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Research Article

Teacher Allocation and Evaluation Based on Fuzzy C-Means Clustering

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As an important resource in the education industry, teachers play a key role in promoting the high quality of education. In order to explore the overall level of the teaching staff in various regions of China and the allocation level of teachers' educational resources, this paper selects the data or proportion of the student-teacher ratio, teachers' educational background, and teachers' professional titles as indicators. The clustering algorithm based on Fuzzy C-means conducts a cluster analysis on the allocation of compulsory education teachers in 31 provinces in China. The allocation of teachers in 31 provinces is divided into four categories, and the analysis and evaluation are carried out. At the same time, according to the current situation of teacher allocation in compulsory education, relevant countermeasures and suggestions are put forward to improve the overall balanced development of teacher allocation in China and narrow the gap of teacher allocation in China, in order to promote the balanced development of teacher allocation in compulsory education.

1. Introduction

Education is the foundation of a country and an important pillar for the country's long-term development and sustainable growth [1, 2]. Recent years, China has always prioritized the development of education, promoted the development of education, made breakthroughs and innovations, and achieved leapfrog development. The education plan is teacher-oriented, and the most important basic work in the development of education is to strengthen the construction of the teaching staff. The "Opinions of the Central Committee of the Communist Party of China and the State Council on Comprehensively Deepening the Reform of Teacher Team Construction in the New Era," issued in January 2018, stated that teachers are the first resource for educational development, and teachers must be strengthened first in rejuvenating the country. With the rapid development of China's educational undertakings and the continuous strengthening of the construction of teachers' teams, the allocation of regional teachers directly affects the level of education equalization. By effectively evaluating the level of teacher allocation, it is possible to find out the allocation of teachers in different regions and the differences between regions and further optimize the allocation of teachers to promote fair and balanced development of education.

The development level of the regional economy affects the balanced development of education in all provinces in China, and there is a large gap in educational resources and teachers among regions, urban and rural areas, and schools [3]. As the first resource for educational development, the balanced allocation of teachers is the key to narrowing the regional gap and improving the quality of education and teaching in China [4]. Therefore, the balanced allocation of teachers has become a research hotspot in recent years. Zhai and Sun discussed the balanced development of basic education in China from the perspectives of regions, urban and rural areas, schools and educated groups [5]. Ji et al. studied the current situation of teacher allocation in China's compulsory education stage, pointed out that there is a problem of unbalanced resource allocation in China's urban and rural teacher allocation, and put forward relevant suggestions on how to promote the innovative mechanism of teacher allocation [6].

Most of the existing research on compulsory education resources is to study the distribution of educational resources, or to explore the balance of education in a certain region, and there are relatively few studies on the similarities and differences in the overall level of China's provinces. Based on the relevant data in the "China Education Statistical," this paper uses the Fuzzy C-means clustering algorithm to cluster and divide the teacher allocation level in each region and analyzes the similarity and difference of the current regional teacher allocation. This article is based on the relevant data in the China Education Statistical Yearbook. The regions are selected as China's 31 provinces, autonomous regions, and municipalities (excluding Hong Kong, Taiwan, and Macau), to construct an evaluation index system for teacher allocation, and to explore the degree of differences in the level of teacher allocation between provinces. This paper uses the Fuzzy C-means clustering algorithm to cluster and divide the level of teacher allocation in each region, analyzes the current situation of regional teacher allocation, provides relevant suggestions for the balanced allocation of teachers, and provides a reference for promoting the balanced development of China's basic education.

2. Fuzzy C-Means Clustering Algorithm

Clustering refers to the process of grouping a collection of physical or abstract objects into classes [7, 8]. Cluster analysis is a method of studying individual classification according to the characteristics of things themselves. It uses mathematical methods to quantitatively determine the affinity of samples and divides them into several categories according to similarity metrics, such as distance and similarity coefficient. The classification objects in the same category are like each other, so as to classify the samples objectively. Cluster analysis is considered as a branch of statistics, plays an important role in data analysis, and is widely used in pattern recognition [9], data mining [10], image segmentation [11], and many other aspects. There are many kinds of clustering methods [12]. Currently, the clustering analysis method widely used in practice is the clustering method based on the objective function. In this method, the clustering analysis is reduced to a nonlinear programming problem with constraints, and the optimal fuzzy partition and clustering of the data set are obtained through the optimization solution. Among the clustering algorithms based on objective function, the Fuzzy C-means clustering algorithm is the most perfect in theory and the most widely used, and the clustering process is like the optimization problem with constraints.

