J. COMBIN. MATH. COMBIN. COMPUT. 127b (2025) 3957--3979

Journal of Combinatorial Mathematics and Combinatorial Computing
www.combinatorialpress.com/jcmcc

A Machine Learning Algorithm-Based Quality Improvement Strategy for Inclusive Preschool Public Services

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ABSTRACT
Based on the relevant theoretical basis and research experience, this paper constructs a three-in-one, subjective and objective evaluation index system of inclusive preschool public service quality of "flexible", "green" and "soft" quality. Subsequently, the GA-BP neural network quality assessment model based on machine learning algorithm was constructed by utilizing BP neural network analysis and hierarchical analysis to assign weights to the indicators. It was applied in a scientific operation process to synthesize subjective and objective data to understand the quality of public services of inclusive preschool education, and to propose an improvement path in combination with the IPA analysis model. The results show that the weights of the three first-level indicators are 0.428, 0.4231 and 0.1489, respectively, and the weights of the four second-level indicators, including special child care and migrant child care, are more than 0.1, while the weights of the other second-level indicators are all less than 0.1. Among the third-level indicators, the weights of the reasonable sharing of the cost of pre-school education among the government, families, kindergartens and the society, and the synergy of education and rehabilitation are more than 0.05, while the weights of the other third-level indicators are all less than 0.5, and the weights of the other third-level indicators are more than 0.1. In addition, the difference between the actual evaluation results and the simulation evaluation results of the teaching quality of universal preschool education public services is relatively small. And the error between the real values of GA-BP model is extremely small, and its average error is only 0.483.

Keywords: IPA analysis, BP neural network, hierarchical analysis method, GA-BP model; inclusive preschool education public service quality

1. Introduction

"A hundred years of life begins at an early age." With the high level of attention and support from the Party and the Government, the cause of preschool education has been actively and steadily developing in recent years. The relevant documents stipulate that the development of preschool education must

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Received 12 February 2024; Revised 20 April 2024; Accepted 25 December 2024; Published Online 16 April 2025.
DOI: 10.61091/jcmcc127b-220

adhere to the public welfare and inclusive, and strive to build a public service system of preschool education covering urban and rural areas with a reasonable layout, so as to ensure that children of the appropriate age receive basic and quality preschool education [1-3]. The introduction of the document laid down the important position of preschool education in the national education reform and development, and also pointed out that the target direction of the country's current development of preschool education is to adhere to the public welfare and universality of preschool education. At the same time, the relevant documents also require adherence to the principle of public welfare in education, deepening education reform, promoting education equity, promoting the balanced development of compulsory education and integration of urban and rural areas, improving the guarantee mechanism for inclusive preschool education and special education and specialized education, and encouraging the diversified development of senior secondary schools. The most urgent thing in the future is to further implement the government's responsibility, focus on the development of universal, inclusive, safe and high-quality universal preschool education public services, and strive to meet the needs of the general public to receive high-quality universal preschool education [4-7].

The proposal and development of inclusive preschool education public service is an inherent requirement for realizing the quality, sustainability and in-depth development of preschool education, a necessary way to enhance the level of preschool education public service, and a positive response to the difficulties and blockages in the reform of the preschool education system and mechanism in the face of the country [8-10]. The construction of inclusive preschool education public services requires the state to start from the top-level design, to carry out systematic planning and promotion of preschool education development, and to plan for the establishment of an overall, synergistic and global mechanism for the development of inclusive preschool education [11-13]. The development of inclusive preschool education public services involves the immediate interests of the public, representing the government in the development of preschool education process has an unshirkable responsibility, the need to further play the leading role of the government, all levels of government in promoting the development of preschool education are very important [14-16]. However, at present, the universal development of preschool education is still faced with problems such as unbalanced development of urban and rural areas and regions, insufficient supply of public services, and a weak teaching force that still needs to be further improved. Especially with the acceleration of urbanization, the liberalization of the three-child policy, and the implementation of the goal of a city with a population of ten million, the number of young children of school age in Yung will increase significantly, which will, to a certain extent, bring challenges to the existing pre-school education [17-19]. And how local governments can cope with the above problems and utilize machine learning algorithms to effectively achieve the quality improvement of public services for inclusive preschool education deserves in-depth exploration [20-22].

In this paper, the public service quality assessment index system of inclusive preschool education with 3 first-level dimensions, 11 second-level dimensions and 65 third-level dimensions is first constructed. After that, the principle of machine learning algorithm under BP neural network is briefly stated, on the basis of which the public service quality index assessment model based on GA-BP neural network is constructed, and when the public service quality index prediction is carried out, the determined input variables and output variables are inputted into GA-BP neural network for training and testing, and the relevant data are inputted into the trained and tested GA-BP neural network to realize the prediction of public service quality indicators. Finally, the public service quality improvement strategy for inclusive preschool education is proposed in combination with the IPA model.

2. Machine learning-based assessment of the quality of public services for inclusive preschool education

2.1. Construction of the evaluation index system for universal pre-school education

The weight is the degree of importance of an indicator to the whole indicator system. This paper adopts Satie's hierarchical analysis [23] to decompose the selected objectives into a hierarchical structure, and consults the corresponding experts and scholars to make comparative judgments on the indicators of the same dimension, and finally inputs the results to determine the weights. The indicator system for assessing the quality of public services of inclusive preschool education is shown in Table 1.

Table 1. The pre-education public service quality evaluation index system

Primary dimension	Secondary dimension	Tertiary dimension
Flexible quality	A kiss of a special child	Special teaching faculty
		Faculty of special teaching
		Health special teaching environment
		The number of special institutions
		Education rehabilitation work
		Education opportunities and effects
	Mobile children	There is no difference from the equal access of the purse-bound resources.
		The admission support system is perfect
		To weaken the restriction on the admission restrictions of migratory children
		Family education AIDS agency
		Subsidy
		Control of changes in migratory children
	Children in low-income families	Exemption from charge
		Study and living allowance
		Children are given priority at
		Family education guidance
	In relatively poor areas, young children were kissed	Food and clothing supplies for children's meals
		The puhui park is sufficient
		Grant policy perfection
		Good at
		Teacher orientation training policy
		The teachers' team is stable
Green mass	Ecological sustainability of the garden	Environmental layout and greening
		Waste utilization at
		Pollution control
		Energy savings target
		Information model
	Ecological sustainability of the garden	Science conservation activities
		Young courses are effectively connected
		Young children support
		Rational environment of childcare environment

