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Design of online Mutual Evaluation system for Teachers' Teaching level based on Ant Colony clustering algorithm

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ABSTRACT. *In order to improve the quality of online mutual evaluation of teachers' teaching level and carry out online mutual evaluation of teachers' teaching level, an online mutual evaluation model of teachers' teaching level based on ant colony clustering algorithm is proposed, and an empirical analysis is carried out with statistical data. The statistical information model of teachers' teaching level online mutual evaluation is constructed. according to the mining results of teachers' teaching level online mutual evaluation information, the frequent itemsets association rules are reconstructed, the correlation dimension characteristic quantity of teachers' teaching level online mutual evaluation information is extracted, and the regular feature quantity of teacher teaching level online mutual evaluation cross-correlation information fusion is analyzed. Taking this as the constraint condition, the related information mining evaluation of teachers' teaching level online mutual evaluation is carried out, and the statistical analysis and robustness test of teachers' teaching level online mutual evaluation are carried out by using the method of statistical feature analysis. The simulation structure shows that the model has good accuracy and high confidence in online mutual evaluation of teachers' teaching level, and improves the quality of online mutual evaluation of teachers' teaching level.*

KEYWORDS*: ant colony clustering algorithm; teacher teaching; level; online mutual evaluation; system*

1. Introduction

With the advent of the 21st century, with the rapid development of science and technology, technology has entered the industry of education, and has been continuously integrated into every subject of education. Teachers no longer use traditional chalk and blackboard for teaching, but use multimedia, computer and other information equipment for teaching. This teaching mode is teachers' information teaching[1]. Teachers' information teaching provides convenience for

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the growth of children and promotes the development of school teaching activities. With the continuous progress of the reform of online mutual evaluation of teachers' teaching level, higher requirements are put forward for the quality and effect of online mutual evaluation of teachers' teaching level. In the online mutual evaluation of teachers' teaching level, it is necessary to focus on improving students' enthusiasm for teachers' teaching level learning, combined with the employment prospect of teachers' teaching level, so as to improve the teaching quality of teachers' teaching level. On-line mutual evaluation of teachers' teaching level, combined with questionnaire survey and sampling statistical analysis method, analyzes the bottleneck of teachers' teaching level teaching and promotes the reform of teachers' teaching level teaching level, which can effectively improve the quality of teachers' teaching level online mutual evaluation, in order to quantitatively evaluate teachers' teaching level online mutual evaluation and improve the systematic evaluation ability of teachers' teaching level education and teaching evaluation. Establish the online mutual evaluation method of teachers' teaching level, and carry on the empirical analysis[2].

At present, the theory of multiple intelligences is widely used to evaluate the teaching quality and students' learning effect in all kinds of schools[3]. It promotes the development of education and teaching reform. In view of the practice of online mutual evaluation reform of teachers' teaching level, this paper puts forward an online mutual evaluation model of teachers' teaching level based on ant colony clustering algorithm mining, and carries on the empirical analysis combined with statistical data. The correlation dimension characteristic quantity of teachers' teaching level online mutual evaluation information is extracted, the regular characteristic quantity of teacher teaching level online mutual evaluation cross-correlation information fusion is analyzed, and the statistical feature analysis method is used to carry on the statistical analysis and robustness test of teachers' teaching level online mutual evaluation information. Finally, the empirical test is carried out, and the conclusion of effectiveness is drawn.

2. Construction of the evaluation system of teachers' information teaching ability

2.1. Information awareness and attitude

Teachers should be able to deeply understand the importance of information teaching, and can use information technology to improve the way of teaching, so that they can integrate into their own classroom, beautify their own teaching effect, so as to improve their classroom satisfaction. Teachers should start with theoretical knowledge, increase their own theoretical literacy, cultivate their own information technology, and be a comprehensive quality talent[4].

