://doi.org/10.1155/2022/9108458

Research Article

The Effect of Polymer Composite Materials on the Comfort of Sports and Fitness Facilities

Qingkun Feng[1] and Lijun Wang[2]

[1]*Institute of Physical Education and Health, Zhaoqing University, Zhaoqing, 526000 Guangdong, China*
[2]*Institute of Physical Education and Health, Yulin Normal University, Yulin, 537000 Guangxi, China*

Correspondence should be addressed to Lijun Wang; wanglj432@ylu.edu.cn

Received 23 March 2022; Revised 10 May 2022; Accepted 23 May 2022; Published 18 July 2022

Academic Editor: Awais Ahmed

In a narrow sense, polymer composites refer to multiphase materials composed of polymers and other substances with different compositions, shapes, and properties. They can be divided into structural composites and functional composites. In a broad sense, polymer composite materials also include polymer blend systems, collectively referred to as "polymer alloys." The purpose of this paper is at studying how to study the impact of polymer composite materials on the adaptation and comfort of sports and fitness facilities. This paper puts forward the problem of comfort, which is based on the construction materials of sports equipment, and then elaborates on the polymer composite materials and makes a case design and analysis of the applicability of polymer composite materials in sports equipment being carried out. The experimental results show that 34.81% of the people are very satisfied and relatively satisfied with the quality identification of sports equipment and only 41.99% of the people are very satisfied and relatively satisfied with the feeling of sports equipment when exercising. Both are less than half of the total sample size, which shows that the current state of sports facilities is worrying.

1. Introduction

With the rapid development of the society, under the dual pressure of work and life, people pay more and more attention to healthy life. However, the current sports equipment and fitness facilities as a whole still cannot meet the people's fitness needs, which not only limits the public's participation in physical exercise but also exacerbates the contradiction between the public's growing fitness needs and the unbalanced and insufficient supply of fitness facilities. The wide application of polymer functional composite materials in sports equipment improves the comprehensive performance of sports equipment and fitness facilities and promotes the vigorous development of sports enterprises. In view of this, it is particularly important to discuss the design research of sports equipment and facilities in sports and fitness venues.

The improvement of the comfort of sports facilities will help alleviate the contradiction between the growing demand for sports activities and the lack of sports facilities, and it can help people improve people's comfort in sports activities. Convenient transportation, good sports environment, excellent sports equipment, and comfortable sports atmosphere can not only stimulate people's desire to engage in sports activities to a certain extent but also help them improve their physical condition and enjoy physical and mental health during exercise. Likewise, it helps extend the lifespan of sports facilities.

The innovation of this paper is that (1) this paper combines polymer composite materials with deep learning and introduces the theory and related methods of the neural network in detail and (2) in the face of the comfort of sports facilities, using questionnaires and analyzing the performance of polymer composite materials to analyze come in handy. Through the evaluation of the experimental results, in the selection of materials for sports equipment, materials and comfort should be given top priority and suitable materials will improve the comfort and experience of athletes.

2. Related Work

Since the 19th century, humans have used naturally modified polymer materials. After entering the 20th century, polymer materials entered a huge development stage. Atci E presented atomic models for the transport of single-component gases (CH_4, CO_2, H_2, and N_2) and binary gas mixtures (H_2/CO_2, H_2/N_2, and H_2/CH_4) in zeolitic imidazole framework (ZIF) membranes and ZIF/polymer composite membranes. The atomic model predictions are validated by comparison with available experimental data for ZIF-90 films. However, his experimental data was less [1]. Xin et al. reported a convenient and versatile strategy to prepare cesium lead bromide or organic lead halide methyl ammonium bromide polymer composites. They verified it by using methyl methacrylate, butyl methacrylate, and polystyrene and successfully built a prototype white light-emitting diode with viable color properties and narrow bandwidth. However, its application scope was limited [2]. Vaisanen et al. conducted a critical review of the impact of multiple types of waste, residues, or process by-products on NFPC and assessed their potential as NFPC components. However, his content was relatively brief [3]. Dang et al. investigated anisotropic aluminum nitride (AlN) whiskers and isotropic spheres as mixed fillers in the epoxy resin and polyvinylidene fluoride (PVDF) matrix to improve thermal conductivity of polymer composites. And polymer composites with mixed fillers of AlN whiskers and spheres with different volume ratios were prepared. However, his results were not comprehensive enough [4]. Moura et al. reported on the production and characterization of composites for wound healing applications, investigating bioactive glasses obtained by a sol-gel method and doped with two different metal ions. However, his performance was lower [5]. Khan A used chemical vapor deposition (CVD) technology to extract two different morphologies of carbon nanomaterials (CNM), namely carbon nanobeads (P1) and a mixture of carbon nanotubes and carbon nanobeads (P2). The morphology of the composites was analyzed by FESEM to study the interaction of fillers with the matrix to improve performance. However, his influence factors were more [6]. Zhang and Goekce summarized in situ and ex situ laser prototyping methods and downstream batch processing techniques for nanoparticle-polymer composites (LaNPCs) and discussed determining factors of polymer-solvent-laser parameterization on the target physical and chemical properties of composites. The advantageous features of this technique were demonstrated by highlighting representative works related to various promising applications. Finally, it described the challenges and prospects facing LaNPC, as well as perspectives on how recent research results are changing the direction of research in this field. However, their focus was not enough [7]. Li et al. investigated polymer composites reinforced by pristine and functionalized graphene to determine the improvement of the tribological properties of polymer composites. A molecular layer model with Fe atoms as the top nanolayer was established, and the tribological properties of the polymer composites were improved by sliding the top Fe nanolayer on the surface of the polymer matrix. The simulation results show that the average friction coefficient and wear rate of the functionalized graphene/polymer composites are reduced by about 13% and 42.3%, respectively. However, their data were not accurate enough [8].