		Develop parent resources
		Listen to the parent voice
		The family society of the garden
		Parent empowerment
	Support for the sustainable development policy of teachers and the pratt park	The teachers' support policy was implemented at
		The fusion of training and training after the teacher's post
		Improve the teachers' professional title
		Teacher's rights and interests protection system
		The joint development of the public office and the purf private garden
		Government, family, kindergarten and society properly share the cost of pre-school education
		The development incentive mechanism of the HP private garden
		The mechanism of the general park
		The teachers' support policy was implemented
Soft quality	Teacher's wind	Political direction
		Incubation child
		Caring for children
		Follow the rules of your toddler
		Maintain integrity
		Norms of conservation behavior
	Teacher quality at	There is a proportion of the teacher's qualification certificate
		Teacher professional structure
		The certificate of a special teacher is
		Teacher title structure
	The number of teachers	Students and teachers are better than
		The students and the babysitter were more than
		Students and doctors are better than
	Social participation and cultural resources	Supporting social forces in the garden
		Child-care guidance service system
		The number of public welfare services
		Education public welfare activities
		To form a multi-subject system
		Play the teaching device full
		Picture books are well equipped
		Cultural resources and activities

2.2. BP neural network based machine learning

2.2.1. Fundamentals of BP Neural Networks. The BP neural network model [24] has a three-layer topology with input, output, and hidden layers, where each layer of the network has multiple parallel neuron signals. The process is as follows: after the input signal enters the BP neural network, the input signals are transmitted in the corresponding order, and the first place where the signal arrives is the node of the hidden layer of the network, where the input signals are activated by the transfer function, which processes the input signals, and the activated signals are then transmitted to the output layer of the network model, where the signals are processed by the output layer, and the state of neurons in each layer and the state of neurons in the next layer are connected with each other, and the neurons in each layer are connected with each other. The state of neurons in each layer and the state of neurons in the next layer are influenced by the cascade effect. According to the connection weights and thresholds of each layer, an actual value is finally output by the output layer, and the result obtained is the result of the processing of the whole network model. The neural network output structure is actually a linear combination of weights, thresholds and input signals of the network, and then the output value and the desired value are calculated and compared, and the error between the two is used as the source information, and back propagation is carried out starting from the output layer, and the thresholds and weights of each layer are constantly updated, and training and adjustment are carried out accordingly until the output value is infinitely close to the desired output value. The BP neural network algorithm is essentially a constant updating of the weights and thresholds, and finally makes them able to match the environmental information.BP neural network is divided into two inverse sides, forward and backward propagation. Signal forward propagation when the signal enters from the input layer and then reaches the output layer after the function processing of the hidden layer, the nodes of each layer will only play a role in the nodes of the next layer, while the reverse propagation if the signal data in the process of forward propagation, can not get the desired output results, then the network model will let the signal propagate in reverse by the output layer, reverse propagation to the neuron nodes of each layer and correct the weights and thresholds, until the desired output result is obtained, so that the error of the obtained output result is within the ideal range.The specific structure of the BP neural network is shown in Figure 1.

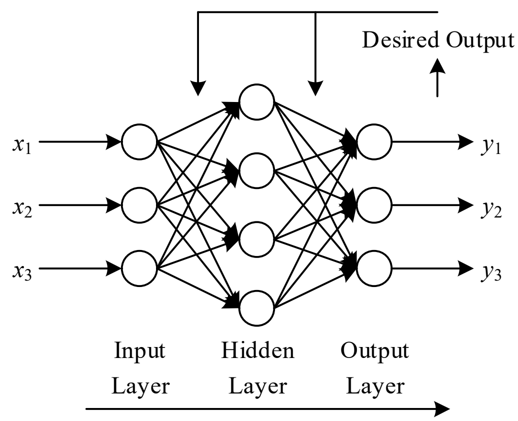

Fig. 1. Bp neural network structure diagram

Where x represents the input signal of the BP neural network, y represents the output signal, and n represents the number of eigenvalues of the input signal. As can be seen from the figure, the BP neural network is a nonlinear function composed of three layers of input, hidden and output layers, which are associated with each other layer by layer. Through continuous learning, the parameters between each neuron are dynamically adjusted to explore the complex interconnections between many data, with good generalization and fault tolerance.

2.2.2. Algorithmic flow of BP neural network. The algorithmic process of BP neural network is mainly divided into two major steps: first, the forward propagation of the signal, including the initialization of the network, the signal is transmitted from the input layer through the hidden layer to the output layer, and the input and output values of the hidden and output layers are calculated: The second is the backward adjustment of the error, which includes calculating the error between the actual output value and the desired value, if the error requirement is satisfied, then the algorithm iteration ends, otherwise the backward propagation of the error will be performed and the connection weights between the neurons and the round value will be updated. This cycle continues until the error between the output value and the desired value is within the specified range. The specific algorithm process includes the following steps:

1) Initialization of BP neural network. First of all, the topology of the network should be determined according to the actual situation of the input samples, including the number of layers of the network, the number of credits in each layer, etc., and finally the connection weights and thresholds between the layers should be initialized.

Here in this paper, the number of nodes in the input layer is set to N, the number of nodes in the hidden layer is set to H, and the number of nodes in the output layer is set to M; i represents the i th neuron in the input layer, and the range of values is $I-N$; h represents the h th neuron in the hidden layer, and the range of values is $I-H$; j represents the j th neuron in the output layer, and the range of values is $I-M$; and the number of training samples is k, and the range of values is $I-K$; The input vector of the neural network is $X_K = [x_1, x_2 \ldots x_n]$ The output vector of the output layer is $Y_K = [y_1, y_2 \ldots y_m]$; the desired output vector is $T_K = [d_1, d_2 \ldots d_m]$.

Randomly initialize the connection weights between the i st neuron of the input layer and the h nd neuron of the hidden layer to be w_{hi}, the connection weights between the h th neuron of the hidden layer and the j th neuron of the output layer to be w_{jh}; the weights of the h th neuron of the hidden layer to be θ_j; and the weights of the j th neuron of the output layer to be θ_j. In addition, here in this paper, we choose Sigmoid as the activation function f:

$$f(x) = \frac{1}{1+e^{-x}} \tag{1}$$

A set of samples X_K is randomly selected as the input vector, then the output of the i nd neuron of the input layer is Y_i:

$$Y_i = f(x_i) \tag{2}$$

2) Input and output of the hidden layer. Based on all the above conditions, the input vector I_h of the h st neuron of the hidden layer can be calculated:

$$I_h = \sum_n w_{kl} I_i + \theta_i \tag{3}$$

The input vector is then processed using the activation function to obtain the output vector Y_h of the h st neuron of the hidden layer:

$$Y_h = f(I_n) \tag{4}$$

3) Input and output of the output layer.Similarly, the input vector I_j of the j st neuron of the output layer can be calculated based on the output vector of the hidden layer calculated above:

$$I_j = \sum_n w_j Y_h + \theta_j \tag{5}$$

The output vector of the j st neuron of the output layer is Y_j:

$$Y_j = f(I_j) \tag{6}$$

4) Calculate the error. Set the desired output vector as T_k. Based on the real and output values of the output layer calculated in the previous step, define the error function as E:

$$E_k = \frac{1}{2}\sum_{j=1}^{M}(d_j - Y_j)^2 \tag{7}$$

where the maximum number of training times is determined to be S.

