



Allocation Method of Teaching Resources of Talent Training Course Based on BP Neural Network

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Abstract. The traditional allocation method of teaching resources is unbalanced, which leads to the low utilization value of teaching resources in talent training courses. In order to make the allocation of teaching resources of talent training course balanced and facilitate the management and application of teachers before, during and after teaching, a method of allocating teaching resources of talent training course based on BP neural network is proposed. Firstly, the BP neural network model is constructed according to the framework of teaching information resource allocation of talent training courses, and the information characteristics of teaching resources of talent training courses are extracted. According to the characteristics, the target object feature tag is managed to complete the information allocation of teaching resources of talent training courses. The experimental results show that the proposed method has good performance in practical application and can promote the utilization value of teaching resources in talent training courses.

Keywords: BP Neural Network · Personnel Training · Curriculum Teaching Resources · Configuration Method

1 Introduction

Talent cultivation is related to the future and development of a country, therefore, talent cultivation has always been a hot issue in education. With the rapid development of science and technology, artificial intelligence technology has been widely used in the field of education [1]. With the continuous development and improvement of information technology, artificial intelligence technology has also been widely used in the field of education. Among them, the teaching of talent training course based on BP neural network has become a hot research direction [2]. As a mature artificial intelligence technology, BP neural network is essentially a feedforward artificial neural network, which can be used to deal with the nonlinear relationship between input and output. In the teaching of personnel training courses, by using BP neural network, students' learning ability, personal needs, hobbies and other factors can be taken into account, so as to provide personalized curriculum resources and achieve higher teaching results [3].

In the teaching of personnel training course, BP neural network can be used to optimize the allocation of resources and improve the teaching effect. Specifically, through BP neural network, students' learning ability can be deeply analyzed, and course content and teaching material resources can be scientifically planned according to students' individual needs, so as to improve students' learning efficiency and effectiveness.

Reference [4] proposes a learning path recommendation system for programming education based on neural network. This system applies recursive neural network to learners' ability map, which shows learners' scores. In short, the learning path is constructed from the submission history of learners through the process of trial and error, and the ability chart of learners is used as an indicator of their current knowledge. Reference [5] puts forward the practical research on the construction of teaching resources of specialized courses under the background of educational informatization. The article points out the difficulties in the current construction of teaching resources of specialized courses in educational informatization, illustrates the construction ideas of teaching resources of specialized courses from the perspective of multi-party cooperation in Industry-University-Research, and puts forward the specific curriculum scheme and three-dimensional teaching content of Principles of Management, which is of great significance to enrich the construction of teaching resources of specialized courses under educational informatization. Reference [6] puts forward the configuration method of open education resource database oriented to graphic database. The progress of telecommunications stimulates personalized learning and collaborative learning, which enables the teaching and management personnel of educational institutions to carry out teaching innovation. These innovations include open educational resources, which have promoted teaching practice and students' free learning since its establishment. Therefore, the goal of this study is to design an open education resource library, configure a recommendation system and a graphics-oriented database.

On the basis of the above research, this paper puts forward a method of allocating teaching resources for talent training courses based on BP neural network. The innovation of this method is to construct a BP neural network model through the framework of teaching information resource allocation of talent training courses, extract the information characteristics of teaching resources of talent training courses, and set the feature label of feature management target object according to the extraction results to complete the information allocation of teaching resources of talent training courses. This method can help teachers better carry out personalized education, improve teaching effect and accelerate students' learning process. Tailor-made courses for students in an intelligent way, so as to realize personalized education and improve teaching effect and students' learning results.

2 Allocation of Teaching Resources of Talent Training Course Based on BP Neural Network

BP neural network can automatically learn and discover the rules and patterns of resource allocation by learning a large number of data samples, which is more data-driven, and can adjust itself according to the actual situation to improve the accuracy and effect of resource allocation. BP neural network can continuously optimize the allocation of

resources through the back propagation algorithm, so that the teaching resources can more accurately match the needs of students and improve the teaching effect. The network can dynamically adjust according to students' learning feedback and performance, and correct and improve the resource allocation strategy in time.

The information allocation of teaching resources of talent training courses is based on the newly added information and historical information of teaching resources of talent training courses, and the teaching information resources of talent training courses are updated. Based on the information of teaching resources of talent training courses of BP neural network, this paper constructs a resource information allocation system framework with the best performance and the fastest efficiency, and its system framework is shown in Fig. 1.