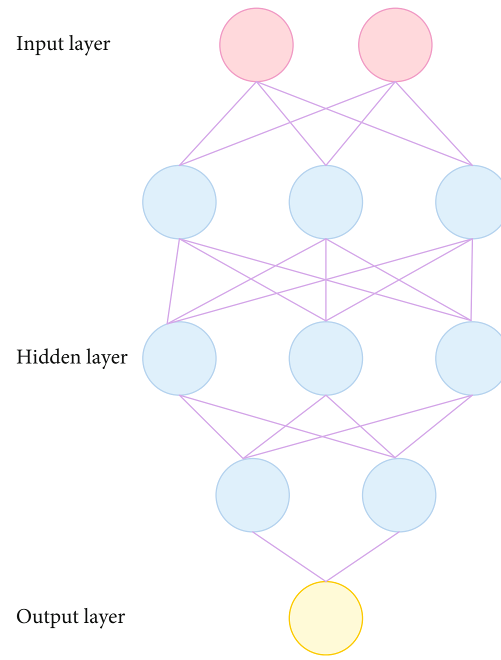


Figure 1: Architecture of an artificial neural network.

3. Classification Method of Polymer Composite Materials

3.1. Introduction to Deep Learning Based on Polymer Composite Material Classification. In recent years, deep learning technology has been successfully applied to speech recognition, handwriting recognition, and computer vision and achieved remarkable results in the fields of natural language self-processing [9]. The classification of polymer composites can also be carried out with the help of deep learning techniques.

The artificial neural network is an information processing system, which has some characteristics of ordinary BNN. In short, the artificial neural network can be regarded as an integrated system of the mathematical model of the human brain. The structure is shown in Figure 1. A large number of interconnected neurons constitute an ANN, and each neuron is interconnected with other neurons by having corresponding weights. In this, the knowledge to solve the problem can be represented by the weights. The structure of artificial neural network is composed of the feedforward network, feedback network, and mutual combination network. A neural network is an operational model that consists of interconnected connections between a large number of nodes (or neurons).

Deep learning is a very popular method in machine learning, covering theoretical viewpoints in many fields. It is to learn the inherent laws and representation levels of sample data. In order to realize more intelligent human-

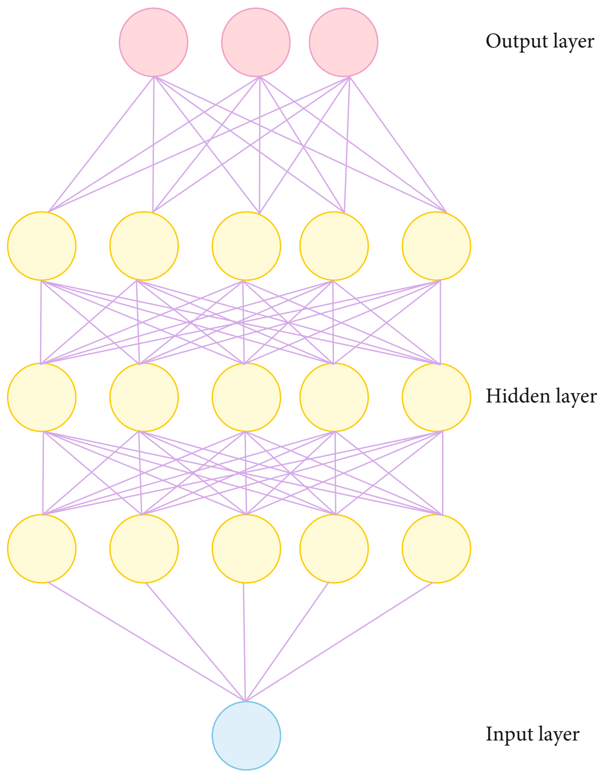


Figure 2: Deep neural network.

computer interaction, researchers imitate the human brain and thinking and establish various neural network models. Deep learning is one of them [10]. Deep learning is a multilevel representation learning method, learning data features by creating models, and finding a better data representation is the primary purpose of representation learning, as shown in Figure 2.

The convolutional neural network was first proposed in the 1980s. The idea of the CNN was inspired by human research on the cat visual system, but due to the limitations of computer resources at that time and other resource-limited problems, it could only stop there. The three major deep learning giants proposed a standard LeNet-5 network structure, using gradient descent for training, and achieved good experimental results, making it possible to train deep neural networks. The essence of the convolutional neural network is to construct multiple interconnected kernel convolution kernels, which can output data features and topological features. A structure is hidden between data by performing layer merging function on the data input side [11, 12], as shown in Figure 3.

As the number of layers continues to increase, the derived features become more and more abstract and these abstract features are finally merged through a fully connected hierarchy and classification problem. Feedback is resolved through Softmax or Sigmoid activation functions.

Before introducing Softmax regression, it is necessary to introduce logistic regression. Logistic regression is a simple binary classification algorithm that achieves classification by fitting the classification boundaries of the data and uses optimization methods such as gradient descent to determine

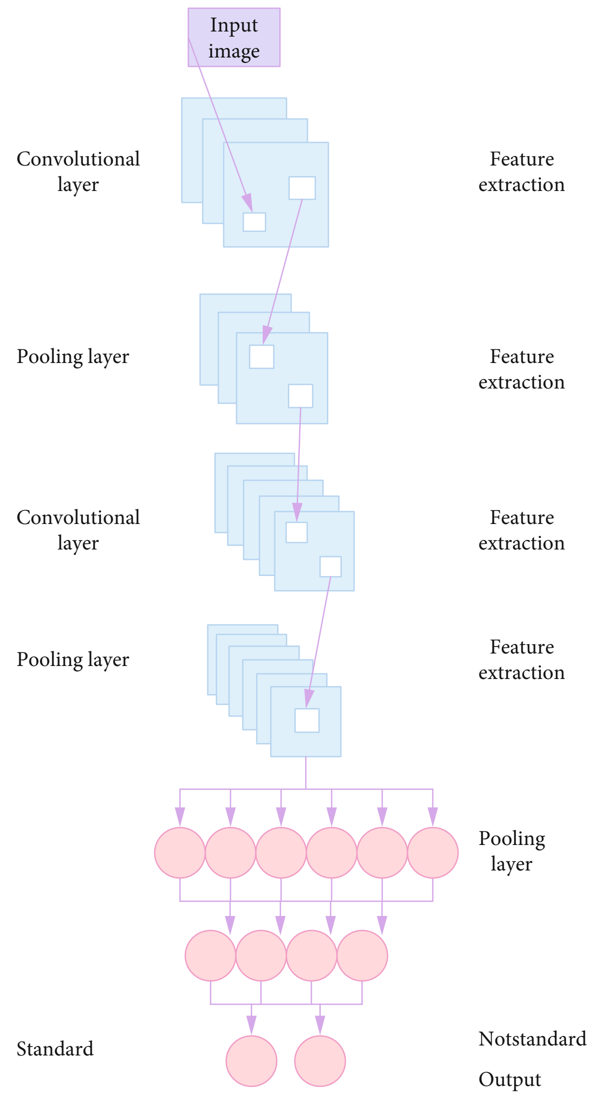


Figure 3: Convolutional network structure diagram.