5) Update of weights and thresholds. According to the characteristics of the BP neural network, if there is an error between the actual output value and the desired output value, the back propagation of the error signal is carried out, i.e., the error is calculated layer by layer starting from the last layer forward and the connection weights and thresholds between the layers are recalculated and adjusted according to the calculated error.

The learning rate of the network is set to be η and the error requirement is ε. Based on the above calculations, the weights and thresholds are updated and the corresponding formula is:

$$w'_{hi} = w_{hi} + \Delta w_{kj} = w_{kj} + \eta \overline{\xi}_h^H Y_i \tag{8}$$

$$w'_{jh} = w_{jh} + \Delta w_{jh} = w_{jh} + \eta \overline{\zeta}_j^M Y_h \tag{9}$$

$$\theta'_h = \theta_h + \Delta\theta_h = \theta_h + \eta \overline{\zeta}_j^M \tag{10}$$

$$\theta'_j = \theta_j + \Delta\theta_j = \theta_j + \eta \overline{\zeta}_h^H \tag{11}$$

where $\overline{\xi}_h^H$ is the local gradient of the hidden layer neuron, calculated as:

$$\overline{\xi}_h^H = f'(I_h) \sum_{j=1}^{M} \xi_j^M w_{jh} \tag{12}$$

ξ_j^M is the local gradient of the neuron in the output layer, calculated as:

$$\overline{\xi}_j^M = Y_j\left(1 - Y_j\right)\left(d_j - Y_j\right) \tag{13}$$

6) Determine whether all samples have been trained. Judge whether all the samples have been trained, if not all trained, select the next set of samples provided to the neural network, return to step (1), otherwise continue to the next step.
7) Calculate the total error of the network:

$$E = \sum_{k=1}^{k} E_k = \frac{1}{2} \sum_{k=1}^{k} \sum_{j=1}^{M} \left(T_j^k - Y_j^k\right)^2 \tag{14}$$

Judge whether the total error E obtained satisfies the error requirement $E < \varepsilon$, if it does, the training is over: if not, proceed to the next step.
8) Judge whether the conditions are met. If the condition is satisfied or greater than the maximum number of training S, then stop training, if the condition is not satisfied, then return to step (1).

2.3. Model for assessing the quality of public services in inclusive preschool education

2.3.1. Determining model input variables. The purpose of this paper is to construct a public service quality indicator prediction model based on the consideration of synergistic effects to help managers realize the quantitative prediction of public service quality indicators to ensure the smooth implementation of the project portfolio. This paper uses BP neural network to realize the prediction of public service quality indicators, and the use of BP neural network needs to first determine the inputs and outputs of the model, so this section mainly determines the inputs and outputs of the model, which lays the foundation for the construction of the prediction model of public service quality indicators based on GA-BP neural network later.
1) Determine model input variables. To determine the input variables of the model, firstly, it is necessary to get the value of the project benefit index, and then based on the value of the benefit index of the projects within the project portfolio, combined with the degree of synergy between the projects within the project portfolio, the index value of the public service quality index is obtained, and the value is used as the input variable of the model. The specific steps are as follows: Obtaining Project

Benefit Indicator Values After determining the benefit evaluation criteria, relevant experts are selected and invited to evaluate the benefit indicators of the projects, so as to obtain the original project benefit data samples. After obtaining the results of expert evaluation, convert them into corresponding trapezoidal fuzzy numbers, and then use the following formula to aggregate all fuzzy numbers into a specific set of values, i.e., the value of the project's benefit index:

$$R\left(\breve{A}\right)=\frac{7b+7c+2a+2d}{18}*\frac{7w}{18} \tag{15}$$

2) Calculation of public service quality indicator index values. After the preliminary processing of the collected results using trapezoidal fuzzy numbers in the previous step, the project benefit indicator values were determined. Since the public service quality indicators include not only the direct benefits generated by the projects within the portfolio, but also the synergistic benefits due to synergies. Therefore, after obtaining the value of the project benefit indicator, it is necessary to sum up the value of the project benefit indicator with the value of the synergistic benefit, so as to obtain the value of the public service quality indicator. That is, the input variables of the model are shown below:

$$U_j=\sum_{i=1}^{m}u_{ij}*(1+S) \tag{16}$$

The value of the public service quality indicator is equal to the sum of the benefits generated directly by the project, plus the synergies generated due to synergies. Where there is m project in the portfolio, U_j represents the value of the j rd benefit indicator for a portfolio of projects, S is the synergy coefficient, which is a constant of 1.5% for a high degree of synergy, 1.0% for a medium degree of synergy, and 0.5% for a low degree of synergy. u_{ij} represents the value of the j th indicator for the i th project within the portfolio.

Through the above steps, this paper can realize the integration of the values of the project effectiveness indicators into the values of the public service quality indicators after obtaining the raw data to get the input variables of the model.

2.3.2. Determining model output variables. Hierarchical analysis is the transformation of the research object into a structured model with hierarchy and order, which can reasonably gather the experience and subjective judgment of experts and decision makers. Its basic steps are:
1) Establish the hierarchical model. The hierarchy of assessment indicators is divided into a factor layer, a criterion evaluation layer and a programmatic assessment layer, in which the criterion program layer is used as a specific assessment indicator, the factor program layer, i.e., the criterion program layer, can be used as a number of assessment influencing factors, and the main assessment object under study is the target program layer. The number of layers in the model is closely related to the complexity of the problem under study, and is often used in three-tier architecture systems.
2) Establish judgment matrix A, calculate the weight vector of each indicator:

(1) Use a_{ij} to indicate the relative importance of factor i compared to factor j, and obtain the judgment matrix $\overline{A}=\left(a_{ij}\right)_{m\times m}$ for the two-by-two comparison of factors at each level, as shown below:

$$A=\begin{pmatrix} a_{11} & a_{12} & \dots & a_{1n} \\ a_{21} & a_{n2} & \dots & a_{2n} \\ \vdots & \vdots & \vdots & \vdots \\ a_{n1} & a_{n2} & \dots & a_{nn} \end{pmatrix} \tag{17}$$

The judgment matrix scales and their meanings are shown in Table 2:

Table 2. Determine matrix scale and its meaning

a_{ij}	u_i / u_j	a_{ij}	u_i / u_j
1	Equally important	7	Very important
3	Slightly important	9	Absolute importance
5	More important	2,4,6,8	The median of the above adjacent judgments