ISSN 2522-6398 Vol. 2, Issue 8: 115-127, DOI: 10.25236/FER.2019.020816

2.2. Integration of informatization technology and teaching curriculum

Teachers should not only realize the importance of information technology, but also be able to apply information technology to their own teaching courses. Through certain reasonable teaching design and multimedia technology, teachers should be able to display their teaching content to students perfectly, so that students can realize the importance of theoretical knowledge from the visual point of view. In view of the special group of higher vocational students, teachers should pay attention to the particularity of students, in view of the teaching content should reasonably master its difficult degree, avoid the phenomenon that students are tired of learning because of the difficulty of teaching content, in addition, teachers should also pay attention to the cultivation of practical ability of higher vocational students, add some practical elements in multimedia design, so that students can realize the theoretical content from practice. Finally, teachers should pay attention to the degree of classroom activity in class, neither rigid, so that students lose interest in learning, cannot be too active, so that students turn the classroom into a classroom[5].

2.3. Implementation of informatization teaching

A good teaching design should also have a good implementation, otherwise the design will be a piece of paper, worthless, so teachers should not only aim at the classroom, carry out reasonable teaching design, but also be able to display the content of teaching design perfectly in the classroom. On the one hand, teachers need to be able to maintain classroom discipline and explain the teaching content according to the characteristics of higher vocational students. On the other hand, in order to solve the problem of imperfect configuration, a good soldier needs to have good weapons in order to give full play to his quality. Therefore, the state should introduce some investment in schools, so as to facilitate the maintenance and replacement of school equipment. In addition, schools should tilt their own teaching methods to information teaching, so as to increase the budget for the introduction of equipment. Finally, the state should set up a special technical group to develop advanced multimedia equipment, such as VR technology, so that students can make use of visual feelings to deepen the study of theoretical knowledge, so as to promote the development of teaching[6].

3. Online mutual evaluation information sampling and statistical modeling of the teacher's teaching level

3.1 Analysis of constraint parameters of online mutual evaluation of teachers' teaching level

In order to realize the analysis of online mutual evaluation of teachers' teaching level, firstly, the feature analysis model of online mutual evaluation of teachers'

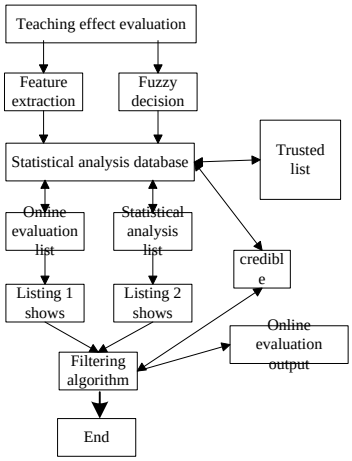
ISSN 2522-6398 Vol. 2, Issue 8: 115-127, DOI: 10.25236/FER.2019.020816

teaching level is constructed, the descriptive statistical analysis of online mutual evaluation of teachers' teaching level is carried out by using fuzzy comprehensive decision-making method, and the interactive model of big data output and statistical evaluation of teachers' teaching level is constructed, and the characteristic decomposition is carried out according to the transmission quality of information interaction. Extract the statistical characteristic quantity of teachers' teaching level online mutual evaluation, according to the teacher's teaching level teaching quality evaluation big data output information flow related information, carry on the teaching quality measurement information analysis, construct the teacher's teaching level teaching quality evaluation big data statistical characteristic analysis model, realize the teacher's teaching level online mutual evaluation big data online modeling. By using descriptive statistical analysis method, the feature sampling model of teaching output information of teachers' teaching level is constructed[7], the linear programming design between Π_{cs} and Π_{sc} is carried out, and the measurement characteristics of the sequence of online mutual evaluation information of teachers' teaching level are solved. The predicted state parameters D’t+1 and the predicted value L’t+1 of online mutual evaluation of teachers' teaching level are obtained at t 1 time. The relationship between them is satisfied.

$$D'_{t+1} = 1-(1-\lambda)\sum_{n=0}^{\infty}\Omega_{m+n+1}((n+1)b-t) \quad (1)$$

$$L'_{t+1} = (1-\lambda)\sum_{n=0}^{\infty}\Omega_{k+n}(n+1)b \quad (2)$$

In the above formula, the Basset function is represented. According to the above design, the statistical information model of online mutual evaluation of teachers' teaching level is obtained, which is used as the basis of data output to model the online mutual evaluation of teachers' teaching level[8]. The overall design framework of the designed online mutual evaluation model of teachers' teaching level is shown in figure 1.