the best regression coefficients [13]. One of the more important formulas in logistic regression is the step function:

$$Q(X) = \frac{1}{1 + E^{-\theta^Z X}}. \tag{1}$$

Its waveform is as follows; the value range is between [0,1]; Figure 4 is the logistic regression step function formula.

Its corresponding negative log-likelihood loss function is defined as

$$Q(\theta) = -\frac{1}{u}\left[\sum_{i=1}^{v} Y^i \log f_\theta\left(X^i\right) + \left(1 - Y^i\right) \log \left(1 - f_\theta\left(X^i\right)\right)\right]. \tag{2}$$

Based on linear regression, logistic regression applies a logistic function, but because of this logistic function, logistic regression has a favorable place in the field of machine learning [14].

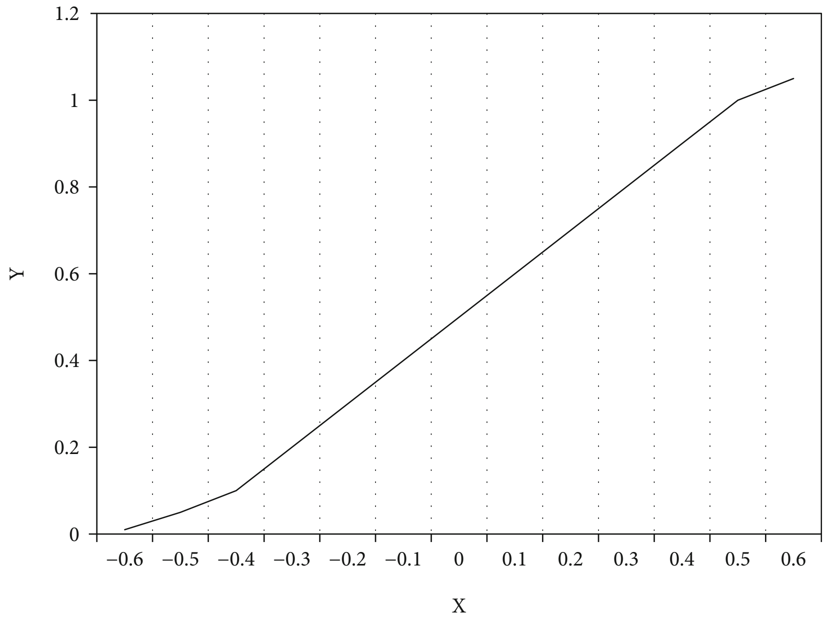


Figure 4: The logistic regression step function formula.

The assumption of the logistic regression model is as follows:

$$h_{\varphi}(t) = g\left(\varphi^{Z} t\right). \tag{3}$$

A commonly used logic function (and also the function mainly used in this paper) is the sigmoid function, and its expression is shown in formula (4):

$$g(x) = \frac{1}{1 + e^{-x}}. \tag{4}$$

The graph of this function is shown in Figure 5.

Therefore, the assumptions of the logistic regression model are as follows (5):

$$h_{\varphi}(t) = \frac{1}{1 + e^{-\varphi^{Z} x}}. \tag{5}$$

For the LR model, the classification is based on the following: for a given input variable t, calculate the probability that the output variable is 1 according to the selected parameters, that is,

$$h_{\varphi}(t) = P\left(\frac{y = 1}{t\,;\varphi}\right). \tag{6}$$

The ReLu (rectified linear units) function is a popular activation function that has gradually replaced the sigmoid function. The function graph of ReLu is shown in Figure 6; it does not tend to saturate with the gradual increase of the input x.

Details of the Softmax classifier are as follows:

$$x(i|j) = \frac{\exp\,(V_i \cdot j)}{\sum_{w=1}^{W} \exp(V_w \cdot j)}. \tag{7}$$

Splitting the prediction function into two steps, taking the 1st row of V and multiplying that row with j,

$$V_{i \cdot j} = \sum_{a=1}^{d} Q_{iaxa} = f_j. \tag{8}$$

Calculating all f_w, $w = 1, \cdots, W$. Applying the Softmax function to obtain normalized probabilities,

$$x(i|j) = \frac{\exp\left(f_j\right)}{\sum_{w=1}^{W} \exp(f_w)} = soft\,\max\,(f)_j. \tag{9}$$

Softmax regression is an extension of logistic regression for solving multiple classification problems. Softmax regression is a supervised learning algorithm that can be combined with deep learning methods or unsupervised learning methods [15]. In logistic regression, the training sample set consists of samples labeled $\{(m^{(1)}, n^{(1)}), (m^{(2)}, n^{(2)}), \cdots, (m^{(x)}, n^{(x)})\}$ with the input feature $m^a \in \varphi^{y+1}$. The dimension of the feature vector m is $y + 1$, $m_0 = 1$. Supposing that the function is as follows,

$$h_{\alpha}(m) = \frac{1}{1 + \exp\,(-\alpha^T m)}. \tag{10}$$

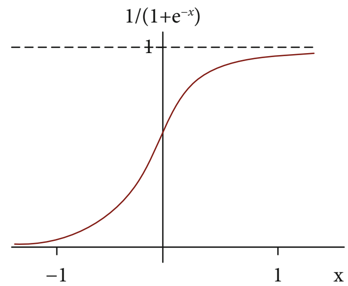


FIGURE 5: Sigmoid function diagram.

