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Computer-Aided Design AND APPLICATIONS

Improving College English Teaching Quality Through Wireless Network Artificial Intelligence in E-Learning

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Abstract: To address the problems in the previous teaching quality assessment system, a mathematical model for teaching quality assessment is established using a neural network trained by a particle swarm optimization algorithm (PSO). The method uses a BP model trained by PSO to fit the complex relationship between the numerous indicators affecting teachers' teaching quality assessment and the evaluation results. The experimental results show that artificial neural networks can better build a comprehensive evaluation system for meeting a wider range of systematic and complete evaluations. The results show that the artificial neural network can be used to improve and optimize the teaching mode. They enhance the teaching effect and quality of teaching comprehensively and cultivate applied, complex, and high-quality talents with high English application ability.

Keywords: blended teaching mode; split-classroom mode; teaching reform; particle swarm optimization algorithm; E-Learning.
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1 INTRODUCTION

The application of modern artificial intelligence technology in education has achieved remarkable results, but it can still replace students' language learning. Because English can be used for communication and expressing human emotions and opinions, AI still needs to handle various problems in the face of complex language environments. In this context, college English teachers must bring their values into play, take advantage of AI technology, and continuously innovate English teaching methods and their roles to meet the requirements of education development in the new era[11].

The main developments in teaching and learning obtained by artificial intelligence technology relying on online platforms can be the establishment of human-machine dialogue systems, extensive

data analysis to grasp students' classroom learning dynamics, and teachers to provide more data helpful information for teaching and learning[2]. Using such technology in the English classroom has completely changed the traditional teaching model in which the teacher mainly transmits textbook knowledge. With AI technology's assistance, student communication and interaction objects are transformed from students and teachers to intelligent machines[4]. Firstly, it enriches the path of students' language input and output; secondly, it can also penetrate English[13].

The application of artificial intelligence in college English teaching is changing the traditional way of obtaining English knowledge from teachers and providing students with more prosperous independent learning channels, making it possible to learn English outside of the classroom and into students' lives[15]. With the help of artificial intelligence technology, students can use online learning platforms or software to complete English listening, reading, writing, and practicing according to their knowledge shortcomings and upload their learning results to the system to provide feedback to students through assessment so that they can grasp the problems of English independent learning in time and keep the right direction of learning[12][14]. Teachers can also further optimize how students learn independently and enhance the efficiency and quality of independent learning[29].

The involvement of artificial intelligence technology in the teaching field can replace the traditional teaching mode of teachers in the classroom to answer questions and solve problems, create more space for teachers to teach in the school, and help them detach from the heavy teaching work and devote more energy to cultivating students' professional ability and literacy, providing thought help as well as action support for students' all-round development, and accomplishing the goal of developing skillful and high-quality talents[27]. In addition, teachers can also get more time and opportunities for teaching research. For classroom teaching research, teachers can use artificial intelligence data analysis technology to record students' performance in the classroom and draw specific images to form a database that responds to the learning situation[8]. With comparative analysis of student learning, they can understand the strengths and weaknesses of each student and develop personalized teaching guidance programs, forming systematic research results to provide specialized support for teaching practice[24]. In terms of scientific research, teachers can also use AI technology to understand the latest developments and future trends in English teaching and present the results summarized in classroom teaching in scientific research to improve teachers' cognition of English teaching and increase their experience in teaching practice, helping teachers to achieve competence development and providing help for the evaluation of teachers' titles[9]. In conclusion, using artificial intelligence technology in college English teaching can transform how teachers transfer basic knowledge for teaching, thus providing good prospects for students' employment[6].

2 ADVANTAGES OF TEACHING BASED ON THE INTEGRATION OF INFORMATION TECHNOLOGY

2.1 It is Conducive to Cultivating Students' Independent Learning Ability and Interest in Learning

Combining the respective advantages of the split-classroom teaching mode and the blended teaching mode, under the information technology-based split-classroom integrated teaching mode, lectures and discussions are staggered so that students can have sufficient time to arrange their learning, such as reading the textbook content deeply, completing the assigned homework, choosing the most suitable way and time to understand deeply, and internalizing and absorbing the teaching content taught in class in a personalized way, which This helps students to develop self-directed independent learning, and also allows them to actively think about problems during the internalization and absorption process, to stimulate their subjective initiative to observe and find issues and to encourage them to bring their confusion and difficulties to the face-to-face discussion class to discuss and solve with the teacher and classmates. In the discussion classroom, the teacher uses group

discussion and whole-class communication to organize students' discussion. Students present their homework results, share their learning experiences, and answer each other's questions and confusion. Students have the opportunity to brainstorm and think together, which helps cultivate students' divergent thinking ability, teamwork ability, self-expression ability, and interpersonal communication ability, and can effectively enhance students' participation. Realize students' embodiment of self-worth and have a great sense of gain and satisfaction, thus fully mobilizing students' learning enthusiasm[1].