(2) Calculate the importance ranking index r_i.

$$r_i = \sum_{j=1}^{n} a_{ij} \tag{18}$$

(3) Construct judgment matrix B with element b_{ij} in matrix B.

$$b_{ij} = \begin{cases} \dfrac{\left(r_i - r_j\right)\left(k_m - 1\right)}{r_{\max} - r_{\min}} + 1 & r_i \geq r_j \\ \left[\dfrac{\left(r_j - r_i\right)\left(k_m - 1\right)}{r_{\max} - r_{\min}} + 1\right]^{-1} & r_j < r_j \end{cases} \tag{19}$$

where $r_{\max} = \max\{r_i\}$, $r_{\min} = \min\{r_i\}$, $k_m = \dfrac{r_{\max}}{r_{\min}}$

(4) find the transfer matrix C of judgment matrix B, c_{ij} for each element of matrix C.

$$c_{ij} = \lg b_{ij} \tag{20}$$

(5) Find the optimal transfer matrix D for transfer matrix C, d_{ij} for each element of matrix D.

$$d_{ij} = \frac{1}{n}\sum_{k=1}^{n}\left(c_{ik} - c_{jk}\right) \tag{21}$$

(6) Find the goodness-of-fit agreement matrix B' for judgment matrix B, b'_{ij} for each element of matrix B'.

$$b'_{ij} = 10^{d_{ij}} \tag{22}$$

(7) Find the eigenvectors W of the identity matrix B'.

$$W_i = \frac{\sqrt[n]{\prod_{j=1}^{n} b'_{ij}}}{\sum_{i=1}^{n}\sqrt[n]{\prod_{j=1}^{n} b'_{ij}}} \tag{23}$$

respectively, to obtain $W = \left(W_1, W_2, \ldots, W_n\right)$ as the weight vector of the n indicator factors.

3) Judgment matrix consistency test. Calculate the maximum eigenvalue of the judgment matrix $\lambda_{\max}$, define the consistency index $CI = \dfrac{\lambda_{\max} - m}{m - 1}$ and the average random consistency index RI. consistency ratio $CI = \dfrac{CI}{RI}$, $CR < 0.1$ when the judgment matrix passes the consistency test.

2.3.3. GA-BP-based public service quality assessment of inclusive preschool education. The working principle of genetic algorithm is mainly to first generate a set of initial population, which contains multiple chromosomes, in which the individual chromosomes represent the solution of the problem, and then the chromosomes form a new generation of chromosomes through crossover, mutation and other operations, and finally the optimal chromosome is derived after many iterations, in which the optimal chromosome represents the best solution and the best solution of the research problem. Since the purpose of using genetic algorithm in this paper is to optimize the initial weights and thresholds of the BP neural network, the chromosomes in the population represent the initial weights and thresholds, and the optimal chromosome obtained by genetic algorithm serves as the optimal initial weights and thresholds of the BP neural network. The basic process of optimizing BP neural network by genetic algorithm is as follows:

1) Population initialization. This step is to use binary coding for individual coding, and the gene of each individual consists of four parts, including input layer and hidden layer connection weights, hidden layer weights, hidden layer and output layer connection weights, and output layer thresholds, and all the gene coding consists of 0 and 1, and the individual coding consists of the coding connection of the above weights and initial values. The length of individual coding is calculated as follows:

$$L = (M \times S + S \times N + S + N) \div 10 \tag{24}$$

Where, L represents the coding length, M represents the number of neurons in the input layer, S represents the number of neurons in the hidden layer, and N represents the number of neurons in the output layer.

2) Determine the fitness function. The genetic algorithm searches for weights and weights to minimize the error function E of the BP neural network as shown in Equation (25). Since within the genetic algorithm when the fitness value of an individual is larger, the solution represented by its counterpart is more optimal, the optimization is in the direction of large fitness. Therefore, in this paper, the inverse of the error function is set as the fitness function f, so as to select the optimal initial weights and weights when the error is minimum, as shown in Equation (26):

$$E = \frac{1}{n}\sum_{i=1}^{n}\left(y_i - t_i\right)^2 \tag{25}$$

$$f = \frac{1}{E} \tag{26}$$

Where n is the number of samples, y_i is the expected value of the i rd sample. And t_i is the actual output value of the i th sample.

3) Selection, crossover and mutation.Genetic algorithms make individuals evolve through the operations of selection, crossover and mutation to get the optimal solution, which can be used as the optimal initial weights and thresholds for the BP neural network. As can be seen from the previous section, the selection operator adopts roulette selection, the crossover operator adopts the simplest single-point crossover operator, and the mutation is to change the genes with a certain probability, and since the gene code consists of 0 and 1, if the gene code of the mutation is 0, it will be made to be 1: otherwise, it will be made to be 0.

Based on the above steps, and combined with the basic principles of the BP neural network model, the specific workflow diagram of the GA-BP neural network constructed in this paper is shown in Figure 2.

