Research Article

Machine Learning Based Preschool Education Quality Assessment System

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Preschool education (PE) is the initial stage of life education, and early childhood is an unrepeatable process. PE has the same importance as other education stages because of the significant impact it can have on later childhood development. Furthermore, from the perspective of educational equity theory, every child has the right to receive PE, the right to obtain the same high-quality educational resources, and the right to fair final results. Therefore, the research on the quality of PE has theoretical value and practical significance. In order to strengthen the quality of PE, this paper designs a PE quality assessment system to evaluate teachers' teaching achievements. In this regard, the performance of each functional module in the system is tested, and the test results show that the module access is successful at more than 97%, indicating that the system meets the operating requirements. This paper uses the characteristics of the KNN algorithm classification in the machine learning algorithm to classify the teaching quality (TQ) of 7 pre-school teachers, and obtains the membership degrees of teachers in the four categories of grades, indicating that the KNN algorithm is more suitable for the classification of TQ assessment results than the general classification algorithm.

1. Introduction

With the increasing demand for high-quality talents in the market, the importance of talents is constantly being valued, and education is one of the important ways to cultivate talents, so it is very important to develop the potential of young talents. The most important function of education is to promote individual development, including individual socialization and individuation. The social function of education is to train talents for the development of the country and serve the political and economic development of the country. Preschool education provides the future workforce with a solid foundation of knowledge and skills and can develop the skills they need in an increasingly competitive market. The economic functions of emphasizing education in modern society mainly include providing a good background for the sustainable and stable development of the economy; improving the potential labor ability of the educated; and forming concepts, attitudes, and ways of behavior that adapt to modern economic life.

With the increasing importance of PE, it is hoped that more and more scholars will devote themselves to the theoretical and practical research of the PE quality assessment system. A large number of studies at home and abroad have shown that the quality of PE has an important impact on the learning and development of children throughout their lives. The essential characteristic of sports is to develop the body, strengthen the physique, promote the all-round development of people, and serve social development by means of physical exercises. The process of social development is subject to certain political and economic constraints and serves certain political and economic purposes. Developed countries are at the forefront of the world in terms of society and economy, but their education quality has always been a concern for people from all walks of life [1]. Some foreign PE institutions usually publish education quality assessment reports on their websites, and some states have specially designed relevant logos for PE institutions to use. The transformation of human nature through sports is not only the unity of physical structure and physiological

function but also the unity of body and mind. Physical education teaching should pay attention to students' invisible psychological development while pursuing students' physical transformation. On the one hand, more institutions are encouraged to participate in the evaluation system, and on the other hand, it expands the influence of the quality rating system so that parents are more fully aware of the importance of high-quality PE to their children's physical and mental development, and meet families' needs for high-quality PE institutions. After the evaluation is officially completed, all data will be notified to the participating institutions in the form of emails and letters. The public can download PE evaluation reports and other materials from their websites and can also obtain free TQ information and institutions of different PE institutions and to understand the degree of normalization of the relevant institutions[2, 3]. The characteristics of the sports industry include high spatial dependence, obvious time consumption, high consumption level, and high service quality. However, the research on the construction of the PE quality evaluation index system in my country is in the development stage. Most scholars in the field of PE focus their research perspective on the education price system itself, and there are few theories on the setting and selection of various factors in the PE evaluation system [4, 5]. From this point of view, both foreign and domestic attention is paid to the TQ of PE, which has laid a good foundation for the future training of talents. In a broad sense, sports culture refers to a culture with independent significance and value recognized by society by processing, organizing, and ordering physical activities that meet human needs through the body in order to enrich human life and meet the needs of survival. It includes spiritual culture and behavioral culture.

This paper first analyzes the evaluation goal of the evaluation system, which is also the main purpose of evaluation that is to promote child development, early childhood professional development, and family education development; then proposes the KNN algorithm, which can be used to classify teachers' TQ; and then designs PE. The functional modules of the quality evaluation system and the evaluation standard guarantee system; finally, the system functions are tested, the implementation method of the system login module is analyzed, and the evaluation and classification results of the KNN algorithm on the quality of PE are analyzed.