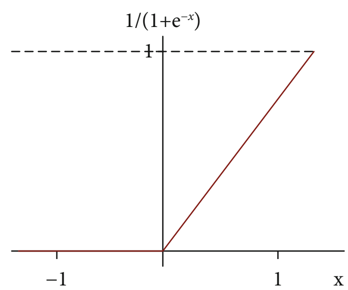


FIGURE 6: ReLu function diagram.

The model parameter α will be trained to minimize the cost function:

$$S(\alpha) = -\frac{1}{x}\left[\sum_{i=1}^{x} n^{(a)} \log h_\alpha\left(\mathrm{m}^{(a)}\right) + \left(1-n^{(a)}\right)\log\left(1-h_\alpha\left(m^{(a)}\right)\right)\right]. \quad (11)$$

In convolutional networks, the process of convolution includes two parameters: the first parameter is the input and the second parameter is the kernel function (i.e., the convolution kernel) [16]. The unit output by the convolution operation is called a feature map. Taking a two-dimensional image Q as input and the two-dimensional convolution kernel being P, the convolution of q and P is as follows:

$$S(a,b) = (Q * P)(a,b) = \sum_a \sum_b Q(i,j)P(a-i, b-j). \quad (12)$$

Mathematically, convolution is interactive because the convolution kernel is flipped relative to the input. However, most of the existing neural network libraries are based on a crosscorrelation function that does not flip the kernel and both methods are called convolution [17]. In this paper, the convolution is represented in this way. The convolution operations mentioned below are all convolution operations without flipping the convolution kernel. The crosscorrelation function is expressed as follows:

$$S = (a,b) = (Q * P)(a,b) = \sum_i \sum_j Q(a+i, b+j)P(i,j). \quad (13)$$

The convolutional neural network (CNN) is one of the structures of the deep learning network, which is characterized by a large number of convolution operations in the network structure. In addition, the activation function and pooling layer are also its basic structures. These three basic structures make it have better local perception characteristics and feature abstraction ability than multilayer perceptron (MLP) [18]. At present, the CNN has been widely used in many subfields of image processing and computer vision, such as image classification, image semantic segmentation, and visual object detection.

3.1.1. Calculation Output. For the l layer of the fully connected layer, the output result is as follows:

$$\begin{aligned} A^x &= g(C^x), \\ C^x &= V^x A^{x-1} + Q, \\ E^z &= \frac{1}{2}\sum_{k=1}^{l}(P_k^z - B_k^z)^2 = \frac{1}{2}\|P^z - B^z\|_2^2. \end{aligned} \quad (14)$$

In the formula, P^z is the expected output value of the zth sample and B^z represents the actual output value of the zth sample after the network operation.

3.1.2. Backpropagation. The data is calculated layer by layer through the network, and the error between the actual output and the expected output is obtained, which can be regarded as the sensitivity of the neuron base. The formula is as follows:

$$\frac{\partial E}{\partial Q} = \frac{\partial E}{\partial C}\frac{\partial C}{\partial Q}. \quad (15)$$

The formula for the sensitivity of layer x in the backpropagation stage is as follows:

$$\delta^P = \left(V^{x+1}\right)^P \delta^{x+1} \bullet g'(C^p). \quad (16)$$

The sensitivity of the output layer node is as follows:

$$\delta = g'(C^x) \bullet (B^z - P^z). \quad (17)$$

3.1.3. Weight Update. The derivation of the error for the x layer weight of the fully connected layer is the crossproduct of the x layer input and its sensitivity. The weight update formula is as follows:

$$\begin{aligned} \frac{\partial E}{\partial V} &= A^{x-1}(\delta^x)^P, \\ \Delta V^x &= -\eta \frac{\partial E}{\partial V^x}. \end{aligned} \quad (18)$$

3.2. Polymer Composites. The biggest advantage of polymer composite materials is the advantages of various materials, such as high strength, light weight, temperature resistance, corrosion resistance, heat insulation, insulation, and other properties. According to the application purpose, select

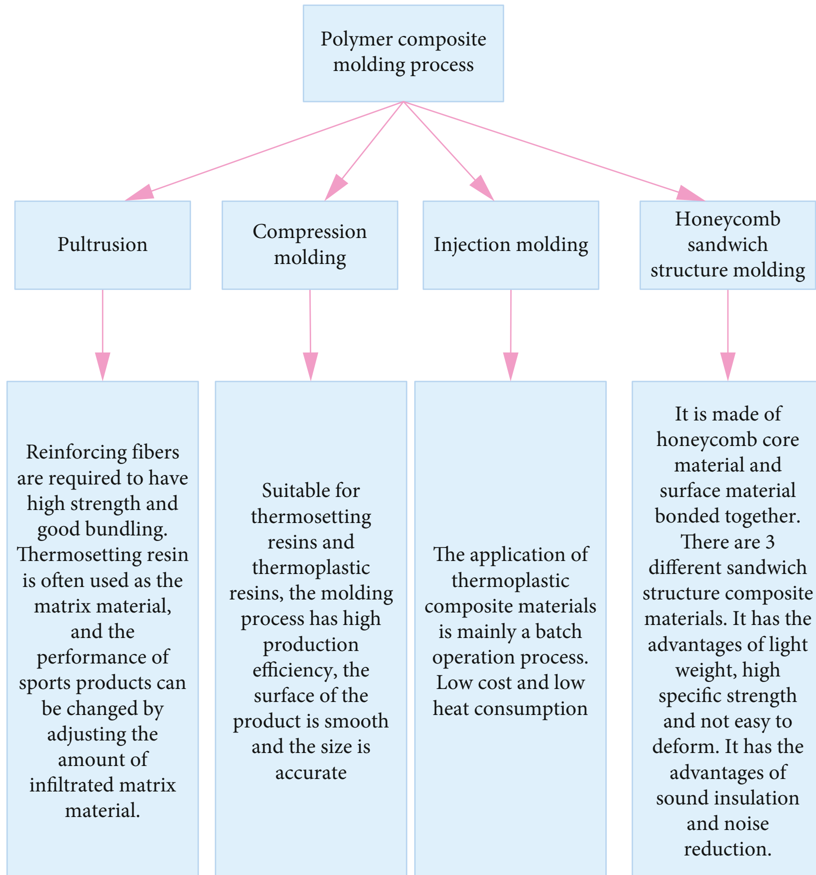


Figure 7: Polymer composite-type process.

polymer materials and other materials with special properties to make composite materials that meet the needs.