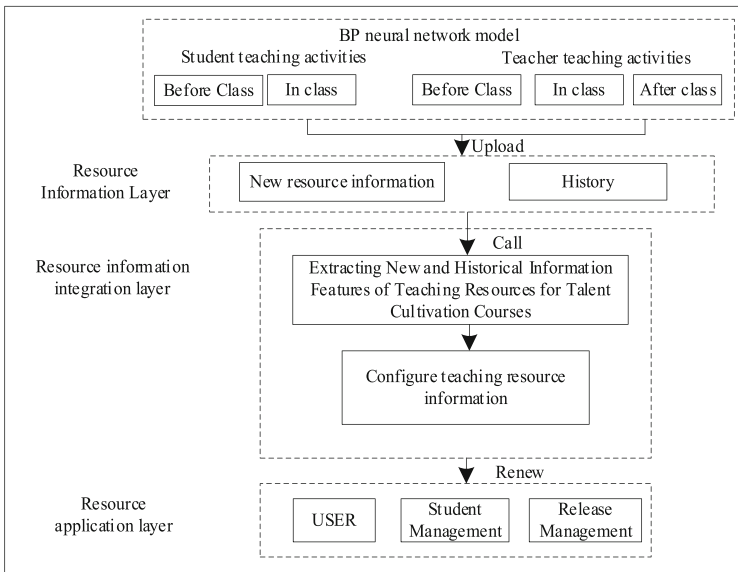


Fig. 1. Framework diagram of teaching information resources allocation for talent training courses

As can be seen from Fig. 1, students' activity information and teachers' teaching information generated by using BP neural network to teach talent cultivation courses are uploaded to the resource information layer, and the resource information allocation layer calls the newly added and historical teaching resource information of talent cultivation courses in the resource information layer, and realizes the allocation of teaching resource information of talent cultivation courses through BP neural network model and feature extraction of teaching resource information of talent cultivation courses, and finally updates the allocated information to the resource application layer for use by teachers, students and managers.

2.1 BP Neural Network Model

BP neural network is an artificial neural network based on back propagation algorithm, also known as multilayer feedforward neural network [7, 8]. It consists of an input layer, an output layer and several hidden layers, and each neuron is connected with the neurons in the previous layer and the next layer. BP neural network adjusts the connection weight between each neuron through multiple iterations and back propagation errors to realize the mapping of input and output. The specific structure is shown in Fig. 2.

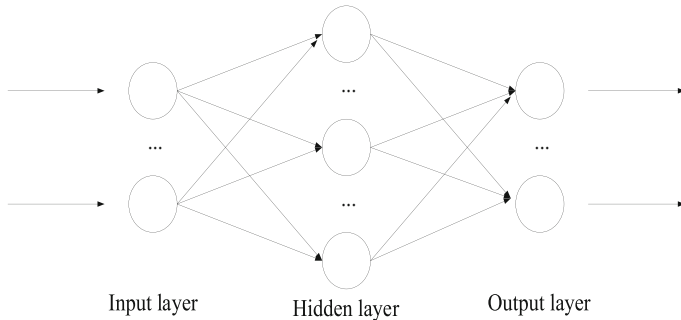


Fig. 2. Schematic diagram of BP neural network model structure

In the training process of BP neural network, the parameters of the network are adjusted by making the input data undergo multiple back propagation errors until the error is minimized, so that the network can accurately map the input to the required output. In the allocation of teaching resources for talent training courses, BP neural network can be applied to many fields, such as talent selection, student evaluation, curriculum recommendation and so on [9]. Through the training and analysis of data, BP neural network can help teachers better understand students' learning patterns, learning behaviors and learning achievements, so as to design courses and allocate resources more scientifically and effectively. There are n neurons in the input layer, and these neurons simultaneously constitute a node on each subordinate line; There are n different groups in the same hidden layer, and the data value of n can be set according to different conditions, in which each group can be composed of k small neurons [10]; After reaching the second hidden layer, there will be n groups, which means that each group at this level is composed of k small neurons; And every neuron in the input level is connected with every other neuron in the hidden level; Each sub-network in the network model has only one output layer, and the final result is determined by the output layer of each sub-network.