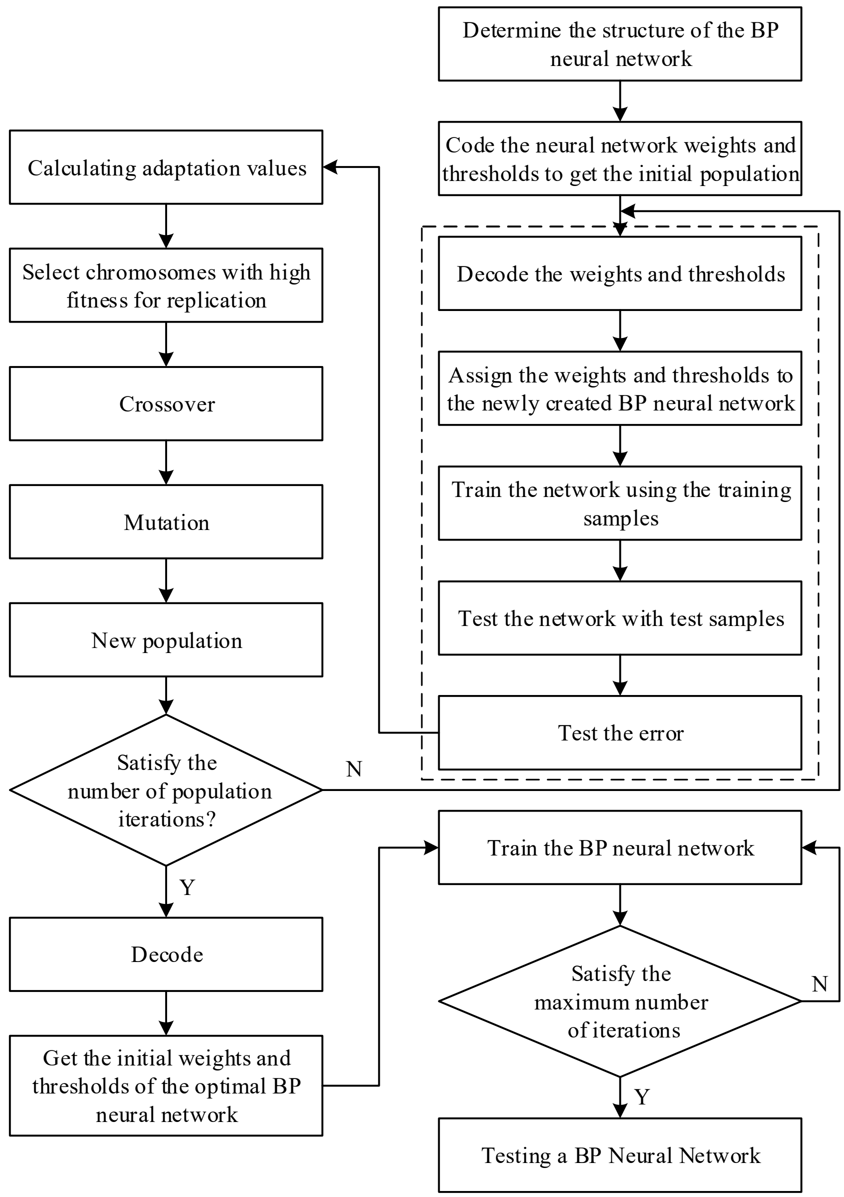

Fig. 2. GA-BP neural network workflow diagram

On the basis of the above steps and chapters, this paper constructs a public service quality indicator prediction model based on GA-BP neural network [25-26], and when public service quality indicator prediction is carried out, the determined input variables and output variables are inputted into GA-BP neural network for training and testing, and the relevant data are inputted into the trained and tested GA-BP neural network, which can realize the public service quality indicator prediction.

3. Results and analysis of the assessment of the quality of public services for inclusive preschool education

3.1. *Calculation of weights for assessment indicators*

The results of the indicator weights and CR means for each judgment matrix are shown in Table 3. From the statistical results, the first-level indicator with the largest proportion is flexible quality (0.428), followed by green quality (0.4231), and finally soft quality (0.1489). All experts agreed that inclusive public services have always been the core of pre-school education, and the flexible quality and green quality it contains are the most basic and extensive needs of parents of school-age children, especially the high usage of flexible quality and green quality makes inclusive pre-school education the most important channel for parents to send their children to pre-school education, thus maximizing the satisfaction of their children's pre-school education. Among the level 2 indicators, those with higher weights include special child care, mobile child care, ecological sustainability of the garden environment and sustainability of policies to support teachers and inclusive garden development, and the weights of these four level 2 indicators are 0.1451, 0.1238, 0.119 and 0.2644, respectively, while the weights of the other level 2 indicators all account for less than 0.1. Among the level 3 indicators, only the government, families, kindergartens and society reasonably share the cost of preschool education (0.0572) and educational rehabilitation synergy (0.0525) ranked the top two, and the weights of other tertiary indicators are all less than 0.05. It can be seen that the experts believe that the cost of education is the most central demand of the parents of schoolchildren and have certain expectations of the extent of the government's education costs, which requires the governmental preschool institutions to vigorously publicize information about preschool education. In particular, the publication of information on important educational rehabilitation synergies, the improvement of the enrollment support system, the synergistic development of public and inclusive private gardens, and the incentive mechanism for the development of inclusive private gardens can narrow the information gap between gardens and families in need of pre-school education, enhance the transparency of education, and raise the level of parental trust in the gardens.

Table 3. The index weights and the CR mean results of each judgment matrix

Primary dimension	Secondary dimension	CR	Tertiary dimension
Flexible quality(0.428)	A kiss of a special child(0.1451)	0.0113	Special teaching faculty (0.0131)
			Faculty of special teaching (0.0150)
			Health special teaching environment (0.0271)
			The number of special institutions (0.0094)
			Education rehabilitation work (0.0526)
			Education opportunities and effects (0.0279)
	Mobile children (0.1238)	0.0054	There is no difference from the equal access of the purse-bound resources. (0.022)
			The admission support system is perfect (0.0381)
			To weaken the restriction on the admission restrictions of migratory children (0.0216)
			Family education AIDS agency (0.0111)
			Subsidy (0.010)
			Control of changes in migratory children (0.021)
	Children in low-income families (0.0875)	0.0047	Exemption from charge (0.0093)
			Study and living allowance (0.0365)
			Children are given priority at (0.0161)
			Family education guidance (0.0256)
	In relatively poor areas, young children were kissed (0.0716).	0.0076	Food and clothing supplies for children's meals (0.0078)
			The puhui park is sufficient (0.0177)
			Grant policy perfection (0.0128)
			Good at (0.0177)
			Teacher orientation training policy (0.0078)
			The teachers' team is stable (0.0078)
Green mass(0.4231)	Ecological sustainability of the garden (0.0397)	0.0072	Environmental layout and greening (0.0104)
			Waste utilization at (0.0097)
			Pollution control (0.0106)
			Energy savings target (0.0055)
			Information model (0.0035)
	Ecological sustainability of the garden (0.119)	0.0087	Science conservation activities (0.0196)
			Young courses are effectively connected (0.0169)
			Young children support (0.0128)
			Rational environment of childcare environment (0.0233)

			Develop parent resources (0.005)
			Listen to the parent voice (0.0217)
			The family society of the garden (0.010)
			Parent empowerment (0.0097)
	Support for the sustainable development policy of teachers and the pratt park (0.2644)	0.0122	The teachers' support policy was implemented at (0.0203)
			The fusion of training and training after the teacher's post (0.0203)
			Improve the teachers' professional title (0.0203)
			Teacher's rights and interests protection system (0.032)
			The joint development of the public office and the purf private garden (0.0375)
			Government, family, kindergarten and society properly share the cost of pre-school education at (0.055)
			The development incentive mechanism of the HP private garden (0.0377)
			The mechanism of the general park is (0.0210)
			The teachers' support policy was implemented at (0.0203)
Soft quality(0.1489)	Teacher's wind (0.0284)	0.0104	Political direction (0.0034)
			Incubation child (0.0043)
			Caring for children (0.0043)
			Follow the rules of your toddler (0.004)
			Maintain integrity (0.0062)
			Norms of conservation behavior (0.0062)
	Teacher quality at (0.0344)	0.0082	There is a proportion of the teacher's qualification certificate (0.016)
			Teacher professional structure (0.0095)
			The certificate of a special teacher is (0.0065)
			Teacher title structure (0.0024)
	The number of teachers (0.0639)	0.0187	Students and teachers are better than (0.039)
			The students and the babysitter were more than (0.0194)
			Students and doctors are better than (0.0105)
	Social participation and cultural resources (0.0172)	0.0163	Supporting social forces in the garden (0.0034)
			Child-care guidance service system (0.0017)
			The number of public welfare services (0.0017)
			Education public welfare activities

			(0.0017)
			To form a multi-subject system (0.0018)
			Play the teaching device full (0.0033)
			Picture books are well equipped (0.0019)
			Cultural resources and activities (0.0017)

3.2. GA-BP neural network evaluation prediction results

The actual evaluation results and BP simulation evaluation results are shown in Table 4. From the training results, the average error of the BP neural network-based universal preschool education public service teaching quality evaluation model is 2.865, and the relative error is 0.03, the difference between the actual evaluation results and the simulation evaluation results is small.