2.2 It is Conducive to Improving Teaching Efficiency

The traditional didactic teaching method is that classroom teaching is entirely dominated by teachers, completing the teaching content predetermined by teachers in advance. The practice process in the combination of lecture and practice is only within the limited framework of teachers' teaching design, without eliminating teachers' ideas and arrangements to think; therefore, the nature of students' passive learning has remained the same. Hence, students need more initiative and enthusiasm, and the teaching effect could be better [7]. The hybrid teaching mode based on information technology support, mainly guided by line-oriented, constructivism, cognitivism, and other teaching theories, relying on diversified teaching methods, realizes the organic integration of classroom lectures, classroom discussions, and online learning[7]. It can also present the role of student-led-subject combination, thus returning the leading position of students to classroom teaching, enhancing the interactivity between teachers and students, and significantly increasing the participation, which in turn enhances collaboration, thus effectively improving the teaching effect[5].

2.3 Give Full Play to the Teacher's Guiding Role

Under the blended teaching mode of split-classroom, the teacher's role changes from being the lecturer of "filling the classroom" to being the guide of the learning process, and the teacher organizes the teaching process, uses information technology and intelligent teaching tools and means to control the overall process of students' learning[30]. The teacher manages the teaching process, uses information technology and smart teaching tools and means to have macro control over the overall process of students' learning, and can supervise students' learning behaviors through online platforms, apps, and intelligent terminals, evaluate students' learning performance, and provide timely feedback to students[19]. In the classroom discussion, the teacher plays the role of a learning companion, guiding students to learn and discuss, no longer allowing students to passively accept learning according to the teacher's predetermined ideas, fully reflecting the leading position of students in the learning process, encouraging each student to dare to express their views, bravely collide with ideas, be good at interactive communication, and learn to collaborate and advance[20],[21]. Students can not only learn knowledge but also develop their creativity, thinking ability, and teamwork ability in the learning process, helping students to build comprehensively[26].

2.4 Beneficial to the Effective Use of High-Quality Teaching Resources

With the rapid development of modern information technology, Internet technology network online courses, large-scale online open courses MOOC, the emergence of national high-quality available courses, online courses into the general trend of college education teaching system for teachers to obtain and select a large number of high-quality teaching resources to provide a convenient and guarantee[23]. Teachers can combine the characteristics of their courses to determine high-quality resources for innovative teaching design: rich teaching content, diversified teaching forms, and novel teaching resources[10]. According to their learning needs and interests, students can jump out of the limitations of time and space and conduct independent fragmented learning anytime and anywhere through the Internet platform, APP, or mobile bright end to maximize the utilization of teaching resources [25].

3 EXAMPLES OF TEACHING QUALITY ASSESSMENT

The university has widely adopted the online assessment system for students, the system of listening to classes by experts of the Teaching Quality Management Committee, and the system of teachers listening to each other's classes for grading, and attaches great importance to the quality of teaching. The following 16 evaluation indexes are used, expressed by $X_1, X_2, \ldots,$ X16. Among them, X_1 represents the enthusiasm and fullness of work; X_2 represents the organization of class; X_3 represents the seriousness of lecture; X_4 represents the timeliness and patience of post-lecture counseling and answering; X_5 represents the correct content, capacity and speed of teaching; X_6 represents the scientific, logical and systematic content of lecture; X_7represents the ability to clarify the key points and difficulties and handle them properly; X_8 represents the situation of linking theory with practice; 99 represents the inspiration of innovative thinking; X_9 represents the assignment of homework. X_{10} represents the assignment and correction of homework; X_{11} represents the use of different methods according to teaching needs; X_{12} represents the use of multimedia teaching methods; X_{13} represents the standardized and vivid teaching language of clear and reasonable writing; X_{14} represents the ability to educate students with the teaching content and classroom discipline; X_{15} represents the teacher's compliance with discipline; X_{16} represents the overall impression of the lecturer. 16 represents the overall impression of the teacher[17],[31],[22],[28].