ISSN 2522-6398 Vol. 2, Issue 8: 115-127, DOI: 10.25236/FER.2019.020816

Fig. 1 Overall design framework of the evaluation model

3.2. Statistical information model of teachers' teaching level

The online mutual evaluation model of teachers' teaching level is composed of five states, $\lambda=(X,O,A,B,\pi)$, in which X is the fuzzy state in the online mutual evaluation model of teachers' teaching level, and SDF. is the fuzzy state of the online mutual evaluation model of teachers' teaching level. $X=\{x_i,i=1,2,3\cdots,N\}$ is the observation state of the online mutual evaluation model of teachers' teaching level. The definition of $O=\{o_j,j=1,2,3\cdots,M\}$ is as follows:

$$\begin{aligned} &\max F(X)=(F_1(X),F_2(X),\ldots,F_n(X)) \\ &s.t. \quad g_j(X)\le 0 \ \ (\mathrm{j}=1,2,\ldots,\ \mathrm{p}) \\ &\quad \mathrm{h_k}(X)=0 \ \ (\mathrm{k}=1,2,\ldots,\ \mathrm{p}) \end{aligned} \tag{3}$$

According to the online mutual evaluation information of the teacher teaching level, the dynamic structure of the on-line mutual evaluation comprehensive evaluation of the teacher teaching level is as follows:

$$\begin{aligned} &C_{code} ::= (name, A, \Psi_{ckcallee}, \Psi_{ckcaller}, X_{decl}, X_{req}, X_{grnt}) \\ &C_{data} ::= (name, \Psi_{ckcallee}, \Psi_{ckcaller}, X_{decl}) \\ &\hat{C} ::= (name, \Psi_{ckcallee}, \Psi_{ckcaller}, X_{decl}, X_{req}, X_{grnt}, \{C_1,.....,C_i\}) \\ &iC ::= (name_r, C, X_{grnt}) \\ &i\hat{C} ::= (name_r, C, X_{grnt}, \{iC_1,.....,iC_i\}) \\ &E ::= x = E_1; E_2 \mid call\ iC_i \mid return\ iC_i \mid \\ &\qquad grant\ Prin\ Tgt\ P\ F \mid \\ &\qquad checkguard\ iC\ Tgt\ \Psi \end{aligned} \tag{4}$$

In the process of online mutual evaluation of teacher's teaching level, in the confidence interval, the statistical data output from the teaching level of the teacher is used as input to carry out the object-oriented self-regression analysis, and the comprehensive evaluation and statistical analysis result of the subject construction is as follows:

$$A=\left[\begin{matrix} f_{x_1} & f_{x_2} \\ g_{x_1} & g_{x_2} \end{matrix}\right]\Bigg|_{P_0(x_1^0,x_2^0)} \tag{5}$$

Combined with correlation detection and analysis method, the feature decomposition of online mutual evaluation sequence of teachers' teaching level is carried out, and the results of feature decomposition are as follows:

ISSN 2522-6398 Vol. 2, Issue 8: 115-127, DOI: 10.25236/FER.2019.020816

$$\begin{aligned} \min \quad & F(x) = (f_1(x), f_2(x), ..., f_m(x))^T \\ s.t. \quad & g_i \le 0, \qquad i = 1,2,..., q \\ & h_j = 0, \qquad j = 1,2,..., p \end{aligned} \tag{6}$$

The panel regression analysis of big data samples for online mutual evaluation of teachers' teaching level was carried out, and the output of statistical characteristic quantity robustness test for teachers' teaching level teaching quality evaluation was obtained as follows:

$$p = -(f_{x_1} + g_{x_2})\big|_{P_0(x_1^0, x_2^0)} \tag{7}$$

$$q = \det A \tag{8}$$

Obviously, the x is satisfied that the $x \sim N(Ex, En'^2)$, according to the online mutual evaluation information of the teacher teaching level, carries out frequent itemset association rule reconstruction on the online mutual evaluation data of the teacher teaching level, extracts the correlation dimension characteristic quantity of the online mutual evaluation information of the teacher teaching level, and improves the reliability of the teaching quality evaluation[10-12].