Table 4. Results of the actual evaluation and the bp simulation evaluation result

Test sample number	Actual evaluation results	Simulation results	Error	Relative error
1	92.45	93.03	0.58	0.01
2	98.7	95.99	2.71	0.03
3	95.47	99.74	4.27	0.04
4	94.25	87.4	6.85	0.07
5	95.39	97.02	1.63	0.02
6	95.15	99.00	3.85	0.04
7	90.25	88.9	1.35	0.01
8	97.03	90.65	6.38	0.07
9	94.9	95.03	0.13	0.00
10	92.65	93.55	0.90	0.01

Predictions were made in the last 10 groups of test sample data, and the GA-BP neural network evaluation prediction results are shown in Figure 3. From the figure, it is obvious that among the prediction results of the 10 groups of samples, only group 4 (6.85) and group 8 (6.38) have an error greater than 5 points, and the error between the rest of the prediction groups and the true value ranges from 0.13-4.27, which is less than 5 points. It can be seen that the prediction results are in line with reality, but there are still many influencing factors in various aspects of inclusive preschool education that cannot be quantitatively selected into the evaluation system, so errors in this regard are unavoidable.

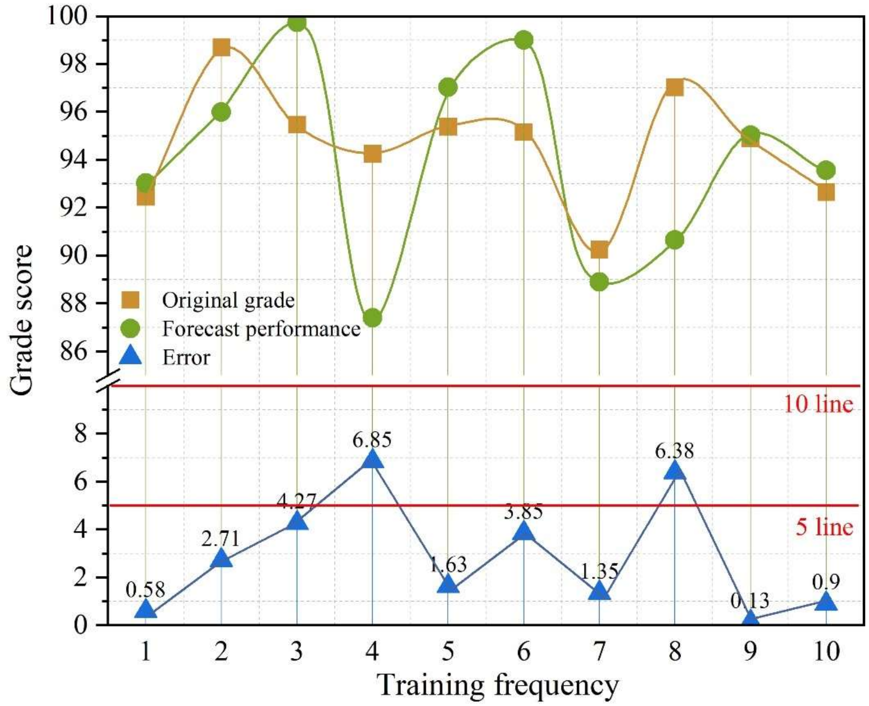

Fig. 3. GA-Bp neural network evaluation prediction results

3.3. *Comparison of model prediction effects*

In order to better reflect the effect of the two neural network evaluation models, BP and GA-BP, this paper utilizes the original GA and BSA algorithms to predict the same 10 sets of test set data from the sample data for comparative analysis. The comparison results of the four models are shown in Table 5. Although the traditional evolutionary algorithms (GA, BSA) are able to produce prediction results based on the students' scores for each item, it can be seen from the 10 sets of evaluation data in the figure that the evaluation results of GA and BSA are more fluctuating, and even exceed the normal scoring ranges (106.88 and 101.93) for the 8th set, while the BP neural network algorithms, regardless of the improvement or not, can be in the scoring range of predict the students' scores. After calculating the average error of prediction for 10 groups of scores of four methods, GA, BSA, BP and GA-BP, it is found that the difference between the error of GA and BSA methods and the true value is the largest, and the average error of their 10 groups of test samples is 13.758 and 15.483 points, respectively, and the error of BP method is relatively small, 5.584, and the error between the GA-BP method proposed in this paper and the true value is The error between the GA-BP method proposed in this paper and the true value is extremely small, and its average error is only 1.559. Based on the above analysis results, it can be clearly concluded that the prediction model proposed in this paper has the best prediction effect and the prediction results are infinitely close to the true value.

Table 5. The comparison of the four models

Test sample number	GA	BSA	BP	GA-BP	Actual evaluation results
1	78.48	72.03	88.89	94.27	97.65
2	71.86	75.26	92.83	98.34	96.49
3	87.37	73.46	84.03	96.77	99.56
4	83.52	78.35	91.78	95.67	95.14
5	79.43	89	78.15	72.39	73.27
6	77.75	77.91	89.17	94.57	91.71
7	80.79	75.6	94.75	90.56	90.42
8	106.88	101.93	95.44	92.1	92.55
9	81.07	87.76	89.79	93.68	95.63
10	82.84	97.66	90.12	93.41	94.17
Mean error	13.758	15.483	5.584	1.559	

3.4. Tests of variability of indicator elements

Also combined with the data collected by the questionnaire, based on the theory of expected difference, the paired-sample t-test using SPSS software can be derived from the mean and paired difference of the expected importance and actual perception of the 29 indicators of the indicator stratum, which reflects the difference between what the evaluator thinks is the importance of the indicator and what is actually perceived, with a negative value indicating that there is no difference, and a positive value indicating that there is a difference.