The value range of evaluation indexes was set as [0, 100], and the scores of students, experts, and teachers against 14 college English teachers in the school were aggregated to obtain the results shown in Table 1. The table's analysis shows that the relationship between the evaluation target (i.e., teaching effect) and each evaluation index is complex and non-linear. What kind of relationship exists between them? To solve this problem, we use the neural network optimized by PSO to establish the mathematical model of this evaluation system.

Sample number	*Evaluation Indicators*																*Evaluation Objectives*
	X_1	X_2	X_3	X_4	X_5	X_6	X_7	X_8	X_9	X_{10}	X_{11}	X_{12}	X_{13}	X_{14}	X_{15}	X_{16}	
1	*88*	*92*	*89*	*85*	*92*	*80*	*95*	*89*	*82*	*79*	*81*	*80*	*80*	*79*	*87*	*88*	*89*
2	*85*	*84*	*87*	*89*	*87*	*84*	*93*	*88*	*79*	*76*	*83*	*90*	*81*	*78*	*88*	*79*	*86*
3	*88*	*83*	*86*	*87*	*90*	*86*	*92*	*85*	*78*	*75*	*86*	*93*	*83*	*73*	*85*	*72*	*80*
4	*92*	*84*	*82*	*88*	*88*	*82*	*87*	*86*	*70*	*85*	*89*	*92*	*86*	*92*	*89*	*76*	*83*
5	*83*	*90*	*83*	*86*	*91*	*83*	*88*	*82*	*80*	*92*	*92*	*96*	*85*	*93*	*83*	*73*	*82*
6	*91*	*89*	*94*	*82*	*93*	*89*	*86*	*83*	*83*	*93*	*93*	*95*	*89*	*85*	*92*	*71*	*81*
7	*81*	*87*	*91*	*83*	*96*	*86*	*80*	*86*	*8*	*91*	*96*	*94*	*95*	*86*	*90*	*74*	*85*
8	*88*	*79*	*90*	*92*	*98*	*84*	*79*	*84*	*5*	*90*	*94*	*97*	*92*	*87*	*81*	*95*	*91*
9	*83*	*86*	*80*	*93*	*90*	*87*	*72*	*80*	*92*	*80*	*97*	*87*	*90*	*81*	*84*	*84*	*79*
10	*90*	*85*	*88*	*88*	*87*	*89*	*76*	*95*	*90*	*82*	*90*	*88*	*94*	*80*	*79*	*83*	*75*
11	*92*	*82*	*93*	*85*	*88*	*92*	*80*	*92*	*81*	*86*	*93*	*89*	*91*	*83*	*78*	*82*	*73*
12	*90*	*92*	*91*	*86*	*86*	*90*	*89*	*79*	*83*	*80*	*92*	*86*	*79*	*86*	*76*	*81*	*92*
13	*85*	*93*	*87*	*83*	*85*	*96*	*92*	*82*	*89*	*79*	*85*	*83*	*82*	*92*	*93*	*80*	*85*
14	*87*	*80*	*88*	*82*	*83*	*97*	*75*	*83*	*79*	*82*	*86*	*82*	*81*	*79*	*81*	*85*	*91*

Table 1: Summary of teaching quality.

Taking the number of online multilingual sentences as an independent variable, three translation systems are used to test the speed of online multilingual translation. The results are shown in Table 1. The test results in Table 1 show that the document [7] network multilingual timely translation

system does not count the network multilingual data in the database in terms of hardware design, so the training data cannot be obtained. The average translation speed during the network multilingual test is 4.275 sentences per second; the performance of the document [8] network multilingual timely translation system is relatively better than that of the document [7] network multilingual translation system. Convenient translation system, but due to the inability to extract the semantic features of network multi-language, the translation of network multi-language becomes more complicated. After calculation, the average translation speed in the process of the network multi-language test is 5.566 sentences per second; based on data, The network multi-language timely translation system of the English intelligent translation software based on the analysis algorithm combines the software and hardware advantages of the above two systems to speed up the translation speed of network multi-language. After calculation, the average translation speed in the network multi-language test process is 1 second. 8.34 Sentence count.