The Fuzzy C-means clustering algorithm takes the minimum weighted square distance from the data sample to the cluster center point as the optimization goal. By specifying the number of cluster centers, the membership degree of each sample data relative to the cluster center is calculated, and the fuzzy classification of the original data is realized based on the different membership degrees of the objects to be classified, to complete the purpose of data classification. Fuzzy C-means clustering algorithm is a variant of K-means clustering algorithm. But unlike K-means clustering algorithm, Fuzzy C-means clustering algorithm is a soft clustering method. The Fuzzy C-means clustering algorithm is based on the similarity measure, clustering samples with high similarity into the same group and samples with low similarity into different groups. The advantage of this method is that it can perform effective cluster analysis on the objects to be classified with fuzzy boundaries between them and can clearly point out the center of each class. And it can clearly reflect the connection and dispersion between different classes and can effectively solve the problem of small similarity difference between data. This algorithm is simple and fast, with intuitive geometric meaning, and the clustering results are more flexible. Fuzzy C-means clustering algorithm is a kind of unsupervised learning algorithm, which introduces fuzzy theory, expresses the probability of a sample belonging to a certain class by membership degree, and classifies data points into similar classes, which has ambiguity and uncertainty. The combination of cluster analysis and fuzzy theory is more in line with the actual data distribution, more suitable for practical applications, has a strong advantage in the analysis and processing of large amounts of data, and can better reflect the actual distribution of data [13, 14].

The Fuzzy C-means clustering algorithm can be described as follows: the hypothetical dataset $X = \{X_1, X_2, X_3, \ldots, X_n\}$ contains n sample data and divides X into C classes $(2 \le C \le n)$ and uses $V = \{V_1, V_2, V_3, \ldots, V_c\}$ to represent the C cluster center matrices of the dataset.

Define the Fuzzy C-means clustering algorithm objective function as

$$J_m = \sum_{i=1}^{N} \sum_{j=1}^{C} \left(u_{ij}\right)^m x_i - c_j^{\,2}, \tag{1}$$

wherein

$$\sum_{i=1}^{c} \left(u_{ij}\right)^m = 1, 0 \le u_{ij} \le 1, 0 \le m < \infty. \tag{2}$$

In the formula, N represents the size of the dataset; C represents the number of cluster centers; u_{ij} represents the membership degree of the sample x_i to the cluster center c_j, that is, the probability that x_i belongs to the j class; m represents the fuzzy coefficient of membership degree u_{ij}, value range $[1, \infty)$. The larger the value of m is, the more blurred the clustering effect will be. x_i represents the ith sample object; c_j represents the jth cluster center; $x_i - c_j^{\,2}$ represents a measure of similarity between samples.

In clustering, the Fuzzy C-means clustering algorithm mainly includes the following steps:

Step 1: initialize the basic parameters, select the appropriate number of clusters C, select the appropriate fuzzy coefficient m, initialize the membership matrix $U^{(0)}$, and satisfy formula (2);

Step 2: update the cluster center c_i according to the following formula:

$$c_i = \frac{\sum_{i=1}^{N} u_{ij}^{m} \cdot x_i}{\sum_{i=1}^{N} u_{ij}^{m}}, \quad j = 1, \ldots, C. \tag{3}$$

Step 3: update membership matrix $U^{(t)}$, $U^{(t+1)}$ according to the following formula:

$$u_{ij} = \frac{1}{\sum_{k=1}^{C} \left(x_i - c_j / x_i - c_k \right)^{1/m-1}}. \tag{4}$$

Step 4: use the membership termination tolerance ε as the index to determine the end condition of the algorithm iteration. Compare the membership change values before and after. If the termination condition $\max_{ij}\left\{|u_{ij}^{(t+1)} - u_{ij}^{(t)}|\right\} < \varepsilon$ is satisfied, the clustering ends, the algorithm terminates, the iteration stops, and the result is output. Otherwise, return to step 2 to continue the algorithm iteration. (t represents the number of iterations of the algorithm, and ε represents the error threshold.)

The flowchart of the Fuzzy C-means clustering algorithm is shown in Figure 1.