4. Optimization design of teaching quality evaluation model for teachers' teaching level

4.1. Frequent itemsets association rules reconstruction

On the basis of constructing the online mutual evaluation statistical information model of the teacher's teaching level, the on-line mutual evaluation model of the teacher's teaching level is designed, and the online mutual evaluation model of the teacher's teaching level is put forward based on the ant colony clustering algorithm[13]. The statistical sequence analysis method is used to reconstruct the teaching quality of the teaching level of the teacher, and the online estimation of the quality statistics sequence is carried out, and when the $\alpha_k \ge 0$, $\sum_{k=1}^{K} \alpha_k$ =1 is satisfied, the fuzzy correlation function of the online mutual evaluation of the teacher's teaching level and the mining of the large data correlation information is met:

$$F_Y(x; \alpha, \lambda) = 1 - \frac{1}{2^{\alpha-1}\Gamma(\alpha)} \int_{2y/\sqrt{\lambda}}^{\infty} \frac{4}{\sqrt{\lambda}\Gamma(\alpha)} w^{\alpha} K_{\alpha-1}(w) dw \tag{9}$$

ISSN 2522-6398 Vol. 2, Issue 8: 115-127, DOI: 10.25236/FER.2019.020816

In the above formula, $K_{\alpha-1}(w)$ is the statistical feature distribution function of teachers' online mutual evaluation and evaluation of teaching level. $\frac{1}{2^{\alpha-1}\Gamma(\alpha)}$ is the semantic feature component of teaching quality investigation and evaluation. The frequent itemsets association rules of teachers' teaching level online mutual evaluation data are reconstructed, and the correlation dimension features of teachers' teaching level online mutual evaluation information are extracted. In the confidence interval, through the piecewise sample test method, the statistical feature model of teachers' teaching level online mutual evaluation is described as follows:

$$\begin{cases} \dfrac{dx_1(t)}{dt} = f_{x_1}(x_1^0, x_2^0)(x_1 - x_1^0) + f_{x_2}(x_1^0, x_2^0)(x_2 - x_2^0) \\ \dfrac{dx_2(t)}{dt} = g_{x_1}(x_1^0, x_2^0)(x_1 - x_1^0) + g_{x_2}(x_1^0, x_2^0)(x_2 - x_2^0) \end{cases} \tag{10}$$

According to the statistical feature analysis, the mutual information feature quantity of the on-line mutual evaluation of the teacher's teaching level is met:

1) $\limsup_{n\to\infty} \left| f^n(x) - f^n(y) \right| > 0$, $\forall x, y \in S, x \neq y$;

2) $\liminf_{n\to\infty} \left| f^n(x) - f^n(y) \right| = 0$, $\forall x, y \in S$;

3) $\limsup_{n\to\infty} \left| f^n(x) - f^n(y) \right| > 0$, $\forall x \in S, \forall y \in P(f)$.

The statistical information model of online mutual evaluation of teachers' teaching level is constructed, and the reconstruction model of frequent itemsets association rules for the evaluation of teachers' teaching quality is described as follows:

$$\begin{aligned} \dot{\sigma}(X,t) &= C\dot{E} - C\dot{P}(t) \\ &= \mathrm{C} \cdot [\dot{e}^T \ddot{e}^T \cdots e^{(n)T}]^T - C \cdot [\dot{p}(t)^T \ddot{p}(t)^T \cdots P^{(n)}(t)^T]^T \\ &= C_n[e^{(n)} - p^{(n)}(t)] + \sum_{k=1}^{n-1} C_k[e^{(k)} - p^{(k)}(t)] \\ &= C_n[x_1^{(n)} - x_{1d}^{(n)} - p^{(n)}(t)] + \sum_{k=1}^{n-1} C_k[e^{(k)} - p^{(k)}(t)] \\ &= C_n[\dot{x}_n - x_{1d}^{(n)} - p^{(n)}(t)] + \sum_{k=1}^{n-1} C_k[e^{(k)} - p^{(k)}(t)] \\ &= C_n[f(X,t) + \Delta f(X,t) + b(X,t)u + d(t) - x_{1d}^{(n)} - p(t)^{(n)}] \\ &\quad + \sum_{k=1}^{n-1} C_k[e^{(k)} - p^{(k)}(t)] \end{aligned} \tag{11}$$