4 TEACHING QUALITY ASSESSMENT MODEL USING BP NEURAL NETWORK WITH PSO OPTIMIZATION

4.1 Basic Particle Swarm Optimization Algorithm

The position of each particle $x_i = (x_{i1}, x_{i2}, \ldots, x_{iN})$ is a potential solution, and its adaptation value can be calculated by substituting it into the objective function to measure its merit. The particle updates its velocity and position according to the following equations.

$$v_{id}^{k+1} = w \times v_i \in [v1_2\left(p_{id} - x_{id}^k\right)_2\left(p_{gd} - x_{id}^k\right)max_{min} \tag{1}$$

$$x_{id}^{k+1} = x_{id}^k + v_{id}^{k+1} \tag{2}$$

Where: $i = 1,2,\ldots,m$ -the population size; $d = 1,2,\ldots,n$ -the number of dimensions of the search space; v_{id}^k - the d -dimensional component of the velocity of the ith particle in the kth iteration, $v_{id} \in [vmax_{min}$, i.e., a maximum velocity limits the velocity of the particle v_i; a non-negative constant, this parameter is used to adjust the role played by the particle's own experience and social experience in the motion, respectively

$$w = w_{\max} - \frac{w_{\max} - w_{\min}}{Num_{max}} \times Num \tag{3}$$

The particle keeps tracking the individual extremes and global extremes in the solution space for searching until it reaches the specified maximum number of iterations or is less than the selected error criterion.

4.2 BP Neural Network Optimization

The BP model is a multilayer feedforward network. In addition to the input and output node layers, there are one or more implicit layers.

When the desired output of the output node is t_i, the actual output, the forward output of the BP network, is calculated as.

1. The output of the hidden node

$$y_i = f\left(\sum_j S\, w_j - \theta_i\right) E = \frac{1}{2}\sum_l (t_i - o_i)^2 \tag{4}$$

2. Output of the output node

$$O_i = f\left(\sum_i T_{ij}\, y_t - \theta_l\right) = f(net_l) \tag{5}$$

Where: the neuron node function is often taken as an S-type function

$$f(x) = \frac{1}{1+exp(-x+\theta)} \tag{6}$$

Where: x - the node input vector,θ - the threshold value.

The error is used to correct the previous layer weights and thresholds for each cell in the hidden layer.

3. The error formula of the output node

$$E = \frac{1}{2}\sum_l (t_i - o_i)^2 \tag{7}$$

The BP algorithm uses the gradient descent method to correct the front layer weights and thresholds using the formula omitted. The gradient descent-based BP algorithm converges slowly, very quickly falls into local extremes, and is extremely sensitive to parameters such as the initial weights of the network, its learning rate, and momentum, which need constant training to be fixed gradually, and excessive training can lead to overfitting phenomena, which affects the generalization ability of the network.

The PSO algorithm has fast convergence, high robustness, and global solid contraction capability and does not require the help of unique information (such as gradient) on the problem itself. Combining PSO with neural networks, the PSO algorithm optimizes the connection parameters.

According to the research and status analysis of the data mining and clustering algorithm in the paper, the author has consulted a large number of literature and conducted in-depth research on the K-Means algorithm. Based on the study and use of the PSO algorithm by researchers in recent years, this paper improves the algorithm and finally tempers the algorithm based on feature selection into the feature selection algorithm [4]. The algorithm first sets the corresponding feature attributes for college students, then filters and cleans irrelevant feature attributes, normalizes the selection of related feature attributes, and then assigns initial values to the cluster centers and updates them continuously. The selected cluster centers are optimized to match the corresponding number of clusters more and more to discover the influencing factors that affect college students' use of translation software.

4.3 PSO Training BP-Type Neural Networks

The PSO algorithm optimizes the neural network by replacing the gradient descent method to train the network weights and thresholds. The key is establishing the mapping relationship between the dimensional space of PSO particles and the neural network connection weights and thresholds. From the analysis in this paper, it is clear that the neural network learning process is mainly the updating process of weights and thresholds, and the PSO search process is primarily the change of its speed and position in different dimensions. Thus, the weights and thresholds in the BP algorithm should correspond to the positions of the particles. The fitness function of the particles is the minimum mean squared error MSE.

$$MSE = \frac{1}{P}\sum_{i=1}^{P}\sum_{i=1}^{N}(t_i - o_i)^2 \tag{8}$$

Generate the optimal solution. When the algorithm stops iterating, the global extremes corresponding to the neural network weights and connection structure are the optimal solutions to the training problem. From the above description, it can be seen that the values of each element of the particle vector are composed of the weights and thresholds in the BP network; the fitness function of the particles is also obtained according to the mean square error of the BP algorithm, which realizes the integration of the PSO algorithm and the BP algorithm.