Polymer composite materials synthesized according to structural requirements are called polymer structural composite materials, and polymer structural composite materials synthesized according to different functional requirements are called polymer functional composite materials. Polymer functional composites are usually composed of the reinforcement phase and matrix phase. Generally, the commonly used reinforcing phases are fibrous materials, such as boron fibers, glass fibers, and carbon fibers. Dispersing them in a matrix phase enhances the overall strength, elasticity and impact resistance of the material. The function of the matrix phase is mainly to bond the dispersed material fibers into a group. The matrix phase materials generally have high special size and special strength, such as plastic epoxy resin, polypropylene, and polyimide. Due to its superior properties, it is used in the cutting-edge technology as well as defense and security. Due to the needs of sports, some sports equipment must have specific functions. Therefore, resin matrix materials are combined with materials with special functions, such as luminescence, antistatic, and magnetic properties, to form polymer functional composites [19, 20].

The molding process of polymer composite materials includes pultrusion molding, compression molding, injection molding, honeycomb structure molding, and other molding processes. The characteristics of some molding processes are shown in Figure 7.

4. Experiment and Analysis of the Comfort of Polymer Composites in Sports Facilities

4.1. Questionnaire Survey. A sample of 362 people was selected through the sampling survey, including 218 males and 144 females. It can be seen from the numbers that boys exercise more frequently than girls. The survey on the quality satisfaction of sports facilities is shown in Figure 8. The respondents showed a "∩" situation in the middle and two lows in terms of their recognition of the quality of sports equipment and their own proprioception during physical exercise. It can be seen in Figure 8(a) that among the quality recognition of sports equipment, 38 people chose to be more satisfied, accounting for 10.50%, 88 people chose to be more satisfied, accounting for 24.31%, the number of people who chose ordinary is 126, accounting for 34.81%, 78 people chose not satisfied, accounting for 21.55%, and 32 people chose very dissatisfied, accounting for 8.84%. As can be seen in Figure 8(b), among the feeling of sports equipment when exercising, 30 people choose very satisfied, accounting for 8.29%, 122 people choose relatively satisfied, accounting for 33.70%, 104 people choose in general, accounting for 28.73%, 74 people who are not satisfied, accounting for 20.44%, and 32 people who choose very dissatisfied,

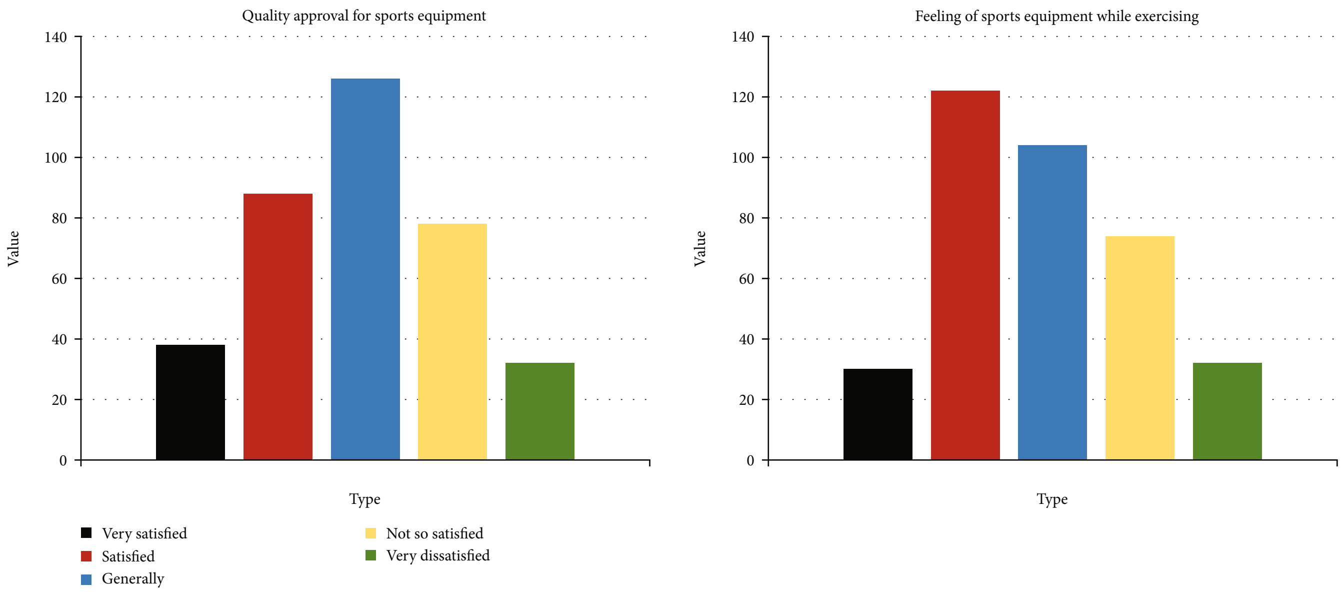


FIGURE 8: Respondents' satisfaction with the quality of sports equipment.

accounting for 8.84%. It shows that the respondents' recognition of the quality of sports facilities and equipment is generally at a medium level.

Figure 9(a) shows that sports facilities are occasionally damaged. As a sports facility, due to frequent use by people, 79.56% of occasional damage is normal. For this kind of normal damage, how the relevant departments should deal with it is a problem. The survey in Figure 9(b) shows that 80.66% of the respondents believe that these sports facilities have not been repaired and dealt with in time after the damage.

In addition, the survey on the maintenance and maintenance of sports facilities showed that 80% of the respondents believed that the relevant departments did not regularly maintain the sports facilities in a timely manner. More than 70% of the respondents believed that the relevant departments did not replace the damaged and irreparable equipment and facilities in time. Thirty percent of the respondents have a potential danger when engaging in physical exercise and feel that they may have potential safety hazards during the exercise process, and nearly 70% of the respondents will choose another kind of equipment for exercise.

