Design of Mathematics Teaching Quality Evaluation System Based on Grey Correlation Analysis

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Abstract
The current teaching quality evaluation method cannot meet the needs of college mathematics teaching quality evaluation, so a more efficient teaching quality evaluation system is in need. Based on teaching quality evaluation, this paper develops the teaching quality evaluation system, then uses hierarchical analysis and gray correlation analysis to obtain the evaluation index and evaluation index weight, and finally proposes an efficient teaching quality evaluation system with higher accuracy. The test results also show that the mathematics teaching quality evaluation system based on grey correlation analysis has higher accuracy and higher evaluation efficiency than other systems. Of course, in the subsequent research, further research should be done on the efficiency improvement of the teaching quality evaluation system.

Keywords: *Grey correlation analysis; quality evaluation system; quality evaluation model*

1 INTRODUCTION

It is of great importance to evaluate the teachers' teaching results according to the teaching quality evaluation, because it can help to improve the quality of mathematics teaching. A lot of scholars have conducted in-depth research in the field of mathematics teaching quality evaluation. Taking advantage of brain wave feedback principle, a teaching evaluation system was formed [1]. Another teaching system was formed according to the subject research [2], but the effect is not very ideal The accuracy of the former evaluation results is not high, while the latter evaluation efficiency is too low. In order to overcome the above problems, it is necessary to develop and design a mathematics teaching quality evaluation system based on gray correlation analysis [3]. The system can not only ensure the accuracy of evaluation results, improve the evaluation efficiency of evaluation results [4] but also fully meet the needs of mathematics teaching quality evaluation in universities [5].

2 MATHEMATICS TEACHING QUALITY EVALUATION SYSTEM

The purpose of mathematics teaching quality evaluation is to improve the quality of mathematics teaching and enhance the teaching ability of mathematics teachers. There are five main roles in the mathematics teaching quality evaluation system, namely, students, teachers, department leaders, supervisors and system administrators. Its functions are shown below [17].

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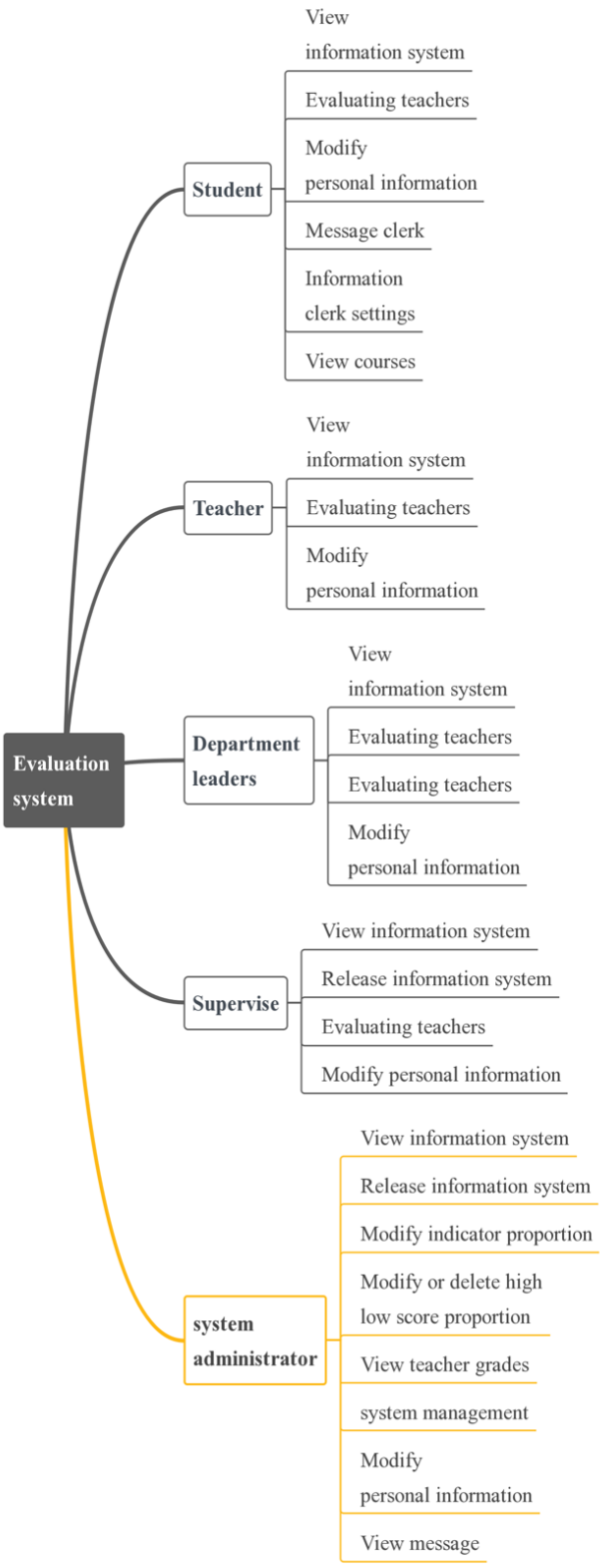