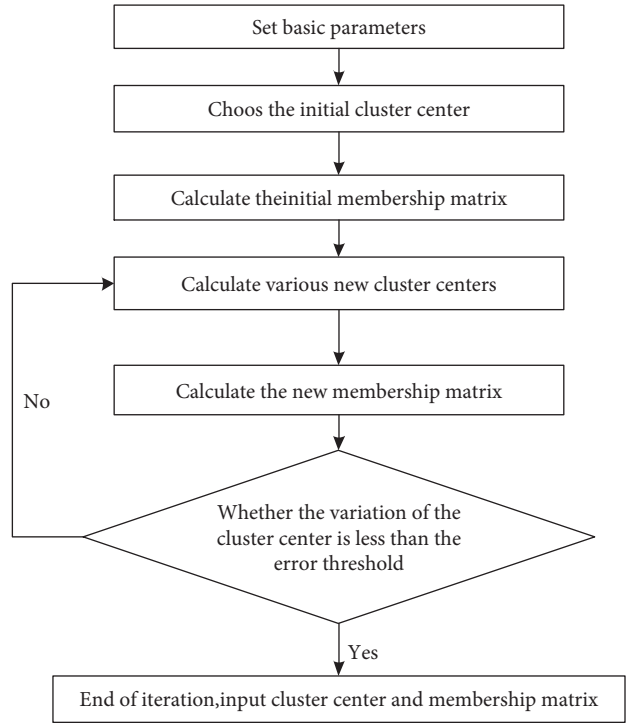

Figure 1: Flowchart of fuzzy C-means clustering algorithm.

3. Teacher Allocation Evaluation Index

In the education industry, the school staff includes full-time teachers, administrative staff, teaching assistants and labor staff, school-run enterprise employees, substitute teachers, and part-time teachers. In this study, teachers refer to full-time teachers in school. Teacher allocation refers to the allocation of teacher resources, so that teachers can achieve a balanced distribution in terms of quantity and quality. The balanced allocation of teachers in the compulsory education stage mainly refers to a reasonable number of staff and a reasonable structure, that is, the balance of gender structure, age structure, educational background structure and professional title structure, and a reasonable flow of teachers.

There are many relevant indicators for evaluation and analysis of teacher allocation, such as student-teacher ratio, educational structure distribution, professional title structure distribution, age, gender, and number of teachers. A single indicator cannot effectively reflect the overall situation of teacher allocation. How to conduct a comprehensive evaluation and analysis of regional teacher allocation based on the above multiple indicators is an important content. Many scholars have done a lot of research on the evaluation system and indicators of teacher allocation. Zhou pointed out the problem of unbalanced teacher allocation in Wuhan, Hunan Province, China, through indicators such as age structure, educational background structure, and professional title structure when studying the current situation of teacher allocation [15]. Zhang conducted research on the allocation standard of Chinese primary school teacher resources. Through case analysis, it pointed out the problems existing in the existing teacher allocation standards and put forward the teacher allocation evaluation standard based on the class-teacher ratio and classified class size based on fully considering the characteristics of primary school teaching, to better promote the balanced development of compulsory education [16]. Based on previous research, Li constructed an index system to measure the allocation level of basic education resources, using weighted indices and models to calculate the level of allocation of educational resources and using cluster analysis to classify school types [17]. Shen and Qiao analyzed the allocation of teachers in basic education in India through indicators such as student-teacher ratio, gender ratio, educational structure, and number of teachers and pointed out the differences in the allocation of teachers' resources [18]. Tian and Liu pointed out that the measurement dimensions of the allocation of teachers in compulsory education focus on the number of teachers, the quality of teachers, and the structure of teachers [19]. When studying the distribution of educational resources and teacher resources, Felix Chama used the student-teacher ratio indicator to analyze the problem of unbalanced distribution of educational resources and teachers in various regions and pointed out that the gap between the allocation of teachers in urban and rural areas is more obvious [20]. Zhao et al. used the teacher-student ratio as a measure to study the spatiotemporal pattern and influencing factors of teacher allocation in Shandong Province [21]. Taking the ratio of teachers to students in compulsory education in China as an example, Liu et al. analyzed and evaluated the difference and balance of teacher resource allocation, revealing the current situation of regional education resource balance [22].