2.2 Information Feature Extraction of Teaching Resources in Talent Training Course

The allocation layer of teaching resources of talent cultivation course extracts the information characteristics of teaching resources of talent cultivation course from the information layer of teaching resources, which needs to consider the new information and

historical information of teaching resources of talent cultivation course [11–13], and extract the information characteristics of teaching resources of talent cultivation course from the overall point of view, so as to avoid missing hidden or repeated construction information when allocating teaching resources information of talent cultivation course [14, 15]. Using BP neural network model to process the new information and historical information of teaching resources, and complete the extraction of information characteristics of teaching resources [16, 17].

Suppose C_1 represents the information of the original window, C_2 represents the information of the incremental window, and the expressions of C_1 and C_2 are respectively:

$$C_1=[c_1, c_2, \cdots, c_z] \quad (1)$$

$$C_2=[c_{z+1}, c_{z+2}, \cdots, c_{z+m}] \quad (2)$$

In formula (1) and formula (2), z and m represent the information of the original and newly added windows respectively, and the teaching resource information C of the talent training course contains C_1 and C_2 , and the mutual information matrices of C , C_1 and C_2 are represented by D , D_1 and D_2 respectively, and the D expression is expressed as:

$$D = (z + m)^{-1} \times (D_1 + D_2) \quad (3)$$

In formula (3), the characteristic decomposition of D_1 can be realized by diagonalization, and its decomposition can be expressed by unit matrix \bar{E}_1 , and the expression of \bar{E}_1 is:

$$\bar{E}_1 = H_1^T \times D_1 \times H_1 \quad (4)$$

In formula (4), H_1 and H_1^T represent the overall features of the original window information source and the decomposed features.

The projection received by H_1 constitutes space, and the calculation formula is:

$$\bar{E}_2 = H_1^T \times D_2 \times H_1 \quad (5)$$

Using the above calculation process, the decomposition results of teaching resources characteristics of talent training courses are obtained [18–20]. Through the decomposition results, the characteristic values of teaching resources information of all talent training courses are obtained, and the expression is:

$$F_{GH} = (\alpha + \beta)^{-1} \times (1 + \alpha_k) \times (\bar{E}_1 + \bar{E}_2) \quad (6)$$

In formula (6), the feature vector of teaching resources of talent training courses is represented by P_Z , and the calculation formula of P_Z is:

$$P_Z = F_{GH} \times K_k \quad (7)$$

In Formula (7), K_k represents the k th feature vector, and according to the information feature P_Z of teaching resources of talent training courses, the allocation of teaching resources of talent training courses is developed.

2.3 Target Object Feature Tag Management

In order to ensure the accuracy of the allocation of teaching resources in talent training courses and meet the needs of different learners for personalized allocation of teaching resources, a learner portrait feature tag is established according to the feature vector P_Z of teaching resources information of talent training courses and learners' learning operation [21–23]. Based on the information such as learners' historical learning preferences, priority selection times for a specific type of resources, and targeted retrieval of resources in a short period of time, user portrait tags are established [24, 25]. When the user portrait label is used as the resource allocation, the type of allocation resources prefers the order, but the difficulty level of the specific allocation of teaching resources for talent training courses needs to be determined according to the learners' cognitive level.

When allocating resources, this method determines the cognitive level of learners according to their mastery of knowledge points, so as to allocate resources with less difficulty across the gradient. Suppose the learner is O , the user portrait tag sequence of the learner is $\{o_1, o_2, \dots, o_m\}$, the knowledge set of the talent training course that the user has learned is $Q = \{q_1, q_2, \dots, q_m\}$, and the test set of the corresponding knowledge point is $K = \{k_1, k_2, \dots, k_m\}$. Represent learners' mastery of this knowledge point by the correct rate of answering questions in different time periods:

$$\zeta_{12} = \frac{Z_{CA} \times O \times Q \times K}{\eta_{\omega}^{\tau_{ij}} \times P_Z} \tag{8}$$

In formula (8), η_{ω} represents the judgment vector of learners' mastery of knowledge point ω ; Learners have mastered the knowledge points of talent training courses, and the judgment value is determined to be 1, otherwise it is determined to be 0. Z_{CA} indicates the learners' failure rate in answering questions; τ_{ij} represents the time factor of forgetting effect; After obtaining the maximum likelihood of the error rate, the learners' cognitive ability level of the learned knowledge points is obtained, and the structure diagram is shown in Fig. 3.