ISSN 2522-6398 Vol. 2, Issue 8: 115-127, DOI: 10.25236/FER.2019.020816

In the finite state space, the correlation dimension characteristic quantity of teachers' teaching level online mutual evaluation information is extracted, described as:

$$\begin{cases} W_{ik}(d) = \dfrac{IDF_1}{IDF_{const}} \times a(H_{ac}) \\ IDF_1 = tf_{ik}(d) \times \log(\dfrac{N}{n_k} + 0.01) \\ IDF_{const} = \sqrt{\sum_{i=1}^{n} (tf_{ik}(d))^2 \times [\log(\dfrac{N}{n_k} + 0.01)]^2} \end{cases} \tag{12}$$

According to the correlation dimension feature quantity of the extracted online mutual evaluation information of teachers' teaching level, the regular feature quantity of cross-correlation information fusion of teachers' teaching level online mutual evaluation is analyzed, and the linear prediction of teaching quality evaluation is carried out by combining gain fuzzy control method[14].

4.2. Evaluation and optimization of teaching quality in teachers' teaching level

The Bellare-Rogaway model is used to design the statistical information model of teachers' teaching level online mutual evaluation. The evaluation function is expanded as follows:

$$\sigma(X,t) = CE - CP(t) \tag{13}$$

The online mutual evaluation model of teachers' teaching level is comprehensively analyzed and scheduled, and the fusion space solution vector is obtained as follows:

$$\begin{aligned} \sigma(X,0) &= E(0) - CP(0) \\ &= C\{[e(0)^T \dot{e}(0)^T \cdots e(0)^{(n-1)T}]^T - [p(0)^T \dot{p}(0)^T \cdots p^{(n-1)}(0)^T]^T\} \\ &= 0 \end{aligned} \tag{14}$$

Under the condition of feature transfer of correlation dimension, the balance point of teaching quality evaluation is as follows:

$$w(t)(u_0, u_1) = \cos(t \mid \nabla \mid) u_0 + \frac{\sin(t \mid \nabla \mid)}{\mid \nabla \mid} u_1 \tag{15}$$

If $e_V = 0$, combined with artificial intervention method is used to model the characteristics, the expression of the output gain of $p_i(t)(i = 1, 2, 3)$, teaching quality effectiveness evaluation is as follows:

$$p_i(t) = e_i(0) + \dot{e}_i(0)t + [\frac{a_{00}}{T^2} e_i(0) + \frac{a_{01}}{T} \dot{e}_i(0)]t^2 + [\frac{a_{10}}{T^3} e_i(0) + \frac{a_{11}}{T^2} \dot{e}_i(0)]t^3 \tag{16}$$

ISSN 2522-6398 Vol. 2, Issue 8: 115-127, DOI: 10.25236/FER.2019.020816

Based on the function of Lipschitz continuous regular function, combined with cross-correlation information fusion method, the fuzzy prediction value of teaching quality evaluation is obtained:

$$\begin{aligned}
&\dot{e}_h = T_h(V_{Th}^1, e_V)h(V_{Th}^1, e_V) - T_h(V_{Th}^1)h(V_{Th}^1) \\
&\quad - T_h(V_{Th}^1, e_V)e_h - \left[T_h(V_{Th}^1, e_V) - T_h(V_{Th}^1)\right]h_1 \\
&\dot{e}_w = \phi\{T_w(V_{Th}^1, e_V)w(V_{Th}^1, e_V) - T_w(V_{Th}^1)w(V_{Th}^1) \\
&\quad - T_w(V_{Th}^1, e_V)e_w - \left[T_w(V_{Th}^1, e_V) - T_w(V_{Th}^1)\right]w_1\} \\
&C_m \frac{dv_{Th}^1}{dt} = -I_L^1 - I_{Na}^1 - I_K^1 - I_T^1 - I_{syn}^1 + I_{SM}^1 \\
&\frac{dh_1}{dt} = \frac{\left(h_{1\infty}\left(v_{Th}^1\right) - h_1\right)}{\tau_h\left(v_{Th}^1\right)} \\
&\frac{dw_1}{dt} = \frac{\left(w_{1\infty}\left(v_{Th}^1\right) - w_1\right)}{\tau_w\left(v_{Th}^1\right)}
\end{aligned} \tag{17}$$