5 EXPERIMENTAL RESULTS

5.1 Neural Network Training

The neural network model for PSO optimization was designed to determine 16 input neurons, representing l6 indicators, 20 neurons in the hidden layer, and one neuron in the output layer.

The dimensionality $dim\ size$ of each particle of PSO is 361(16x20+20x1+20+1) dimensions; the population size is 30, w_{max}=0.9,w_{min}=0.4, $P1$ =2, $P2$ =2, the connection weights [-5, 5], the mean square error is less than 1e-5, or the maximum number of iterations is 10000. the first ten sets of data in Table 1 are selected in this paper after being normalized as training samples, and the training results are shown in Table 2.

Serial number	*1*	*2*	*3*	*4*	*5*	*6*	*7*	*8*	*9*	*10*
Expert evaluation	*0.474*	*0.417*	*0.265*	*0.939*	*0.443*	*0.357*	*0.000*	*0.828*	*0.026*	*1.000*
Network output	*0.4725*	*0.4163*	*0.2638*	*0.9365*	*0.4423*	*0.3582*	*-0.0009*	*0.8348*	*0.0279*	*0.9941*

Table 2: Neural network training output results.

5.2 Neural Network Testing

After the network's training, the last four data sets were used for testing. Then, the error between the output and actual evaluation targets was checked to see if the requirements were met. The normalized values of the last four sets of data in Table 1 are listed in Table 3.

Sample number	X_1	X_2	X_3	X_4	X_5	X_6	X_7	X_8	X_9	X_{10}	X_{11}	X_{12}	X_{13}	X_{14}	X_{15}	X_{16}
1	*0.928*	*0.728*	*1.000*	*0.919*	*0.687*	*0.801*	*1.000*	*0.819*	*0.726*	*0.755*	*0.734*	*0.802*	*1.000*	*0.888*	*0.901*	*0.901*
2	*0.715*	*0.546*	*0.802*	*0.918*	*0.755*	*0.702*	*0.889*	*0.274*	*0.728*	*0.668*	*0.802*	*0.902*	*0.728*	*1.000*	*0.802*	*0.802*
3	*0.359*	*0.185*	*0.402*	*0.585*	*0.562*	*0.502*	*0.779*	*0.819*	*0.365*	*0.334*	*0.202*	*0.000*	*0.275*	*0.334*	*0.201*	*0.200*
4	*0.502*	*0.365*	*0.802*	*0.752*	*0.689*	*0.502*	*0.668*	*0.638*	*0.185*	*0.502*	*0.468*	*0.202*	*0.275*	*0.445*	*0.402*	*0.300*

Table 3: Normalized test values.

The output results calculated by the neural network are compared with the evaluation targets obtained after the inverse normalization process and the actual evaluation targets, and the testing error of the network can be obtained, as shown in Table 4. The results obtained from the test are very close to the original data; that is, the model can determine the teaching effect more accurately according to each evaluation index.

Actual Output	Network Output	Error
93	92.3775	-0.6227
92	92.2686	0.2686
84	83.3760	-0.6240

86	85.9907	0.0093

Table 4: Test error.

5.3 Teaching Effect

The aim is to improve the effectiveness and quality of college English teaching in applied colleges and improve students' independent learning and comprehensive language application abilities. The teaching effect is shown in Figure 1. The application of data mining algorithms in the analysis of college students' English learning translation software is a significant change in the field of education, and it is also the inevitable development trend of future education. However, the adverse effects of security information leakage and student behavior not being trusted by big data should also be a cause for concern. Therefore, educators should do an excellent job monitoring big data algorithms in promoting data mining technology. They cannot unquestioningly trust the teaching evaluation results mined by intelligent algorithms but ignore students' feelings of being untrusted; educators can use data mining results as teaching plans. The basis for the formulation, scientific evaluation of the rationality of intelligent analysis results, and prevention of negative factors from eroding the impact of data mining technology on the evaluation results.