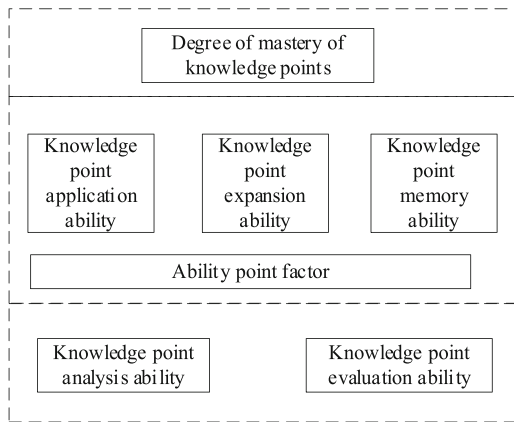


Fig. 3. Structure diagram of learners' cognitive ability to learned knowledge points

According to learners' cognitive level of knowledge points of talent training courses and user portrait labels, the teaching resource information of talent training courses is configured under the designed resource allocation mechanism.

2.4 Information Allocation of Teaching Resources for Talent Training Courses

According to the learners' mastery of this knowledge point, the information allocation of teaching resources of talent training courses is carried out, and the discrete sampling set of the distribution of the teaching resource information of the talent training course is obtained. The node link matrix is related to the teaching resource information of the talent training course in the node time slot, and the scheduling space vector matrix of the teaching resource information of the talent training course in the leading time slot is represented by F , and F is a two-dimensional matrix of $X \times X$. The teaching resource information of talent training course is allocated in a balanced way by using the probability allocation method. In the case of teaching resource allocation and storage, the teaching resource information allocation of talent training course is transformed into the maximum hop number of 2-hop neighboring nodes, and the conversion expression is as follows

$$X_n^2 = X_n^1 \times \left(\bigcup_{i=X_n^1} X_i^1 \right) \times P_Z \quad (9)$$

In formula (9), X represents the total number of transmission paths of teaching resources information of talent training courses, and n and i represent the multiple access protocols at the n time and the scheduled time slot allocation.

The link set of qualified teaching resources distribution of talent training courses can be obtained by correlation detection method, and the feature vector set S of teaching resources information allocation of talent training courses is defined as:

$$S = [F_A, F_B, F_C, F_D] \quad (10)$$

In formula (10), F_A represents time, F_B represents weight, F_C represents weighted average ratio, and F_D represents overload ratio. In order to ensure the balanced allocation of teaching resources in personnel training courses, the resource allocation channel is designed by using BP neural network model, and the output channel X_D is obtained as follows:

$$X_D = \sum_{i=1}^N Q_i / N \times S \quad (11)$$

In formula (11), N represents the independent variable. Assuming that the evolution matrix is represented by $z(m)$, the eigenvector of teaching resource allocation of talent cultivation course is divided into $b(m)$ subvector Q_{mj} by singular value decomposition. In tangent space, the characteristic solution of teaching resource of talent cultivation course satisfies the condition of $Q_{mj} \geq N$, and the transportation module of teaching

resource of talent cultivation course obtains the utilization rate L_{YL} after the allocation of teaching resource. The solution formula is as follows:

$$L_{YL} = \mu^{-1} \sum_{m=1}^{Q_{mj}} t_m = (\mu \times Q_{mj})^{-1} \sum_{n=1}^{Q_{mj}} \sum_{m=1}^{\mu} z_{nm} \tag{12}$$

In formula (12), μ represents the adaptive coefficient. By predicting and analyzing students' learning behavior and learning achievements through the utilization rate of resource allocation, we can get students' personalized learning mode, learning evaluation results and other information. According to this information, teachers can optimize the allocation of course teaching resources according to the different characteristics and needs of students, and the allocation results are shown in Fig. 4.