2. Evaluation Purpose and Introduction to KNN Algorithm

2.1. Evaluation Objectives of the PE Quality Evaluation System

2.1.1. Child Development Goals.
PE has a certain influence on children's emotional cognition and other aspects, and these factors have a relatively obvious effect on children after entering school for three years. Children's academic achievement is also one of the children's goals, and many preschools hope to give every child the same opportunity to achieve academic success. Its long-term goal is to hope that young children can give full play to their potential, achieve success in life, and become useful social citizens [6, 7]. The

system has the functions of statistics, analysis, retrieval according to various requirements, and regular announcements to society. The system provides online inquiry and online evaluation services for students and their parents provides personalized physical health diagnoses for students and enables students to exercise on the basis of accurately understanding their physical health.

2.1.2. Professional Development Goals of Kindergarten Teachers.
The quality standards of PE include the professional development of teachers, the most common ones are teacher training, continuing education, professional development plans, career planning, etc. Early childhood education schools should improve the professional development of preschool teachers by providing scholarships, career development consultants, etc. [8]. The theory of continuing education comes from practice, and its ultimate purpose is to guide practice. It is in this process of two-way interaction that continuing education workers, on the basis of constantly summing up practical experience, constantly absorb excellent research results of relevant disciplines, and strive to build a scientific theoretical system serving practice.

2.1.3. Guiding Goals of Family Education.
As an important place for children to grow, the family plays an important role in PE. The PE quality assessment system also puts forward corresponding goals [9]. First and foremost, we hope to enhance parents' understanding and demand for high-quality PE, improve their ability to identify high-quality kindergartens and provide families with a simple tool to choose the best kindergarten for their children. Secondly, parents hope to balance family and work through the TQ evaluation system, which not only emphasizes the importance of family participation in PE but also hopes that PE can reduce the burden on parents in real life [10, 11]. As parents, through their children's every move, word, and deed, they can timely grasp their psychological state at this moment, find problems in their children, timely educate them, correct them in time, and do not let them stay overnight so that bad behavior habits can be nipped in the bud.

Family education and kindergarten education cooperation are part of the content of PE quality assessment. In the assessment, it is necessary to understand the family background, family cultural traditions and customs, family structure, and other aspects of family life and parental needs related to children. Maintain frequent communication and exchanges (e.g., provide opportunities to communicate with parents, and listen to parents' needs). This can not only improve the parenting skills of parents, make parents more involved in PE but also increase parents' trust and respect for PE institutions and also help parents balance family and work [12, 13]. Through the PE quality evaluation and improvement system and its released data, families understand the education that children receive in PE institutions and choose the most suitable educational institution for their own development. At the same time, this also indirectly promotes the continuous improvement of PE institutions. The quality of its education will also be sustainable

development [14]. Educational principles include the principles of equality, respect, exchange, freedom, unity, example, trust, and tolerance.

2.2. Machine Learning Related Algorithms—KNN. The K-nearest neighbors algorithm (KNN) classifies the dataset samples according to the vector space model. The principle is that the dataset samples of the same category will have a high degree of similarity [15]. Therefore, the possible classification of the dataset samples can be predicted according to the similarity between the dataset samples that need to be classified and the dataset samples whose categories are already known [16]. In view of the classification function of the KNN algorithm, this paper uses the KNN algorithm to classify teachers' TQ results in the PE quality assessment system. The construction and implementation of the classifier generally include selecting samples and dividing all samples into two parts: training samples and test samples; executing a classifier algorithm on a training sample to generate a classification model; executing a classification model on a test sample to generate a prediction result; and evaluate the performance of the classification model.

The K-nearest neighbors algorithm is a machine learning algorithm that can be used for both classification and regression and both forms require increasing neighbor weights [17]. KNN method only determines the category of the samples to be classified according to the category of the nearest one or several samples in the classification decision-making. A common way to increase weights is to give each neighbor a weight of 1/n, where n is the distance between neighbors. The classifier does not need to use the training set for training, and the training time complexity is 0. The computational complexity of KNN classification is proportional to the number of documents in the training set, that is, if the total number of documents in the training set is n, the classification time complexity of KNN is O (n). When calculating the distance between objects in KNN, in order to avoid the matching problem between objects, Euclidean distance or Manhattan distance are generally used [18].