Figure 1. Mathematics teaching quality evaluation system

3 A MATHEMATICS TEACHING QUALITY EVALUATION SYSTEM BASED ON GREY ASSOCIATION ANALYSIS

In order to evaluate the teaching quality of colleges and universities, [7] it is first necessary to analyze the teaching content and teaching methods, and also set up clear evaluation indicators, and evaluate the teaching situation according to the clear evaluation indicators. Suppose that X1 is the teachers 'teaching attitude, X is the evaluation index of mathematics teaching quality, and X2, X3 and X4 are the teachers' teaching behavior, [6] teaching methods and teaching results respectively [8]. Then the evaluation index of teaching quality are:

$$X = X_1, X_2, X_3, X_4 \tag{1}$$

To use the back propagation algorithm, it is necessary to use the gradient search technology to identify the mathematics teaching quality evaluation system [9]. Suppose that uij is the weight coefficient, and the hidden layer of the network is:

$$net_i = \sum_j U_{ij} X \tag{2}$$

Assuming that a(x) is the incentive function of the mathematics teaching quality evaluation system, [10] the calculation method is as follows:

$$a(x) = \frac{1-e^{-x}}{1+e^{-x}} \tag{3}$$

Suppose y is the output variable, Wi is the value range of the weight coefficient, and the network output is:

$$y = \sum_i W_i O_i \tag{4}$$

The criterion function is:

$$E = \frac{y^2}{2} = \frac{e^2}{2} \tag{5}$$

Assuming that the η learning correction rate, the weight coefficient learning law is:

$$\begin{cases} \triangle W_i = -\eta \frac{\partial E}{\partial \omega_i} = O_i \\ \triangle U_{ij} = \eta a^1(net_i) W_i X \end{cases} \tag{6}$$

On this basis, the evaluation system of mathematics teaching quality is constructed, [11] and the weight value of the evaluation index is determined by introducing the AHP method, and then the evaluation vector is obtained. Gray correlation degree analysis method can effectively determine the quality of vectors and summarize the ranking of teachers' teaching quality [12]. The teaching quality evaluation model is shown as follows.

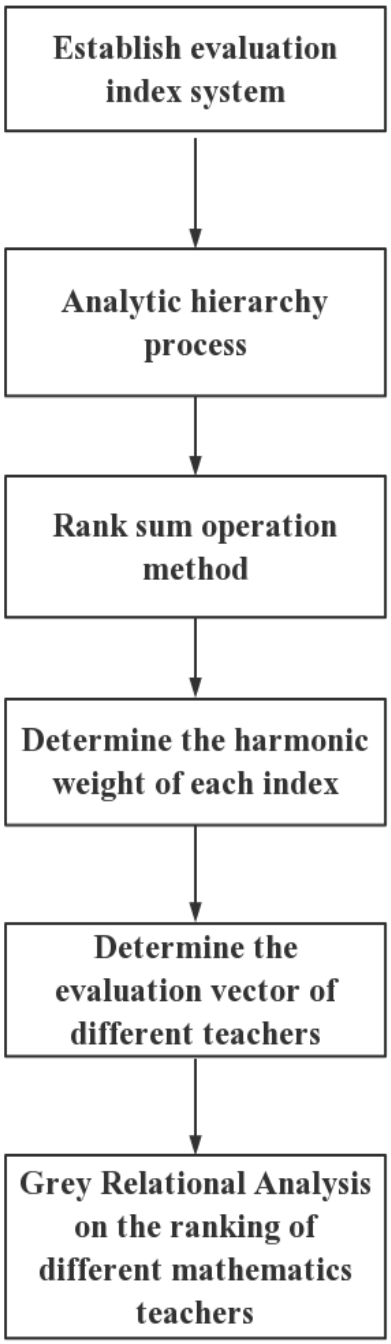

Figure 2: A Mathematics Teaching Quality Evaluation Model Based on Grey Association Analysis