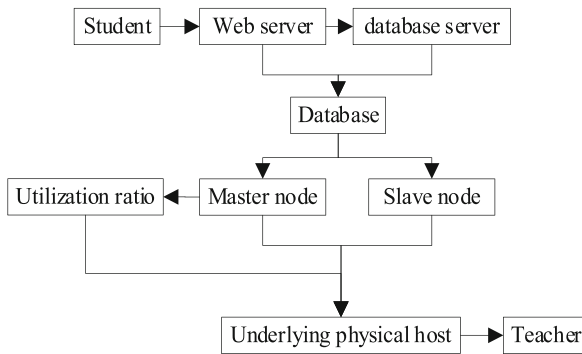


Fig. 4. The result diagram of teaching resources allocation of talent training courses

According to Fig. 3, through the coordinated operation of a Master node and a plurality of Slave nodes, while ensuring the interconnection of various devices, the overall allocation of teaching resources for talent training courses is more interactive. This resource allocation method can help teachers better understand students' learning needs and abilities, thus providing students with better learning experience and more personalized teaching resources. At the same time, it can also evaluate and improve the teaching quality of teachers. Therefore, the research on the allocation method of teaching resources for talent training courses based on BP neural network is completed.

3 Experimental Analysis

In order to verify the effect and feasibility of the teaching resource allocation method of talent training course based on BP neural network, the experiment takes a school in a certain area as the experimental object. The school covers an area of 530,000 m², with 800 teachers and 16,000 students respectively, and randomly selects a class with 45 students. The experimental data is selected from the world's largest open enterprise database, which is the OpenCorporates database. The teaching resource information of the talent

training course based on BP neural network in this class consists of the information of teaching activities before, during and after class. The original information and the newly added teaching information before, during and after class are shown in Table 1.

Table 1. Information Set of Teaching Resources for Personnel Training Courses

Name of teaching resource information set of talent training course	Original information quantity/GB	New information/GB
Information before class	30.6	5.2
Information in class	25.4	8.8
Information after class	40.5	3.6

Taking the original information of teaching resources before, during and after class in Table 1 as the experimental object, this paper tests the influence of different window sizes on the information extraction characteristics of teaching resources before, during and after class. The adaptive sliding window width is 50–300 bytes in the experiment. In order to ensure the objectivity of the experiment, it is introduced into X86 windows, hard disk 80G, Oracle 10g XE database, and the memory is more than 1GB. In the three configuration methods, the course teaching resource files shown in Table 2 are imported respectively, and the names and file formats of each resource file are recorded in Table 2.

Table 2. File types and corresponding formats of course teaching resources

Serial number	List files of type	File layout
1	sqoop-site.xml	Sqoop configuration file
2	Hbase-site.xml	Hbase configuration file
3	hadoop-policy.xml	Hadoop security profile
4	Hadoop-cnv.sh	Bash script
5	Spark-defaults.conf Spark	Default configuration file
6	Masters	Master node configuration
7	Slaves	Slave node configuration
8	Core-site.xml Hadoop	Core configuration

In view of the comparison of the effects of the three configuration methods, the response time of their respective servers is selected as the evaluation index, and five students are selected as experimental volunteers. The required teaching resources of talent training courses are obtained by using the three methods, and the historical retrieval resources of the above five students are analyzed. The configuration effects are compared by the user's preference for resources in the configuration results. The following formula

is the calculation formula of students' preference for resources:

$$Z_{YP} = \sum_{U(u,s)} A_U \times G_h \tag{13}$$

In Formula (13), Z_{YP} represents students' preference for resources; $U(u, s)$ represents the data results produced by s retrieval behaviors of a student u in the recommendation system; A_U indicates the time-consuming factor for students to read the configuration results, and the longer it takes, the more interested students are in resources. The opposite is true; G_h indicates the similarity between the resources allocated to students and the resources retrieved by students in the past. According to the above formula, the calculation of students' preference for resources under the three methods is completed, and the calculated data is drawn as shown in Fig. 5.