To sum up, due to the needs of sports, some sports equipment must have specific functions. Resin-based matrix materials are combined with materials with special functions, such as glowing, antistatic, and magnetic, to form polymer functional composite materials. The following will analyze the experimental performance of polymer composite materials for sports equipment.

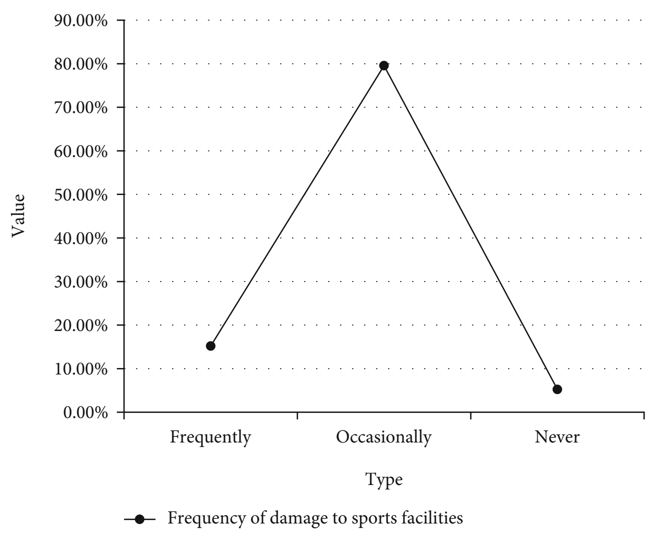
4.2. The Use of Common Polymer Composite Materials for Sports Equipment. Polymer engineering materials are used in the design and production of certain sports facilities and sports equipment to meet different sports needs, such as an equipment compact structure, heat resistance, corrosion resistance, and long service life. The available properties of some selected sports equipment materials are shown in Table 1.

Natural rubber and synthetic rubber are two types of rubber. In some sports, athletes will be subjected to a strong impact force and the rubber material can effectively reduce the impact force, thereby protecting the personal safety of the athletes, and can also effectively absorb shock and slip. Therefore, some rubber composite materials are often used in the design and production of sports equipment, such as high-elastic sports shoes for cushioning landing impact and protective equipment for cushioning impact. When the elastic material is subjected to external pressure, it does not break but causes reversible deformation; when the external force is removed, the rubber returns to its original shape. The main application aspects and properties of rubber materials in the sports field are shown in Table 2.

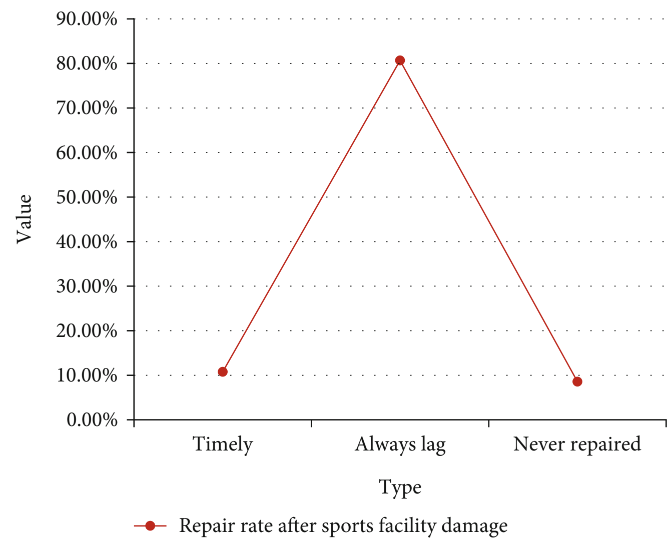
In the production and manufacture of sports facilities and equipment, rubber is one of the most widely used polymer materials, with excellent elastic properties, improving sports safety for athletes and providing athletes with a comfortable experience. Its rubber and composite materials are also widely used in ball equipment such as volleyball, basketball, and football, as well as dumbbells, shuttlecocks, racket outer layers, and racket handles. So, its rubber and composites are used for PVC. Its wide application can slow down the various impact forces received by the human body during use to exercise the body and significantly improve the safety and comfort of sports.

The sports industry is inseparable from the application of fiber polymer materials. Table 3 shows some related sports goods and materials, as well as some corresponding properties.

4.3. Impact of Polymer Composites on Comfort in Facilities. In the design and production of sports equipment, health and comfort should be the primary requirements for material selection. Coolmax fiber fabrics, cool plus fiber fabrics, or cotton fabrics are materials that perform well on this demand and can be used in the design and production of



(a) Respondents' perception of damage to sports facilities



(b) Respondents' views on the maintenance and handling of sports facilities

Figure 9: Respondents' survey on postmaintenance of sports equipment.

Table 1: Performance of polymer materials commonly used in sports equipment.

Sporting goods	Material	Effect
Sports bike	Polyetheretherketone, polycarbonate	Strong, heat resistance, impact resistance
Rubber track	Polyurethane rubber	Friction resistance, solvent resistance, oil resistance, aging resistance, high strength
Basketball	PVC	Antiaging and corrosion resistance
Table tennis	Polyester	High toughness and friction resistance

Table 2: Performance of polymer materials commonly used in sports equipment.

Sporting goods	Material	Chemical nature	Nature
Racing	Natural rubber cavity (NR)	Polyisoprene	For racing tires, with high elasticity
Sports shoes	Styrene butadiene rubber (SBR)	Polystyrene-butadiene	For shoe soles, antiwet and low rolling resistance
Protective equipment	Nitrile rubber (NBR)	Acrylonitrile-butadiene copolymerization	Strong oil resistance, aging resistance, friction resistance

sportswear. Swimsuits and wetsuits for water sports must be highly elastic, soft, and waterproof. Therefore, polyurethane can be treated by the combination of primer and final coating to reduce the resistance of water sports, can improve the comfort and freedom of athletes during water sports, and can effectively help athletes achieve better competition performance [21].