Calculate the importance of each index in the evaluation system to obtain the "rank" of the index [13]. Suppose it is the weight corresponding to the ω_i th indicator, the rank sum of the R_i th indicator,[14] M is the total number of evaluation indicators, n is the total number of judges, [15] and the corresponding weight of indicators is as follows:

$$\omega_i = \frac{2[(m+1)n - R_i]}{mn(m+1)} \tag{7}$$

In order to test the evaluation index, you need to apply the following formula:

$$x^2 = \frac{\sum R_i^2 - (\sum R_I)/m}{\frac{1}{12}mn(m=n)} \quad (8)$$

Compare the evaluation indicators obtained, and the judgment matrix is constructed according to the index, and the maximum value and feature vector are obtained, and the maximum value and feature vector are normalized to obtain the weight value. Assuming that CIn is the average random consistency index, and RIn is the RIn value corresponding to each index, we should take the test and judgment matrix:

$$CR = CIn/RIn \quad (9)$$

In addition, the weight matrix can be obtained by obtaining the influence vectors in different factor layers and normalizing the influence vectors:

$$\omega_i = \frac{2}{1/\omega_i + 1/u_i} \quad (10)$$

Where, ui is the weight confirmed after the hierarchical analysis.

Get the evaluation vector according to the weight value, and by using the gray correlation degree analysis method to judge the vector, the teaching quality ranking of teachers can be obtained [16].

4 SIMULATION EXPERIMENTS

On the MATLAB platform, the mathematics teaching quality evaluation system based on gray correlation analysis is tested, and the accuracy is taken as the test index, which is%. The experimental results are as follows:

Table 1: Comparison of the accuracy of the mathematics teaching quality evaluation results in different systems

Number of experiments / time	Accuracy of mathematics teaching quality evaluation results /%		
	Proposed system	Document [4] system	Document [5] system
5	98.0	96.1	94.2
10	97.2	93.4	91.8
15	98.1	92.5	86.4
20	99.5	90.7	83.5
25	98.4	87.6	80.9

By analyzing the experimental data listed above and comparing the three systems, we can find that the accuracy of the present system is higher, because the present system uses the gray correlation analysis method, which effectively improves the accuracy of the evaluation results. In order to further verify the effectiveness of this system, the evaluation efficiency of these three systems should be compared. The experimental results are as follows:

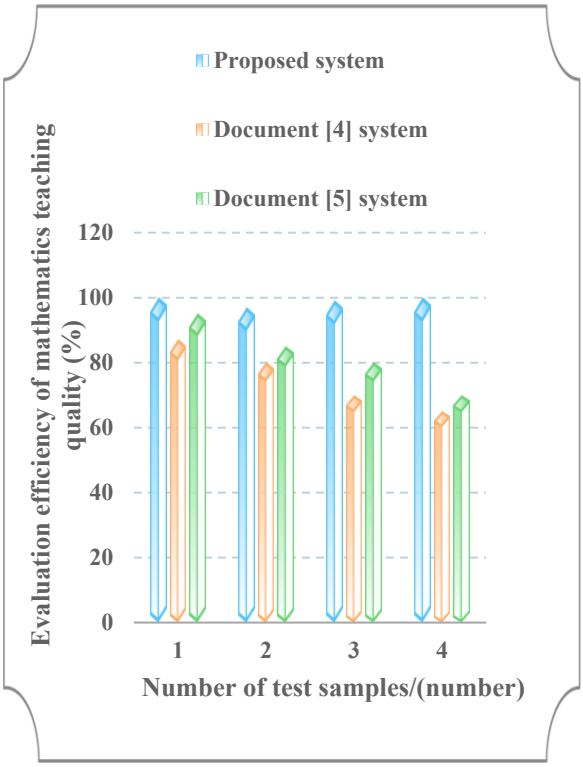

Figure 3: System effectiveness comparison bar chart

According to the analysis of the experimental data in the above figure, we can see that the system is the most efficient and can give the results of mathematics teaching quality evaluation in the shortest time.

5 CONCLUSION

The mathematics teaching quality evaluation system based on grey correlation analysis is proposed based on the current needs of teaching evaluation in colleges and universities. Compared, it has greater advantages than the teaching evaluation system based on brain wave feedback principle and intersubjectivity, such as higher accuracy and efficiency. However, this does not mean that the teaching quality evaluation system has been well developed. In the following research, further optimization needs to improve the evaluation efficiency.

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