Euclidean distance is as follows:

$$d(x, y) = \sqrt{\sum_{k=1}^{n} (x_k - y_k)^2}. \tag{1}$$

Manhattan distance is as follows:

$$d(x, y) = \sum_{k=1}^{n} |x_k - y_k|. \tag{2}$$

Among them, x and y represent the object. The mathematical properties of Manhattan distance include non-negativity, identity, symmetry, and trigonometric inequality.

3. Design of PE Quality Assessment System

3.1. System Function Module Design. Figure 1 shows the four modules of the evaluation system, and their functions are described as follows:
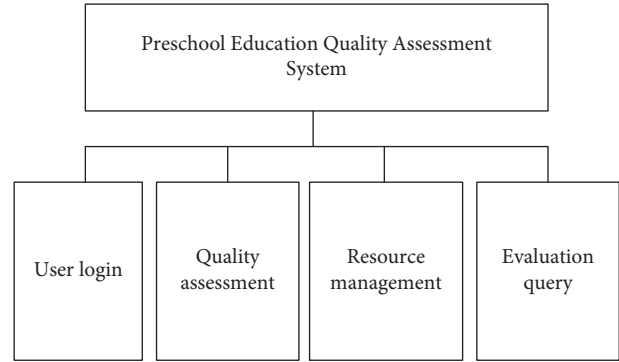

Figure 1: Modules of PE quality assessment system.

3.1.1. User Login Module. User login is the channel for the user to enter the evaluation system. Only by registering the user information can the user obtain the password and account number to log in to the system and then use the functions of the evaluation system. It can effectively distinguish whether the operator is a user or a nonuser of the program, which is conducive to protecting the rights and interests of both parties.

3.1.2. Quality Assessment Module. The quality evaluation module is an evaluation paper that the administrator inputs into the system according to the evaluation indicators and corresponding weights formulated by experts and generates corresponding evaluation indicators and imports information such as the teaching situation and teaching evaluation situation of PE.

3.1.3. Resource Management Module. The main purpose of this module is to manage the basic information of students, teachers, and classes. Perform basic operations such as deleting, adding, and updating the basic information of each object.

3.1.4. Evaluation Query Module. According to different situations of each semester, users with different roles will evaluate the corresponding teachers, and the evaluation result query function includes querying the teaching evaluation results of the corresponding course teachers by course. Teachers not only need to conduct self-assessment on their own TQ but also objectively assess the TQ of other teachers and conduct statistical inquiries on the assessment results so that the teaching assessment results can be fed back to the entire teaching process in a timely manner. Teachers can also check students' opinions and suggestions on teaching so as to change teaching methods in time and use different teaching methods for different teaching objects to improve TQ and improve teaching effect.

3.2. Establishment of a Guarantee System for the Implementation of PE Quality Standards. As an important means of TQ monitoring, TQ assessment has also received more and more attention. Moreover, the Ministry of Education

has also made it clear that it should seize the time to improve the TQ assessment system as soon as possible and strive to revise the assessment indicators to improve the TQ. Moreover, there must be plans and objectives to check the TQ evaluation work and increase the guidance on the TQ evaluation. Learning from the historical experience of PE in developed countries is carried out in order to improve the level of PE. So, the prerequisite must first be to establish a sound education quality assurance system to ensure the sustainable and stable development of PE and the teaching staff and other aspects to strengthen the protection. The factors affecting the quality of education include the rationality of the education system, teaching plan, teaching content, teaching method, teaching organization form, and teaching process; the quality of teachers, the foundation of students, and the enthusiasm of teachers and students to participate in educational activities.

(1) Institutional construction: clarify the important status of PE, lower the entry threshold and encourage social forces to actively participate in the field of PE; coordinate financial institutions to provide corresponding preferential conditions for the establishment of private colleges and universities to solve the problem of financial difficulties in running schools; in view of the improvement of national strength, consider whether PE can be included in the scope of compulsory education to implement full or periodic free tuition.

(2) Financial investment: the government's investment in the field of education has not reached the expected target. In terms of investment direction, most of the education funds flow to the higher education stage, and the amount obtained from preschool education at the lowest level of education is relatively small. Institutions should find an optimal balance in the funding of public colleges and nonprofit private PE institutions and bring private kindergartens and public kindergartens into a unified management system. According to the different nature of the investment object, the financial investment includes free financial allocation that neither collects interest nor recovers the principal; financial loans that both receive interest (generally low interest) and recover the principal; financial investment is an investment that forms national capital and receives capital gains.