Today, most of the running tracks are built with plastic tracks, replacing the previous tracks with cement; the floors of sports fields and gyms also use plastic floors, which are very important to improve the comfort of athletes. Plastic runway and plastic floor have excellent recovery, sound absorption, shock absorption, abrasion resistance, and slip resistance. Compared with the traditional material track, the plastic track has significant elastic kinetic energy, strong force rotation, and vibration reduction ability, which can effectively reduce the impact force of the foot. The risk of injury to the athlete is reduced, and the athlete is more comfortable during training or competition without leg pain associated with prolonged exercise. The plastic track has a certain breathability. At high temperatures, athletes are less likely to emit unpleasant odors. The composition of the plastic track is shown in Figure 10. The construction of the lower layer should ensure the stability of the foundation. The construction of the abovementioned fourth, fifth, and sixth layers is made of plastic materials. The outer layer of the main material is polyacrylic acid, which is closely related to the direct contact with athletes and has strong elasticity and comfort.

Materials commonly used in water sports facilities, such as rowing boats, jet skis, surfboards, and windsurfing boards, are both plastics and composites. These facilities must withstand the mass of athletes and resist the impact of water. Therefore, it must have strong hardness and rigidity. Therefore, composite fiber materials are usually added to plastic materials to improve the durability of the device and meet the needs of athletes. Most of these factories are made of thermoplastic and thermoset materials, which not only are lightweight but also allow athletes to control speed and direction, and have a good feel, thus improving the comfort

Table 3: Applications of fibrous polymer materials.

Sporting goods	Material	Nature
Sports clothing	Nylon, acrylic, polyester	Soft, antiwrinkle, comfortable, easy to wash, and quick dry
Rackets, pitch bars, bicycles, surfboards	Composite fiber material	High strength and elasticity
Golf clubs	Carbon fiber composite material	Increase the mass of the club head, provide greater power, and improve the initial speed and stability of the ball when flying
Ski board	Composite use of carbon fiber-reinforced plastics and other materials	Enhanced bearing capacity and increased stability
Sport bike	Carbon fiber-reinforced plastic	Reduce mass, improve rigidity, and increase driving comfort
Mountaineering equipment	Carbon fiber-reinforced plastic	Improve the strength of the climbing rope, enhance wear resistance, and ensure safety

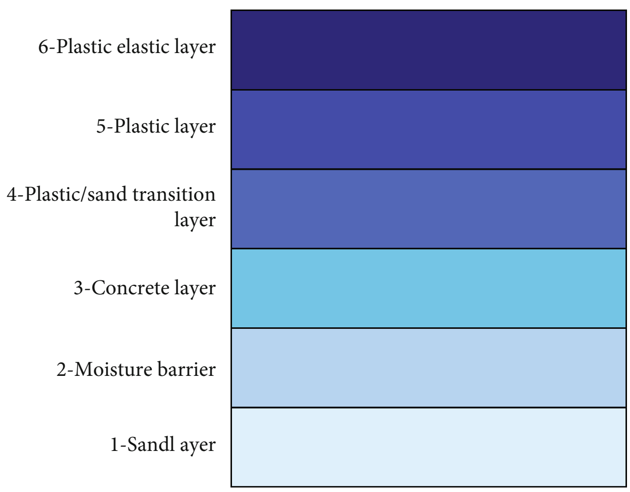


Figure 10: Plastic runway structure.

of sports. In addition to fiber-reinforced plastics, the outer layers of wakeboards, surfboards, and other aquatic facilities often use polyurethane foam composites with thermal insulation, which can reduce the energy consumption of athletes in the water to a certain extent [22]. Other functional materials are made with the motorboat saddle, which can significantly improve the comfort of use.

5. Discussion

First of all, through the study of relevant knowledge points of literature works, this paper initially masters the relevant basic knowledge and analyzes how to study the influence of polymer composite materials on the adaptability and comfort of sports and fitness facilities. The concept and deep learning algorithm of polymer composite materials are expounded, and the applicability of polymer composite materials in sports equipment is tested through experiments.

Comfort is the state of mind that a person is in a carefree, relaxed environment in an environment. It is the subjective feeling of people, including physical, psychological, environmental, and other aspects. There are clear physical and psychological differences between different age groups. So, comfort requires facilities in the public space environment to meet the needs of most people, while installing universal design facilities. For larger sports facilities, simple and varied designs can be installed to meet the needs of different age groups. When designing fitness facilities, factors such as different sizes and heights can be considered to meet the comfort of different groups of people [23]. The choice of material is very important, especially the parts that are in direct contact with people, which directly determines the comfort level of people.

Through the experimental analysis in this paper, it can be seen that polymer composite materials are widely used in the production and manufacture of sports equipment and facilities due to their wide range of sources. The casting process is simple and the cost is low. The use of composite materials has greatly improved the comfort and safety of sports equipment and facilities. With the continuous progress of science and technology, the production of sports facilities must go hand in hand with the development of science and technology in order to promote the development of national sports [24].

6. Conclusions

Since the reform and opening up, with the improvement of the quality of life, people have more free time and begin to gradually enjoy life and pursue health. This study mainly analyzes and discusses the factors that affect the comfort of sports facilities; the research focuses on the analysis of the design and construction of sports facilities and examines the comfort provided to residents during physical exercise. In the category of psychology, influencing factors vary by personal values, but also by personal emotions at different times. This is a relatively complex system. This study explores the factors that affect the comfort of sports facilities. This paper discusses the factors affecting the comfort of sports facilities and is aimed at further constructing the evaluation scale for the comfort of sports facilities, and establish a scientific, reasonable and flexible evaluation index system for the comfort of public sports facilities, and then continue to find and solve problems. For public sports facilities in the design, this scale can be used as a basis. Along with the overall planning of Khao Chung, the focus was on improving the comfort of public sports facilities. Therefore, this study will conduct in-depth research on this issue in the future, construct a sports facility comfort assessment scale, and conduct a scientific assessment of the comfort of sports facilities.

Data Availability

No data were used to support this study.

Conflicts of Interest

There is no potential conflict of interest in this study.

Authors' Contributions

Qingkun Feng and Lijun Wang are co-first authors. Qingkun Feng is the first author; Lijun Wang is a co-first author. These two authors contributed equally to this work.