The results of the paired-sample t-test of the elements of the indicator stratum of inclusive preschool education public services are shown in Table 6. Through observation it is found that the significant P-value of all 65 indicators is <0.05, which indicates that there is a significant difference between the importance of these 65 indicators in the minds of parents of school-age children and what they actually feel. At the same time the paired difference can be found that the value is all positive, which means that the actual perception of parents of school-age children on the evaluation indicators of the quality of public services of inclusive preschool education is lower than the degree of importance. It means that the public services of preschool education in this place do not satisfy the needs of parents of school-age children well. The overall mean of the importance score is 4.3635, and 31 indicators, including the creation of a healthy special education environment, educational rehabilitation synergy and integrated education opportunities and effects, are above the mean, indicating that parents of school-age children attach great importance to these 31 indicators. And the overall mean value of the actual perceived scores of the evaluation indicators is 3.8654, with 29 indicators above the mean value, including special education teacher competence and healthy special education environment creation. The highest level of satisfaction among parents of school-age children is the correct sharing of the cost of preschool education among the government, families, kindergartens and society (3.9063), and the lowest level of satisfaction is the public welfare activities for education (3.8506). Finally, combining the importance of the indicators to parents of school-age children with actual perceptions, it was found that preschool early childhood care, ecological sustainability, and teacher moral character were all important.

Table 6. Test results of the pre-education public service index matching sample t test

Tertiary dimension	Expected importance	Satisfaction score	Pairing error	Sig.	Cohen's d
Special teaching faculty	4.3629	3.8633	0.4861	0.000	0.5018
Faculty of special teaching	4.3344	3.866	0.4702	0.000	0.4833
Health special teaching environment	4.3853	3.875	0.5019	0.000	0.5198
The number of special institutions	4.3386	3.8566	0.4925	0.000	0.5107
Education rehabilitation work	4.3843	3.9041	0.4802	0.000	0.4969
Education opportunities and effects	4.3909	3.8786	0.5123	0.000	0.5279
There is no difference from the equal access of the purse-bound resources.	4.3655	3.8732	0.4923	0.000	0.5057
The admission support system is perfect	4.382	3.8874	0.4946	0.000	0.5073
To weaken the restriction on the admission restrictions of migratory children	4.3722	3.87	0.5022	0.000	0.5165
Family education AIDS agency	4.3564	3.8592	0.4972	0.000	0.5123
Subsidy	4.3628	3.8629	0.4999	0.000	0.5134
Control of changes in migratory children	4.3708	3.8757	0.4951	0.000	0.5089
Exemption from charge	4.3547	3.8607	0.494	0.000	0.5084
Study and living allowance	4.4067	3.8866	0.5201	0.000	0.5351
Children are given priority at	4.3764	3.8658	0.5106	0.000	0.5256
Family education guidance	4.3905	3.8756	0.5149	0.000	0.531
Food and clothing supplies for children's meals	4.3585	3.8561	0.5024	0.000	0.5163
The puhui park is sufficient	4.3775	3.8699	0.5076	0.000	0.5245
Grant policy perfection	4.3493	3.8639	0.4854	0.000	0.5005
Good at	4.3683	3.8677	0.5006	0.000	0.5146
Teacher orientation training policy	4.343	3.8582	0.4848	0.000	0.5017
The teachers' team is stable	4.338	3.8578	0.4802	0.000	0.4943
Environmental layout and greening	4.3551	3.8621	0.493	0.000	0.5074
Waste utilization at	4.3334	3.8593	0.4741	0.000	0.4883
Pollution control	4.3666	3.8612	0.5054	0.000	0.5222
Energy savings target	4.3568	3.8545	0.5023	0.000	0.5196
Information model	4.3477	3.8534	0.4943	0.000	0.5102
Science conservation activities	4.3768	3.8702	0.5066	0.000	0.5184
Young courses are effectively connected	4.3649	3.8654	0.4995	0.000	0.5169
Young children support	4.3746	3.8648	0.5098	0.000	0.5259
Rational environment of childcare environment	4.3833	3.874	0.5093	0.000	0.5236
Develop parent resources	4.3538	3.8525	0.5013	0.000	0.5199
Listen to the parent voice	4.3715	3.8715	0.5	0.000	0.5139
The family society of the garden	4.3642	3.8562	0.508	0.000	0.5245
Parent empowerment	4.3534	3.8592	0.4942	0.000	0.5065
The teachers' support policy was implemented at	4.3655	3.8699	0.4956	0.000	0.5121
The fusion of training and training after the teacher's post	4.3865	3.8724	0.5141	0.000	0.5302
Improve the teachers' professional title	4.383	3.8683	0.5147	0.000	0.5291

Teacher's rights and interests protection system	4.3826	3.8822	0.5004	0.000	0.519
The joint development of the public office and the purf private garden	4.3836	3.8844	0.4992	0.000	0.5164
Government, family, kindergarten and society properly share the cost of pre-school education	4.413	3.9063	0.5067	0.000	0.5219
The development incentive mechanism of the HP private garden	4.3906	3.8887	0.5019	0.000	0.5139
The mechanism of the general park	4.3669	3.8706	0.5038	0.000	0.5171
The teachers' support policy was implemented	4.3563	3.8704	0.4859	0.000	0.4998
Political direction	4.3337	3.8522	0.4815	0.000	0.4983
Incubation child	4.3544	3.8552	0.4992	0.000	0.5174
Caring for children	4.3378	3.8559	0.4819	0.000	0.496
Follow the rules of your toddler	4.3473	3.8529	0.4944	0.000	0.509
Maintain integrity	4.3432	3.8571	0.4861	0.000	0.5015
Norms of conservation behavior	4.3577	3.8544	0.5033	0.000	0.5156
There is a proportion of the teacher's qualification certificate	4.3817	3.8631	0.5186	0.000	0.5341
Teacher professional structure	4.3842	3.8591	0.5251	0.000	0.5394
The certificate of a special teacher is	4.3743	3.8561	0.5182	0.000	0.533
Teacher title structure	4.3508	3.8521	0.4987	0.000	0.5174
Students and teachers are better than	4.3972	3.8897	0.5075	0.000	0.5238
The students and the babysitter were more than	4.3534	3.8659	0.4875	0.000	0.5025
Students and doctors are better than	4.336	3.8601	0.4759	0.000	0.4921
Supporting social forces in the garden	4.3486	3.8546	0.494	0.000	0.5089
Child-care guidance service system	4.3554	3.8523	0.5031	0.000	0.5165
The number of public welfare services	4.3488	3.8543	0.4945	0.000	0.5105
Education public welfare activities	4.3373	3.8506	0.4867	0.000	0.5026
To form a multi-subject system	4.3412	3.8528	0.4884	0.000	0.5037
Play the teaching device full	4.3592	3.8535	0.5057	0.000	0.5224
Picture books are well equipped	4.3543	3.8515	0.5028	0.000	0.5161
Cultural resources and activities	4.3314	3.8536	0.4778	0.000	0.4943
Population mean	4.3635	3.8654	0.4981	0.000	0.5134

3.5. *Results of the IPA model analysis of public service quality*

The results of the analysis of the IPA model of the quality of public services of inclusive preschool education are shown in Figure 4. By statistically analyzing the satisfaction level of the evaluation indicators, we find that their overall average score reaches 3.86537. The lowest score is recorded as 3.8506, while the highest score is 3.91. This range indicates that the satisfaction level of parents of school-age children with the public services of inclusive preschool education remains at a high and stable level overall.