(3) Guarantee the quality of teachers: the entry-level of kindergarten teachers is relatively low, the requirements for teacher quality are not high, and there are not too many restrictions on the academic qualifications of teachers. Most teachers do not have professional teaching qualifications. If the level of teachers' qualifications cannot be guaranteed, it is simply empty talk to improve the quality of PE. For this reason, teachers who do not have the qualifications must be sacked or on-the-job training wait for them to meet the requirements for re-employment; substitute teachers are required to participate in teaching skills training on a regular and irregular basis, and teachers and staff are encouraged to actively participate in industry competitions. Improve teachers' teaching ability; in economically poor areas, teachers' salaries and social security benefits should be improved to avoid excessively high job turnover and turnover rates in the teaching team. Teachers can be rotated between different economic development areas to improve the teaching ability of teachers in backward areas.

(4) Establish a scientific PE supervision system: in order to prevent the occurrence of the phenomenon of teaching supervision being a mere formality, it is first necessary to strengthen the sense of responsibility of government staff, clarify the responsibility and authority of teaching evaluation staff, and strictly implement the accountability of asking questions at the end. The second is to formulate a set of work standard procedures that conform to the laws of teaching supervision and standardize the behaviors of executors.

4. Evaluation System Application Analysis

4.1. System Test

4.1.1. Module Test. In the process of accessing the success rate test of the PE TQ evaluation system, this paper conducts key tests on the system management, resource management, quality evaluation, and evaluation query modules in the system. A total of 180 test cases are designed, of which 176 are tested. The results meet the requirements of the system, 4 results do not meet the requirements, and the success rate reaches more than 97%. The test results show that the system has no major defects, operates normally, and has stable performance, which meets the system requirements for PE TQ evaluation. The test results are listed in Table 1.

4.1.2. Performance Test. As shown in Table 2 and Figure 2, the response time test results of the system web page under the condition that the number of users online at the same time are different through the telephone dial-up network, broadband, and optical network test system, and the system load test results under different user numbers. According to the experimental results, it can be seen that with the increase in the number of users online, the response time of the web page will increase under the three network usage conditions. When using the telephone dial-up network test, the response time of the web page is relatively long. When using the broadband and optical fiber network, the connection speed is not bad, indicating that the system is suitable for the application in broadband Internet access or the optical fiber network environment. When using the fiber optic network, the response speed of the web page is the fastest, and the increase in users has little effect on the response time. Under different numbers of users, the load test of the system in this paper is normal. The concurrent performance test and load

TABLE 1: System module test results.

Module	Testing frequency	Number of successes	Number of failures	Success rate (%)
User login	20	20	0	100
Quality assessment	65	63	2	96.92
Resource management	45	44	1	97.78
Evaluation query	50	49	1	98

TABLE 2: System response time (s) when users are concurrent.

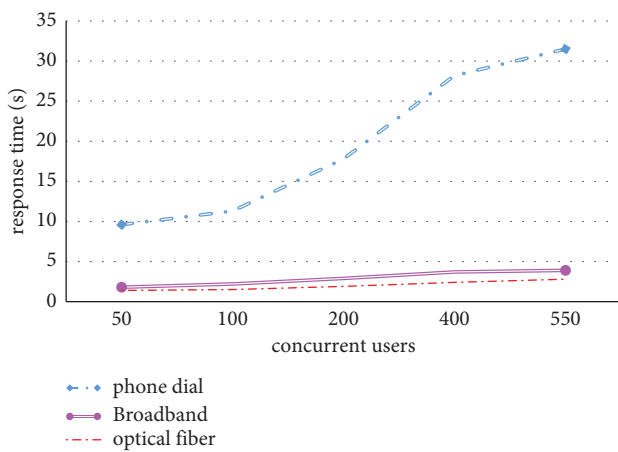| Number of simultaneous online users	Phone dial	Broadband	Optical fiber	Is the system normal
50	9.6	1.8	1.4	Normal
100	11.3	2.2	1.5	Normal
200	17.8	2.9	1.9	Normal
400	28.2	3.7	2.4	Normal
550	31.5	3.9	2.8	Normal

FIGURE 2: Concurrency test results.

test show that the system has good performance and can meet the evaluation requirements of the system for PE TQ.