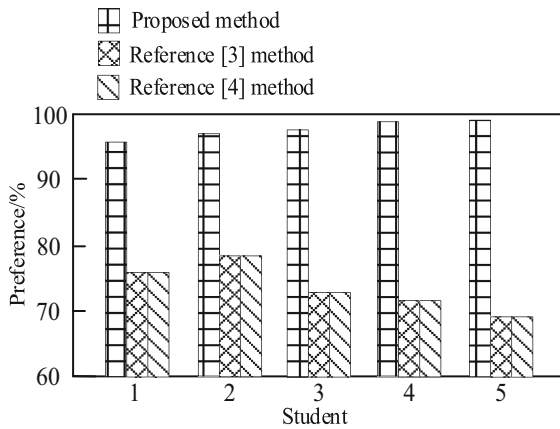


Fig. 5. Comparison diagram of configuration effects of different methods

From Fig. 5, it can be seen that the five students had a higher preference for the recommended resources configured by the proposed method, while the preference for the recommended resources configured by the methods in reference [3] and reference [4] was significantly lower. Specifically, students' preference for the resources allocated by the proposed method exceeded 96%, while the preference for the resources allocated by the methods in reference [3] and reference [4] did not exceed 80%. In summary, the BP neural network-based method for allocating teaching resources for talent cultivation courses proposed in this article not only has good operational performance in practical applications, but also can provide students with the online teaching resources they need for talent cultivation courses, bring higher quality resource recommendation services to students, and promote the utilization value improvement of teaching resources for talent cultivation courses.

Through the recall of teaching resource information management of talent training course, the configuration effect of this method is further verified. According to the output result of teaching resource information configuration of talent training course in Fig. 5,

the recall rate of teaching resource information of talent training course before, during and after class is counted, and the statistical results are shown in Fig. 6.

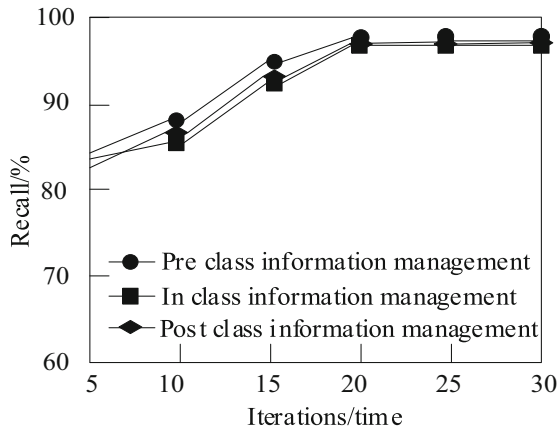


Fig. 6. Comparative results of recall rate of information allocation of teaching resources in talent training courses

From Fig. 6, it can be seen that the proposed method has a high recall of pre class, in class, and post class teaching resource information for talent cultivation courses, and the resource information allocation effect of this method is good. This means that using the method proposed in this article for resource information allocation can better meet the learning needs of students at different stages. The experimental results show that the application of this method in the allocation of teaching information resources for talent cultivation courses can achieve good results, and shows stability when allocating teaching resource information for different types of talent cultivation courses. This indicates that the method proposed in this article has applicability and reliability, and can effectively allocate resource information in different types of courses.

In summary, the methods proposed in this article can effectively allocate teaching resource information for talent cultivation courses, improve teaching effectiveness and students' learning experience. In addition, the application of this method in different types of courses also has stability, providing a feasible resource allocation plan for educational institutions and teachers.

4 Conclusion and Prospect

This paper puts forward the allocation method of teaching resources for talent training courses based on BP neural network, and draws the following conclusions through research:

- (1) The proposed method has good performance in practical application, which can provide students with the online teaching resources they need for talent training courses, bring them higher quality resource recommendation services, and promote the utilization value of teaching resources for talent training courses.

- (2) The application of teaching information of talent training courses has a good effect, and it is stable when configuring teaching resource information of different types of talent training courses.

The next step can be studied in depth in the following aspects:

- (1) For the problem of insufficient and uneven allocation of teachers' resources, we should improve the incentive mechanism for teachers, fully consider the particularity of economy, culture and policy in ethnic areas, and innovate training methods according to the actual situation in Butuo County; It is necessary to strengthen the construction of teachers and improve the training mechanism to ensure the quality of physical education teachers. Relevant departments should define the management subject, formulate the management system, form a supervision mechanism for the implementation of the management system, and have a set of perfect mechanisms suitable for the development of schools, aiming at improving the teaching quality of schools, achieving educational balance and promoting the development of education in ethnic areas with students as the main body.
- (2) To give full play to the linkage mechanism of departments to optimize the balanced allocation of resources and improve the supervision mechanism, relevant managers should pay attention to the construction of sports venues and the allocation of sports equipment in weak areas, establish the investment concept of "differential compensation", and deeply realize that the balanced allocation is not a simple quantitative balance, nor a formal balance; We should attach importance to the development of physical education class, aiming at promoting the all-round development of students; Offering ethnic project courses to make up for the lack of resources can be further studied in the future.

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