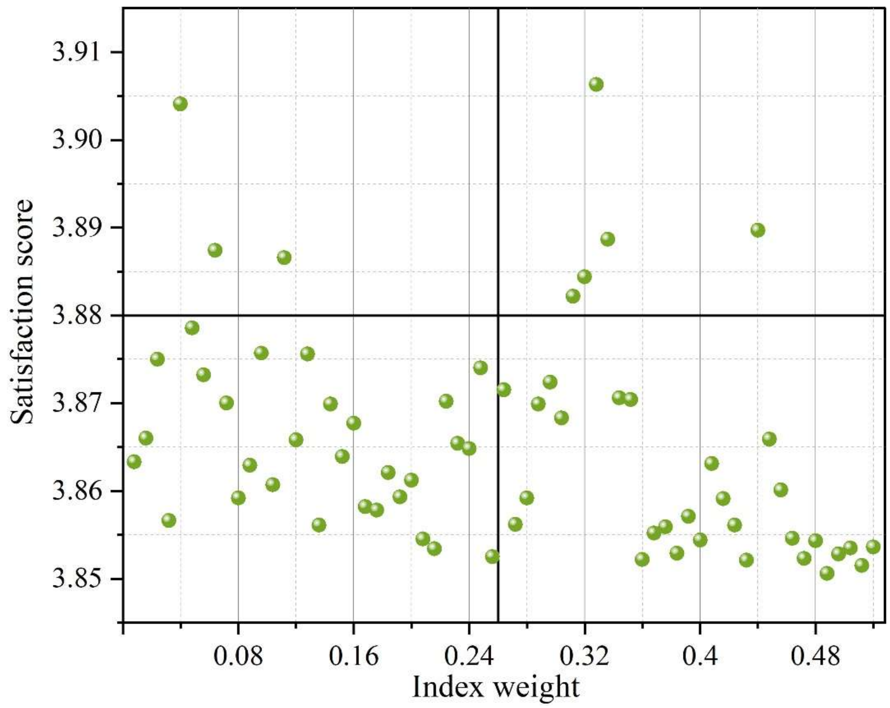

Fig. 4 The pre-education public service GA-BP model analysis results

3.6. Paths for improving the quality of public services for inclusive preschool education

1) Viewing service recipients as the highest value of inclusive preschool education public service provision. The construction of inclusive preschool education public service system aims to ensure the direct needs of the people's survival and development, full of ethical values and objectives. The connotation of "inclusive" and "public service" and the term "inclusive pre-school education public service" determines that pre-school education should be public welfare and inclusive in the process of reform and development. Inclusive pre-school education public services should be based on the pre-school education needs of all children and their families. The best way to improve the quality of inclusive preschool education services is to adhere to the principle of "people-centeredness".

2) Expanding the scale of financial investment in pre-school education and ensuring the quality of investment. The key to determining the development of preschool education is whether there is sufficient and reasonable financial input. Therefore, the financial investment in pre-school education should be as follows: First of all, fair investment in kindergartens of different systems. The average per-pupil expenditure of kindergartens differs significantly according to the system of kindergartens, and the average per-pupil education expenditure of private kindergartens is significantly lower than that of public kindergartens. Secondly, different levels of kindergartens reasonable investment in the development of preschool education should be the first to break through the unfair financial investment tendency, based on the scientific accounting of the cost of running a reasonable investment. Third, the effective investment in different areas of kindergartens.

3) Adhere to the "vulnerable groups, special care," the idea of inclusive preschool public service supply. The reason why vulnerable groups in preschool education become vulnerable is usually caused by social and their own factors, and special attention should be paid to the different situations of different vulnerable groups. First, a basic free preschool education system should be implemented for disadvantaged children in relatively poor areas. The Government should take the lead in establishing a mechanism to guarantee funding for preschool education that is basically free of charge for young children in impoverished areas and disadvantaged groups. Secondly, it should make preschool education free for all children with special needs, rationally plan the structure of teachers, and emphasize the combination of special training and comprehensive development for children with

disabilities. Third, ensure that migrant children are not subject to the restrictions of the school enrollment system. The need for migrant children to have equal and non-discriminatory access to educational resources should be met, and the disparity in access to educational resources between migrant children and children from inflow areas should be gradually eliminated.

4. Conclusion

In this paper, we first constructed a quality evaluation system for public services of inclusive preschool education, and then constructed a GA-BP quality assessment model on the basis of BP neural network machine learning, and analyzed and evaluated the effect and application of the model. The main conclusions are as follows:

1) The weight shares of the first-level indicators flexible quality, green quality and soft quality are 0.428, 0.4231 and 0.1489, respectively. Among the secondary indicators with higher weights are special child care, mobile child care, ecological sustainability of the garden environment and sustainability of the policy to support teachers and inclusive garden development, which have a weight of more than 0.1 for the four level 2 indicators, while all other level 2 indicators have a weight share of less than 0.1. Among the three-level indicators, the weighting of the reasonable sharing of preschool education costs among the Government, families, kindergartens and society, and the synergy of educational rehabilitation, is greater than 0.05, while the weightings of the other three-level indicators are all less than 0.05.

2) The training results of the GA-BP model show that the difference between the actual evaluation results of the teaching quality of inclusive preschool public services and the simulation evaluation results is small. And the error between the prediction group and the real value of the 10 groups of test sample data is extremely small, and the prediction results are in line with the teaching reality.

3) The overall mean values of the importance score and the actual perception score are 4.3635 and 3.8654 respectively, and almost half of the indicator scores are larger than the mean value, which shows that there is a significant difference between the results of the paired-sample t-test of the elements of the indicator stratum of inclusive preschool education public services. At this time, the overall satisfaction of parents of school-age children with the public services of inclusive preschool education remains at a high and stable level.

Funding

1) 2023 Hebei Province Social Science Development Research Project: Research on the Construction Path and Government Governance Strategies of Hebei Province's Inclusive Preschool Public Service System (20230105009).

2) Hengshui University High-Level Talent Scientific Research Startup Fund Project: Research on the Matching of Future Preschool Education Demand and Supply in Hebei Province under the Universal Two-Child Policy (2019GC04).

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