4.2. User Login Function and its Security Implementation.
In this system because the user login and logout functions are considered at the same time, the user login function is more complicated. It is implemented by the page UserLoginPage.aspx, the user control UserLogin.ascx and the user control UserLoginInfo.ascx. UserLoginPage.aspx.cs, UserLogin.ascx.cs, and UserLoginInfo.ascx.cs are their code-behind files, respectively. These pages and user controls are saved in the folder "UserControl".

Unauthorized users do not have access qualifications during the operation cycle of the system, which is the first security that the system must have. This security can be achieved by using Session detection. The specific implementation method is to first set the Session in the user login module and then detect the Session in the subsequent pages. Due to another security requirement, authorized users cannot operate beyond their authority and also need to use the Session detection function. Therefore, restricting the access of unauthorized users can be implemented in the process of preventing authorized users from the unauthorized operation. Authorized users cannot perform

unauthorized operations. This requires different treatments in the Session detection of the page. The specific implementation is as follows:

First, add the setting part of the Session to the user identification function module. As long as the currently logged-in user has passed the user identification, a data segment of user type is added to the Session, and the user type of the currently logged-in user is assigned to this data segment. The next step is to test each function page. Since each ASP.NET page has a response function page_load() when it is loaded, the Session content can be detected in this function. If the detection fails, the page that is about to be opened will be closed immediately. As for preventing unauthorized users from unauthorized operations, since each functional page is for one type of user when the currently logged-in user tries to access a functional page that does not match his user type, the session detection of the functional page will also show failed and end, which also satisfies the security need to prevent authorized users from operating beyond their authority.

4.3. Statistics of Teaching Evaluation Results.
It is an opportunity for kindergartens to make progress when the district/county PE administrative and business management departments go to preschool institutions for guidance. Figure 3 shows the results of the kindergarten teaching supervision survey. It can be seen from the table that about 15% of the kindergartens have not been supervised by the higher-level leading department once a year, and about 37% of the kindergartens have received guidance 2–3 times a year, about 22% of kindergartens get 4–5 times of guidance, and about 13% of kindergartens get supervised more than 6 times a year, and there is not much difference in administrative areas.

Educational evaluation is the main way to improve the quality of kindergarten education and for teachers to improve their educational work. The evaluation times and evaluation methods accepted by kindergartens are directly or indirectly related to the accuracy of evaluation results. As shown in Table 3, it is the proportion of each evaluation subject for preschool TQ evaluation. It can be seen from the
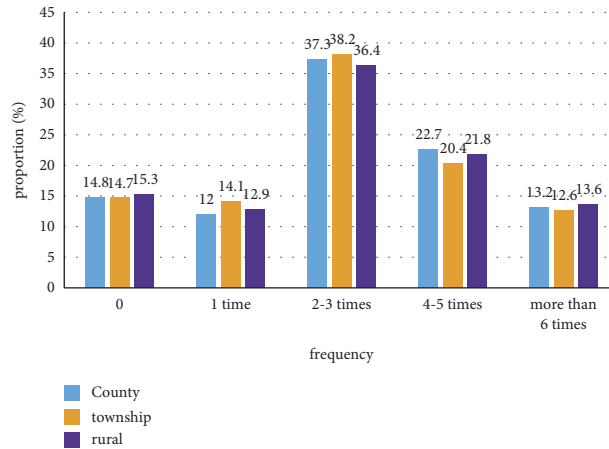
FIGURE 3: Survey results of kindergarten teaching supervision.

TABLE 3: Evaluation subjects and evaluation methods of kindergarten teachers.