References

[1] E. Atci and S. Keskin, "Atomically detailed models for transport of gas mixtures in ZIF membranes and ZIF/polymer composite membranes," *Industrial & Engineering Chemistry Research*, vol. 51, no. 7, pp. 3091–3100, 2017.

[2] Y. Xin, H. Zhao, and J. Zhang, "Highly stable and luminescent perovskite-polymer composites from a convenient and universal strategy," *ACS Applied Materials & Interfaces*, vol. 10, no. 5, pp. 4971–4980, 2018.

[3] T. Vaisanen, O. Das, and L. Tomppo, "A review on new biobased constituents for natural fiber-polymer composites," *Journal of Cleaner Production*, vol. 149, pp. 582–596, 2017.

[4] T. Dang, C. Y. Kim, Y. Zhang, J. F. Yang, T. Masaki, and D. H. Yoon, "Enhanced thermal conductivity of polymer composites via hybrid fillers of anisotropic aluminum nitride whiskers and isotropic spheres," *Composites Part B Engineering*, vol. 114, pp. 237–246, 2017.

[5] D. Moura, M. T. Souza, L. Liverani et al., "Development of a bioactive glass-polymer composite for wound healing applications," *Materials Science and Engineering: C*, vol. 76, pp. 224–232, 2017.

[6] A. Khan, P. Jagdale, M. Rovere, M. Nogués, C. Rosso, and A. Tagliaferro, "Carbon from waste source: an eco-friendly way for strengthening polymer composites," *Composites Part B Engineering*, vol. 132, pp. 87–96, 2018.

[7] D. Zhang and B. Goekce, "Perspective of laser-prototyping nanoparticle-polymer composites," *Applied Surface Science*, vol. 392, pp. 991–1003, 2017.

[8] Y. Li, S. Wang, and Q. Wang, "Enhancement of tribological properties of polymer composites reinforced by functionalized graphene," *Composites Part B Engineering*, vol. 120, pp. 83–91, 2017.

[9] V. A. Krasnyi and V. V. Maksarov, "Improving wear resistance of friction assemblies of oil-well pumps having seals from directionally reinforced polymer composites," *Chemical and Petroleum Engineering*, vol. 53, no. 1-2, pp. 121–125, 2017.

[10] W. Dominik, T. Krzysztof, M. Ireneusz, and D. Grzegorz, "Estimation of the perforation force for polymer composite conveyor belts taking into consideration the shape of the piercing punch," *International Journal of Advanced Manufacturing Technology*, vol. 98, no. 9-12, pp. 2539–2561, 2018.

[11] L. Zhang, N. De Greef, G. Kalinka et al., "Carbon nanotube-grafted carbon fiber polymer composites: damage characterization on the micro-scale," *Composites Part B Engineering*, vol. 126, pp. 202–210, 2017.

[12] Y. Kim, S. Jun, B. K. Ju, and J. W. Kim, "Heterogeneous configuration of a ag nanowire/polymer composite structure for selectively stretchable transparent electrodes," *ACS Applied Materials & Interfaces*, vol. 9, no. 8, pp. 7505–7514, 2017.

[13] S. Nallusamy and A. Karthikeyan, "Synthesis and wear characterization of reinforced glass fiber polymer composites with epoxy resin using granite powder," *Journal of Nano Research*, vol. 49, no. 1, pp. 1–09, 2017.

[14] A. Kumre, R. S. Rana, and R. Purohit, "A review on mechanical property of sisal glass fiber reinforced polymer composites," *Materials Today: Proceedings*, vol. 4, no. 2, pp. 3466–3476, 2017.

[15] S. Rat, M. Piedrahita-Bello, L. Salmon, G. Molnar, P. Demont, and A. Bousseksou, "Coupling mechanical and electrical properties in spin crossover polymer composites," *Advanced Materials*, vol. 30, no. 8, 2018.

[16] Y. Wu, K. Wang, S. Huang, C. Yang, and M. Wang, "Near-infrared light-responsive semiconductor polymer composite hydrogels: spatial/temporal-controlled release via a photothermal "sponge" effect," *ACS Applied Materials & Interfaces*, vol. 9, no. 15, pp. 13602–13610, 2017.

[17] C. Cheng, K. C. Ke, and S. Y. Yang, "Application of graphene-polymer composite heaters in gas-assisted micro hot embossing," *RSC Advances*, vol. 7, no. 11, pp. 6336–6344, 2017.

[18] I. Ngo, S. V. Prabhakar Vattikuti, and C. Byon, "A modified Hashin-Shtrikman model for predicting the thermal conductivity of polymer composites reinforced with randomly distributed hybrid fillers," *International Journal of Heat and Mass Transfer*, vol. 114, pp. 727–734, 2017.

[19] A. Gaffer, A. A. Kahlawy, and D. Aman, "Magnetic zeolite-natural polymer composite for adsorption of chromium (VI)," *Egyptian Journal of Petroleum*, vol. 26, no. 4, pp. 995–999, 2017.

[20] E. Solis-Ramos and M. Kumosa, "Synergistic effects in stress corrosion cracking of glass reinforced polymer composites," *Polymer Degradation & Stability*, vol. 136, pp. 146–157, 2017.

[21] Y. G. Luan, X. A. Zhang, S. L. Jiang, J. H. Chen, and Y. F. Lyu, "Self-healing supramolecular polymer composites by hydrogen bonding interactions between hyperbranched polymer and graphene oxide," *Chinese Journal of Polymer Science*, vol. 36, no. 5, pp. 584–591, 2018.

[22] E. Palesch, A. Knob, T. Plichta, and V. Cech, "Functional interlayers with controlled adhesion developed for polymer composites," *Thin Solid Films*, vol. 656, pp. 37–43, 2018.

[23] Y. Wang, Y. Hou, and Y. Deng, "Effects of interfaces between adjacent layers on breakdown strength and energy density in sandwich-structured polymer composites," *Composites Science and Technology*, vol. 145, pp. 71–77, 2017.

[24] J. Meng and S. Wang, "The construction of sports health management model based on deep learning," *Applied Bionics and Biomechanics*, vol. 2022, Article ID 5194665, 10 pages, 2022.