Everything has two aspects, "quality" and "quantity." In order to analyze the current situation of teacher allocation in various regions of China, this paper draws on the previous evaluation system of educational development level and the evaluation indicators of teacher allocation. According to the

principles of data availability, comprehensiveness, and objectivity, through expert judgment and repeated discussions, this paper analyzes the allocation of teachers in the junior middle school stage of compulsory education in China from the two dimensions of teacher quality structure and teacher quantity structure. This paper selects the student-teacher ratio, the proportion of education structure, and the proportion of professional title structure as evaluation indicators. Based on referring to the "Statistical Indicator System of China's Education Monitoring and Evaluation (2020)," each indicator is calculated according to the relevant national standards or the national average level, and each indicator is standardized in order to measure and compare the construction level of the junior high school teachers of compulsory education in various provinces in 2020, in order to provide a useful reference for the construction of the teachers' team and the balanced development of the allocation of teachers in the junior high schools of compulsory education in all parts of China.

3.1. Teacher Quantity Structure. The number of teachers reflects the amount of human resources invested in education to a certain extent and can reflect the level of human resources investment in compulsory education in different regions. The student-teacher ratio is an important data indicator reflecting the investment of human resources in education in a region, and an important evaluation indicator reflecting the adequacy of the number of teachers. Therefore, the student-teacher ratio is selected to evaluate the structure of the number of teachers in the allocation of teachers.

The student-teacher ratio is expressed as the ratio of the total number of students in a certain level of education to the number of full-time teachers in that level of education, indicating the average number of students taught by each full-time teacher. The higher the index value is, the more students each teacher teaches on average, and the teacher will pay less attention to students and invest less time. On the contrary, the smaller the student-teacher ratio is, the less students are taught by each teacher on average, the teachers have sufficient energy and time to educate the students, and the students can get better teaching.

3.2. Teacher Quality Structure. Teachers belong to the most important aspect of educational resources. Teachers are the leaders of education and teaching activities. The quality of teachers directly determines the quality of students' education, which will have an important impact on the growth and development of students and even the whole life. The quality of teachers reflects the comprehensive professional ability of teachers from the aspects of teachers' age, professional title structure, educational background structure, and teacher training. The continuous development of compulsory education has put forward higher requirements for teachers' educational level, which has become an important indicator to measure teachers' teaching ability. Teacher education is an important factor affecting the quality of teachers. The high percentage of qualified full-time teachers with education indicates that the overall quality of teachers is high.

In this paper, the overall evaluation of teacher quality adopts the structure of teachers' academic qualifications and professional titles. Among them, the educational structure is represented by the qualified or up-to-standard rate of full-time teachers. Considering the different qualification requirements of teachers in each region, this paper takes the full-time teachers with bachelor's degree or above as qualified qualifications; that is, the proportion of education structure is expressed as the ratio of the number of full-time teachers with bachelor's degree or above to the number of full-time teachers in this level of education. To a certain extent, professional titles reflect the teaching ability and academic level of teachers. The structure of professional titles refers to the composition of teachers with different professional titles and, to a certain extent, reflects the work experience, academic accumulation, and social contribution of the teaching staff. According to professional and technical positions, it is divided into senior, deputy senior, intermediate, assistant level, staff level, and undetermined level. The higher the professional title, the higher the teaching level and teaching ability of the teacher. If the proportion of teachers with senior professional titles is small, and the proportion of teachers with low-level professional titles is too large, the vitality of the teacher group will be insufficient, and the structure of teachers' professional titles will appear faulty and clustered, which is not conducive to the overall quality and ability of the teaching team. In order to reflect the overall professional level of the teaching staff, the proportion of professional title structure is expressed as the proportion of the number of full-time teachers with senior teacher titles in a certain level of education to the full-time teachers of that level of education.

4. Cluster Analysis of Teacher Allocation Based on Fuzzy *C*-Means

4.1. Teacher Configuration Data. The basic data studied in this paper are the allocation of teachers in 31 regions in China, and the level of teacher allocation is evaluated from the aspects of the quantity and quality of teachers. The number of teachers is evaluated by the student-teacher ratio, and the quality of teachers is evaluated by the proportion of educational background and professional title. The data comes from "China Education Statistics," as shown in Table 1.

4.2. Clustering of Teacher Allocation Based on Fuzzy C-Means. Before cluster analysis, necessary data preprocessing should be performed on the data to be clustered. Because the evaluation indicators selected for the data objects to be clustered are often multidimensional, there is more than one indicator that can describe the characteristics of the objects, and the dimensions and orders of magnitude of these indicators are often different. Therefore, before performing cluster analysis, it is necessary to process the data to eliminate the influence of inconsistent data dimensions of

Table 1: Evaluation data of teacher allocation.