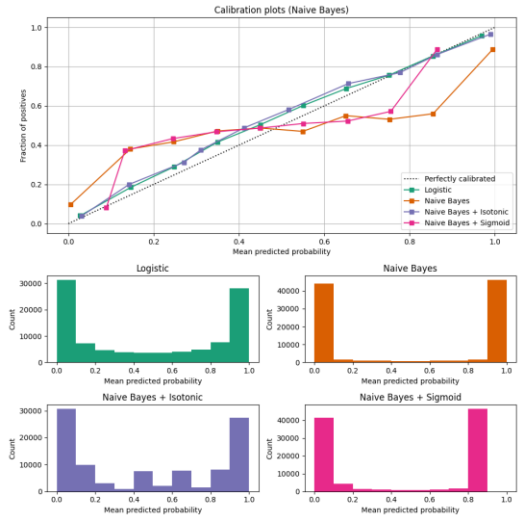

Figure 1: Teaching effect of different methods = effect.

Combining the respective advantages of the split-classroom teaching mode and the hybrid teaching mode and integrating them, seamlessly blending modern information technology such as the Internet, big data, and artificial intelligence into the whole process of "teaching" and "learning," creating a humanized, personalized and intelligent teaching environment, and building a new hybrid teaching mode of college English for students in applied colleges and universities as shown in Figure 2. The test results in Figure 2 show that the matching rate of the English intelligent translation software multilingual timely translation system based on the data analysis algorithm is the highest, followed by the literature [8] network multilingual convenient translation system. In contrast, the literature [7] network The multilingual real-time translation system does not calculate the similarity of multilingual extended characters in the text, resulting in a low matching rate test result.

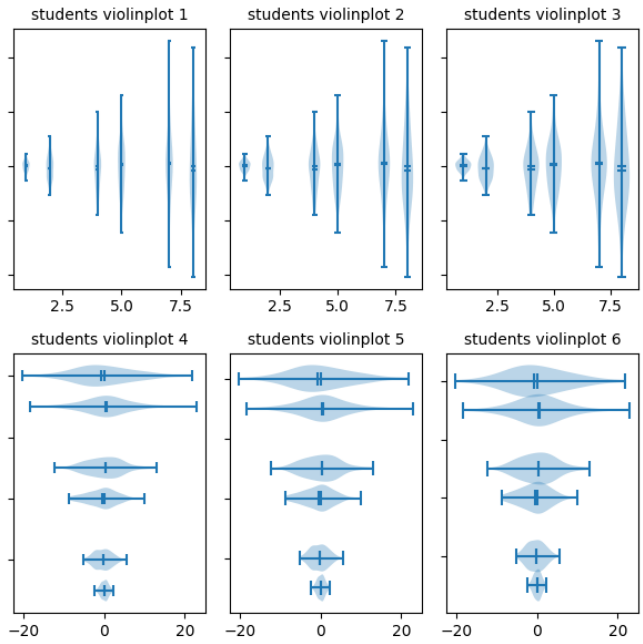

Figure 2: Student learning effect of hybrid classroom teaching.

As shown in Figure 2, under the IT-based hybrid teaching model, teachers can adopt a diversified evaluation method combining formative, performance, and summative evaluation to evaluate the whole student learning process comprehensively. Teachers can use advanced digital information technology to monitor and grasp the dynamic data of students across the entire teaching process in real-time, which is helpful for teachers to analyze and study students' knowledge mastery, actual learning difficulties and needs, and various ability development needs comprehensively. This helps teachers to explore and learn students' knowledge mastery, real learning difficulties and needs, and different competency development needs to fully understand students' overall learning situation and effects and adjust teaching methods and strategies in response to problems to improve teaching effectiveness [16],[18]. The diversified teaching evaluation tools throughout the teaching process can reflect the students' comprehensive learning situation and effect more truly, which is conducive to teachers' more profound understanding of students' knowledge and skills, learning methods, emotional attitudes, values, etc., and improve the effectiveness of teaching evaluation, and also help teachers to provide reference basis for future teaching design.

6 CONCLUSION

To address the problems in the previous teaching quality evaluation system, this paper uses neural networks trained by particle swarm optimization algorithm (PSO) to establish a mathematical model for teaching quality evaluation. The experimental results show that using artificial neural networks can better install a comprehensive evaluation system, which is used to meet a broader range of systematic, complete evaluations. It effectively improves students' independent learning ability of college English and cultivates applied and complex high-quality talents with high English application ability. Introducing wireless network artificial intelligence (AI) into college English teaching through e-learning marks a transformative leap in education. This integration revolutionizes the learning

experience, offering tailored, adaptive approaches that elevate language proficiency and engagement.

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