The periodic solution of the above equations is calculated, and the fast prediction model for evaluating the teaching quality is as follows:

$$\begin{aligned}
&f(x_1, x_2) = \frac{1}{Cm}[I_{SM}^2 - I_L^2 - I_{Na}^2 - I_K^2 - I_T^2 - I_{Syn}^2 \\
&\quad - I_{SM}^1 + I_L^1 + I_{Na}^1 + I_K^1 + I_T^1 + I_{syn}^1] \\
&T_h(V_{Th}) = \frac{1}{\tau_h(V_{Th})} \\
&T_w(V_{Th}) = \frac{1}{\tau_w(V_{Th})}
\end{aligned} \tag{18}$$

If $f(x_1, x_2)$ is known, it is used as a constraint to mine and evaluate the related information of online mutual evaluation of teachers' teaching level, and the statistical feature analysis method is used to carry out the statistical analysis and robustness test of online mutual evaluation of teachers' teaching level[15].

5. Empirical analysis and test

In order to verify the performance of the model in realizing the online mutual evaluation of teachers' teaching level, empirical analysis and simulation experiments are carried out. C++ and Matlab are used in the experiment. The sampling length of the statistical data is 1024, the size of the training set is 3000, the size of the test sample set is 1000, the cycle of statistical analysis is 14 days, iterative step size 20, and the statistical cycle is 1.5. The results of descriptive statistical analysis are shown in table 1.

Table 1 Descriptive statistics results

Variable	Mean value	Std	Min	Q1
Teaching	0.456	0.432	0.142	3.436

ISSN 2522-6398 Vol. 2, Issue 8: 115-127, DOI: 10.25236/FER.2019.020816

input				
Teacher's configuration	0.335	0.346	0.046	2.435
Subject scale	0.123	0.243	0.086	0.345
Government input	0.736	0.157	0.143	4.356
Development potential of the subject	0.767	0.179	0.157	3.332
Teaching quality growth level	0.136	0.324	0.157	2.346

Taking the statistical data of Table 1 as a sample, the online mutual evaluation of teachers' teaching level is carried out, and the regression analysis value of teaching quality assessment is obtained as shown in figure 2.

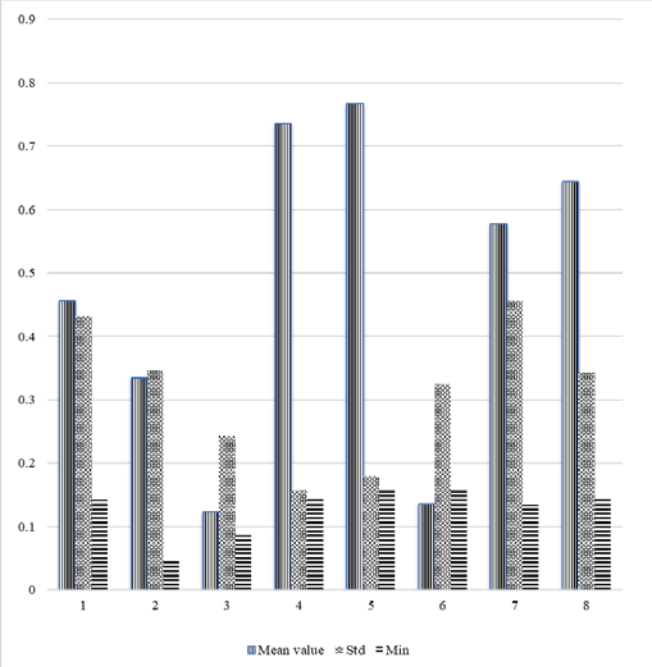


Fig. 2. Regression analysis of teaching quality assessment

ISSN 2522-6398 Vol. 2, Issue 8: 115-127, DOI: 10.25236/FER.2019.020816

Analysis Fig.2 shows that the confidence level of this paper model to carry out teaching quality evaluation is high, and it has high evaluation accuracy at the level of significance of P =0.10, and the root mean square error of quality evaluation is tested, and the contrast results are shown in Fig.3.