Province	Percentage of bachelor degree or above	Proportion of senior titles	Student-teacher ratio
Beijing	0.99	0.28	8.68
Tianjin	0.98	0.35	11.02
Hebei	0.90	0.18	13.72
Shanxi	0.85	0.12	10.27
Inner Mongolia	0.92	0.28	10.87
Liaoning	0.91	0.54	10.14
Jilin	0.92	0.27	9.27
Heilongjiang	0.88	0.27	9.96
Shanghai	0.99	0.12	10.47
Jiangsu	0.99	0.25	11.96
Zhejiang	0.97	0.25	12.29
Anhui	0.88	0.20	13.53
Fujian	0.90	0.21	13.46
Jiangxi	0.79	0.25	15.15
Shandong	0.91	0.15	12.24
Henan	0.83	0.17	13.87
Hubei	0.81	0.20	12.65
Hunan	0.83	0.15	13.33
Guangdong	0.92	0.14	13.47
Guangxi	0.84	0.15	14.83
Hainan	0.86	0.18	13.63
Chongqing	0.93	0.16	13.77
Sichuan	0.83	0.21	12.81
Guizhou	0.86	0.18	13.8
Yunnan	0.90	0.37	13.09
Tibet	0.92	0.11	11.55
Shaanxi	0.94	0.14	11.55
Gansu	0.87	0.18	10.76
Qinghai	0.86	0.25	13.34
Ningxia	0.94	0.23	14.15
Xinjiang	0.84	0.17	11.61

the evaluation indicators and standardize the original data. For the forward index, formula (5) is used for calculation, and for the reverse index, formula (6) is used for calculation.

$$ZX_i = \frac{X_i - X_{\min}}{X_{\max} - X_{\min}}, \tag{5}$$

$$ZX_i = \frac{X_{\max} - X_i}{X_{\max} - X_{\min}}. \tag{6}$$

In the formula, X_i represents the original data, and ZX_i represents the standardized data.

The Fuzzy C-means algorithm is used for clustering, the initial basic parameters are set, and the algorithm is iterated until the iterative termination conditions are met. The cluster centers and membership degree matrices of various types are output to determine the clustering results, realize the classification of the allocation of teachers in different regions, and analyze the similar and differentiated characteristics of the allocation of teachers in different regions. The number of cluster centers and division areas of each type is shown in Table 2. The final membership matrix value of each province is entered, and the category of each region is divided. The schematic diagram of each type of membership matrix is shown in Table 3 and Figures 2(a)–2(d).

Table 2: Clustering center.

Category	Clustering center	Number
Category 1	[0.88650960, 0.36085549, 0.57767729]	5
Category 2	[0.55272039, 0.34462380, 0.749892478]	6
Category 3	[0.58131887, 0.17967651, 0.28817112]	10
Category 4	[0.22865223, 0.18794189, 0.25792950]	10

According to the results of the membership degree matrix, it is classified and divided into clusters with similar teacher allocation levels. The clustering results are shown in Figures 3(a) and 3(b).

4.3. Analysis and Evaluation of Clustering Results. According to the membership matrix, the clustering categories of each region are divided, and each category is evaluated according to the evaluation index, as shown in Table 4.

Through clustering, it can be found that there are obvious regional similarities and differences among the 31 provinces in the evaluation of teacher allocation based on indicators such as student-teacher ratio, educational background structure, and professional title structure. On this basis, the teacher allocation levels of the 31 provinces can be divided into 4 categories.

The first category is Beijing, Tianjin, Shanghai, Jiangsu, Zhejiang, and other eastern regions. These provinces have great advantages in terms of social development conditions, the overall structure of the teaching staff is relatively complete, the quality of teachers is high, the number of teachers is sufficient, and the allocation of teachers is reasonable. Compared with other provinces, the quality of teachers and teaching level is at the leading level, and the proportion of teachers with undergraduate degrees has exceeded 97%, far exceeding the national average. Except for Shanghai, the proportion of full-time teachers with intermediate and senior titles is higher than the national average. In these provinces, the student-teacher ratio is relatively small, and the number of teachers is sufficient to meet the requirements of educational development. Overall, the allocation level of teachers in the region is higher than that in other regions. Compared with other provinces in the first category, teachers with senior professional titles in Shanghai area need to be further improved.

The second category is Shanxi, Inner Mongolia, Gansu, Liaoning, and Heilongjiang, where the overall quality of teachers is relatively high. The main performance is that the number of teachers is relatively sufficient, the students and teachers are lower than the national average level, and the proportion of teachers with a bachelor's degree or above exceeds 85% of the full-time teachers. There is a clear gap in the proportion of senior teachers among regions, especially in Liaoning, where the proportion of senior teachers exceeds 50% of full-time teachers, but the overall allocation of teachers is relatively reasonable.