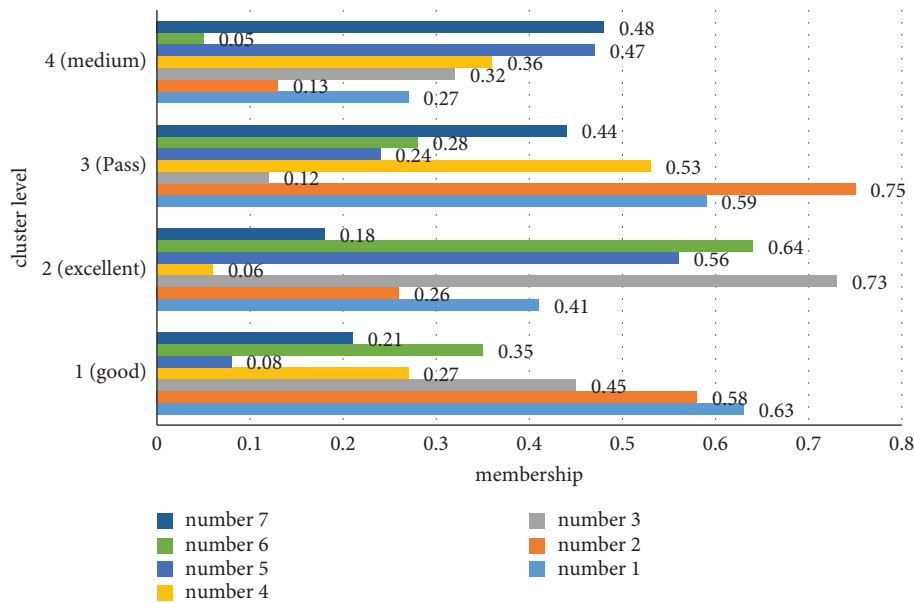| Evaluation subject	Kindergarten principal	Teacher	Parents	Other
Proportion (%)	38.6	35.4	21.3	4.7
Evaluation method	Other people's evaluation	Mutual evaluation	Self-evaluation	Other
Proportion (%)	10.9	43.2	37.5	8.4

FIGURE 4: KNN classification result.

table that in terms of PE quality teaching evaluation, it is mainly based on external teaching supervision. Teachers' evaluations accounted for 38.6%, which is still the dominant position and parents' evaluations of teachers accounted for 21.3%. When interviewing parents about the number of times teachers actively contacted themselves each semester, many parents said that kindergarten teachers contacted them almost every semester 3–4 times, it can be clearly seen from this that teachers lack communication with parents, and parents' lack of teaching supervision is also one of the reasons that affect the quality of PE. In terms of evaluation

methods, teachers' mutual evaluation and self-evaluation dominate, accounting for 43.2% and 37.5%, respectively. There are many objective factors in mutual evaluation and self-evaluation between teachers, which will affect the evaluation results. The final evaluation results of preschool TQ also have a great impact.

4.4. Evaluation Results Based on KNN. Using KNN classification, the TQ of 7 preschool teachers (numbered 1–7) was scored, and the calculation results shown in Figure 4 are

obtained. Combined with the analysis of the scores of the fuzzy comprehensive evaluation method, the scores can be divided into four categories, which are considered to be good, excellent, pass, and medium and correspond to category 1, category 2, category 3, and category 4, respectively. Taking the class with the largest membership degree of each object as its final classification, the same classification result as the system classification method can be obtained. However, the KNN classification provides more information than the system classification. For example, the maximum value of teachers No. 3, 5, and 6 is in the second category, but the membership degree of teacher No. 3 is 0.73, while that of teacher No. 4 is 0.73. The degree of membership is only 0.56. This shows that KNN classification is more scientific and reasonable than the general classification algorithm in the classification of TQ evaluation results.

5. Conclusion

With the dissemination and development of the thought of lifelong education worldwide, early childhood education is becoming more and more important. In the context of the expansion of the democratization of PE, more and more children are entering early childhood education institutions for education, which has promoted the development of education to a certain extent, but at the same time, all sectors of society have begun to pay attention to the quality of education. Because of this, the TQ evaluation system has become a new way to ensure and improve the quality of PE. Teachers, principals, and parents can log in to the system to evaluate the TQ of teachers, and the system will generate an evaluation report. From the rating, you can know how good the TQ of teachers is. Aiming at the system designed in this paper, the module access test and concurrent performance test verify that the system function has a high success rate of access, and it can better meet the concurrent use of users in the broadband network or optical fiber network environment.

Data Availability

The data underlying the results presented in the study are available within the manuscript.

Conflicts of Interest

The author declares that there are no conflicts of interest.
Authors' Contributions
The author read and approved the manuscript for submission.

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