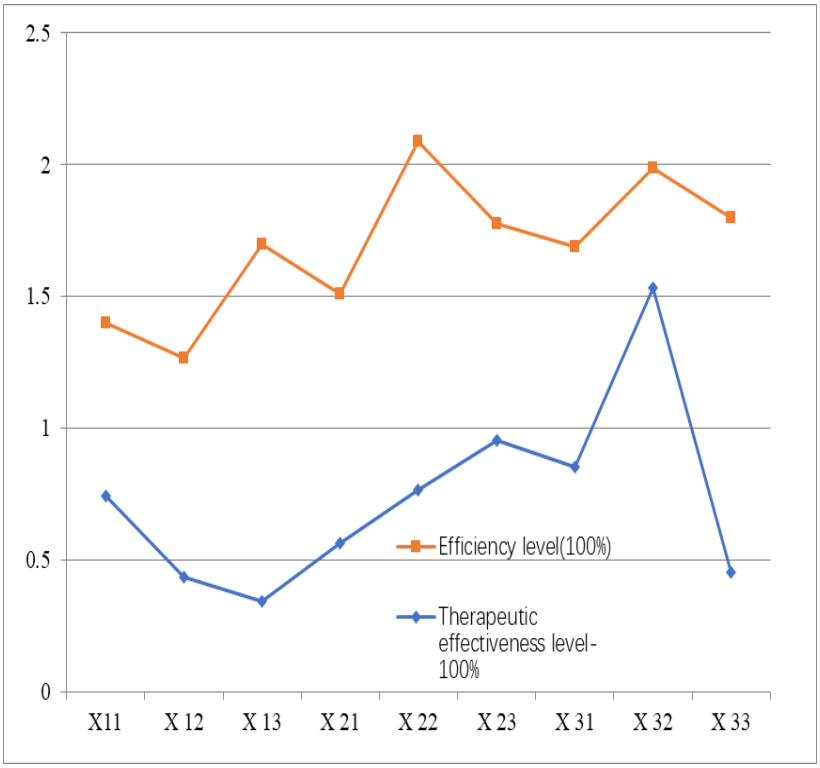


Fig.3 Error performance test

The analysis of figure 3 shows that the model has good accuracy and small error in online mutual evaluation of teachers' teaching level, which improves the quality of online mutual evaluation of teachers' teaching level.

6. Conclusions

Information teaching has gradually replaced the traditional teaching methods, so the development of information teaching ability has become the key today. We should solve the problems of information teaching from four aspects of information teaching ability, including the low comprehensive quality of teachers, unreasonable teacher design and imperfect equipment. In order to construct the evaluation system of information teaching ability. In this paper, an online mutual evaluation model of teachers' teaching level based on ant colony clustering algorithm is proposed, and

ISSN 2522-6398 Vol. 2, Issue 8: 115-127, DOI: 10.25236/FER.2019.020816

the empirical analysis is carried out with statistical data. The statistical information model of online mutual evaluation of teachers' teaching level is constructed. according to the information of online mutual evaluation of teachers' teaching level, the association rules of frequent itemsets are reconstructed, the characteristic quantities of correlation dimension of online mutual evaluation information of teachers' teaching level are extracted, and the regular characteristic quantities of fusion of cross-related information of online mutual evaluation of teachers' teaching level are analyzed. Taking this as the constraint condition, the related information mining evaluation of teachers' teaching level online mutual evaluation is carried out, and the statistical analysis and robustness test of teachers' teaching level online mutual evaluation are carried out by using the method of statistical feature analysis. In this paper, the confidence level of teaching quality evaluation is high and the error is small, which provides a reference for the improvement of teaching quality and teaching reform.

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