The third category is Hebei, Fujian, Shandong, Guangdong, Anhui, Chongqing, Yunnan, Tibet, Shaanxi, Ningxia, and other regions. The proportion of full-time

Table 3: Membership matrix values.

Province	Category 1 membership	Category 2 membership	Category 3 membership	Category 4 membership	Category
Beijing	0.464824549	0.337262511	0.122654599	0.075258341	1
Tianjin	0.711158975	0.164272805	0.082904038	0.041664182	1
Hebei	0.022418855	0.020956522	0.886039326	0.070585298	3
Shanxi	0.137426643	0.407711922	0.210902336	0.243959099	2
Inner Mongolia	0.191276561	0.704116307	0.069451724	0.035155407	2
Liaoning	0.302900283	0.369783085	0.176494096	0.150822536	2
Jilin	0.141450859	0.760255945	0.058206504	0.040086692	2
Heilongjiang	0.055115443	0.86486202	0.043113873	0.036908665	2
Shanghai	0.495608374	0.235627662	0.183964815	0.084799149	1
Jiangsu	0.873761841	0.050616252	0.056309973	0.019311934	1
Zhejiang	0.788043715	0.073004647	0.107543129	0.031408509	1
Anhui	0.04135708	0.051224496	0.465613567	0.441804857	3
Fujian	0.02651004	0.024113151	0.893335797	0.056041012	3
Jiangxi	0.076538629	0.098821696	0.194753868	0.629885807	4
Shandong	0.109705166	0.135474193	0.631410271	0.12341037	3
Henan	0.010936735	0.015739634	0.043078696	0.930244935	4
Hubei	0.04527561	0.086432368	0.119505065	0.748786957	4
Hunan	0.016006267	0.024826699	0.06423787	0.894929164	4
Guangdong	0.045561384	0.035411239	0.854248163	0.064779214	3
Guangxi	0.046731678	0.055174565	0.198942959	0.699150798	4
Hainan	0.013548131	0.018477943	0.085505365	0.882468561	4
Chongqing	0.074141745	0.047637993	0.800010045	0.078210217	3
Sichuan	0.022908199	0.042554208	0.077400829	0.857136764	4
Guizhou	0.019080379	0.024945962	0.126664961	0.829308699	4
Yunnan	0.227603163	0.233372824	0.314891529	0.224132485	3
Tibet	0.225750128	0.256225073	0.379602092	0.138422707	3
Shaanxi	0.317919065	0.253538105	0.329823256	0.098719574	3
Gansu	0.117167993	0.540759779	0.180339831	0.161732397	2
Qinghai	0.058738349	0.084522766	0.279240496	0.577498389	4
Ningxia	0.15378677	0.083194216	0.641823722	0.121195292	3
Xinjiang	0.088401476	0.231715167	0.223429043	0.456454314	4

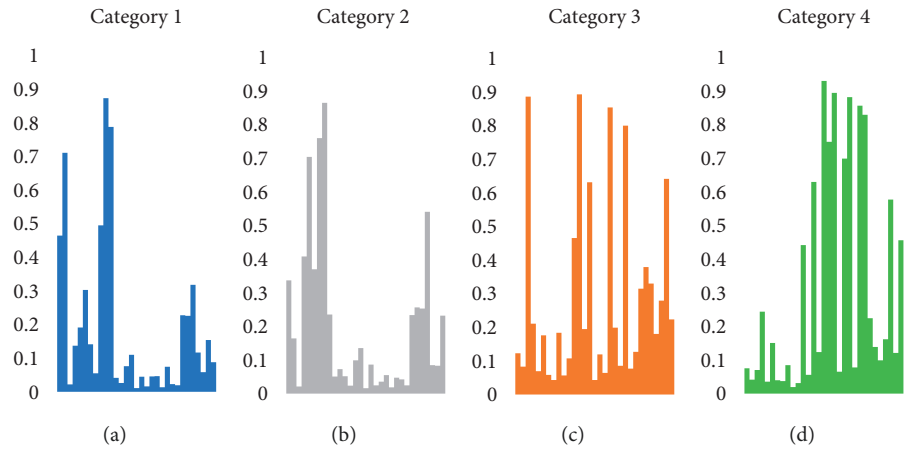

Figure 2: The diagram of membership degree.

teachers with a bachelor's degree or above exceeds the national average, and the quality of teachers is relatively high. However, the student-teacher ratio in Hebei, Anhui, Fujian, Guangdong, Chongqing, Yunnan, and other regions is higher than the national average, the number of teachers is small, and the allocation of teachers is average.

The fourth category is Jiangxi, Henan, Hubei, Hunan, Guangxi, Sichuan, Qinghai, Guizhou, Xinjiang and other regions. The quality of teachers in these regions is average. Compared with other regions, the proportion of full-time teachers with a bachelor's degree or above is lower than the national average, and there is a certain gap in the senior professional titles of full-time teachers. Except for Hubei, the student-teacher ratio is much higher than the national average, the number of teachers is small, and the allocation of teachers is unreasonable.

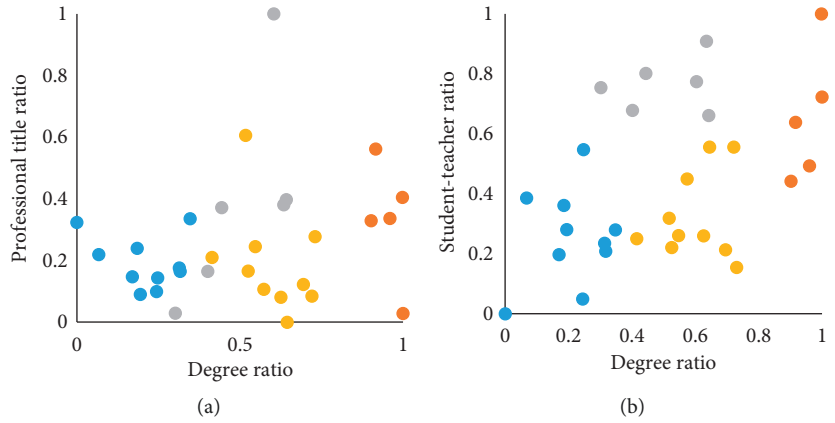

Figure 3: Cluster scatter plot.

Table 4: Clustering results.

Category	Evaluation	Category results
Category 1	The quality of teachers is high, the number of teachers is sufficient, and the allocation of teachers is reasonable	Beijing, Tianjin, Shanghai, Jiangsu, Zhejiang
Category 2	The quality of teachers is relatively high, the number of teachers is sufficient, and the allocation of teachers is reasonable	Shanxi, Inner Mongolia, Gansu, Liaoning, Jilin, Heilongjiang
Category 3	The quality of teachers is relatively high, the number of teachers is relatively small, and the allocation of teachers is general	Hebei, Fujian, Shandong, Guangdong, Anhui, Chongqing, Yunnan, Tibet, Shaanxi, Ningxia
Category 4	The quality of teachers is average, the number of teachers is small, and the allocation of teachers is unreasonable	Jiangxi, Henan, Hubei, Hunan, Guangxi, Sichuan, Guizhou, Qinghai, Xinjiang

5. Relevant Countermeasures and Suggestions

At present, the allocation of teachers among different regions in China is uneven in terms of the number of teachers, educational level, and professional title structure, and there are obvious differences in the allocation of teachers in different regions. In order to promote the balanced development of the allocation of teachers in various regions of China, narrow the gap in the allocation of teachers in different regions, and improve the overall quality of the teaching staff, China can optimize the balanced allocation of teachers from the following aspects.

5.1. Improve the Relevant Policy System and Promote the Balanced Development of Teacher Allocation. In recent years, China has attached great importance to the legislative work of the balanced allocation of teachers in compulsory education. The state has continuously improved the policy system to promote the fair development of education and the balanced allocation of educational resources, continued to deepen the legal system improvement and overall layout of the balanced allocation of teachers from the national level, and issued a series of policy documents to promote the balanced development of compulsory education. In view of the differences in the allocation of teachers between regions, it is necessary to further enhance the vitality of policies, make policy implementation feasible and rational, expand the discretionary power of local governments in the balanced allocation of teachers in the region, and improve the enthusiasm and autonomy of local governments to implement policies. Amend relevant laws and regulations, improve the new system of laws and regulations on the allocation of teachers in compulsory education, and clarify the responsibilities and authorities of governments at all levels in the balanced allocation of teachers. Make clear legal provisions on teacher establishment standards, funding guarantees, remuneration packages, and career development to narrow the gap between urban and rural areas. Continuously improve the teacher training and training mechanism and guarantee of welfare benefits, strengthen the special fund support for the balanced allocation of compulsory education teachers, improve the standard system for the balanced allocation of compulsory education teachers at the specific operational level, and provide complete legal guarantees and policy support for the balanced development of teacher allocation.

5.2. Continue to Increase Investment in Education and Improve Teachers' Treatment. Affected by various factors such as region and economy, the differences in teacher salaries

between provinces, regions, and urban and rural areas in China are quite prominent. In order to improve the construction of the teaching staff, China should continue to increase investment in education funds, guarantee the salaries of teachers in compulsory education in accordance with the law, effectively improve the treatment of teachers, and continuously improve the quality of teachers. At the same time, the financial departments of all regions should adhere to the strategy of giving priority to education, adjust and optimize the financial structure, and give priority to the construction of teaching staff as the focus of education investment. Focusing on compulsory education, urge all localities to give priority to the implementation of the policy on teachers' salary and income in the compulsory education stage, and consolidate and improve the treatment guarantee mechanism for primary and secondary school teachers. Vigorously support teacher education and training, with a focus on supporting the central and western regions to strengthen rural teacher training and improve teachers' professional quality. Vigorously improve the treatment of rural teachers, narrow the gap between the treatment of urban and rural teachers, implement the policy of living allowances for rural teachers, and implement the policy of allowances for teachers in difficult and remote areas. According to the actual situation, all regions have raised the allowance standard, continuously improved the treatment of teachers, made great efforts to make up for the shortcomings of rural teachers, and achieved remarkable results in promoting the construction of the teaching team.

5.3. Improve the Scientific Allocation Mechanism of Teachers and Promote the Construction of High-Quality Teaching Staff. Taking the balanced allocation of teachers as the foothold, we should innovate the replenishment mechanism of the teaching staff to make up for the shortage of teachers, narrow the difference in the number of teachers between urban and rural areas, and alleviate the structural shortage and uneven distribution of teachers. All provinces and regions should continue to implement measures such as special postprograms and public-funded normal students to attract high-level teachers to teach in rural areas and establish a stable and long-term mechanism for supplementing rural teachers. Expand new channels for teacher mobility, improve the exchange and rotation mechanism for faculty and staff, ensure that teachers flow on demand within the region, form a new pattern of scientific and efficient teacher allocation and exchange, and promote the rational allocation of teacher resources. Improve the teacher training mechanism, strengthen on-the-job training for teachers, improve training methods, optimize training content, continuously improve professional skills, and improve the overall quality and quality of existing teachers. Establish a teacher assessment and evaluation mechanism, and further deepen the reform of the teacher title assessment system. Improve promotion channels, release policy dividends, encourage teachers to take an active role, and encourage outstanding teachers to volunteer in remote villages. Appropriately reduce the difficulty of evaluating professional titles for rural teachers, increase the proportion of rural teachers with senior professional titles, and continuously improve the quality and level of the teaching staff. Establish a mechanism for ensuring the balanced allocation of teachers, implement a mechanism for safeguarding the legitimate rights and interests of teachers and staff, ensure that teachers have channels for their demands, and ensure that the innovation mechanism for balanced allocation of teachers runs smoothly.

6. Conclusion

This paper realizes the evaluation and analysis of the allocation of teachers in various regions through Fuzzy *C*-means cluster analysis. Based on considering the selection of evaluation indicators, the teacher quality structure data and teacher quantity structure data are calculated and standardized, and then the Fuzzy *C*-means algorithm is used for clustering. According to the cluster center and membership matrix, the classification and classification of teachers' allocation in each region are analyzed. The results show that the teacher allocation in 31 provinces can be divided into four categories, and the teacher allocation in each region has obvious similarities and differences. Overall, the balance of teacher allocation in the number of teachers, teacher education, and teacher titles needs to be further optimized and improved. This result evaluates the current clustering characteristics and equalization level of teacher allocation in various regions of China and provides a certain reference direction for China to optimize the balanced allocation of teachers and promote the high-quality development of compulsory education. In future research, more evaluation indicators can be considered to provide new analytical perspectives and data support for the evaluation of teacher allocation, and to reveal the regional teacher allocation more comprehensively and accurately.

Data Availability

The labeled datasets used to support the findings of this study are available from the corresponding author upon request.

Conflicts of Interest

The authors declare no competing interest.

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