

The Design and Development of Teacher Evaluation System in Higher Vocational Colleges Based on Data Analysis

Wei Li^{1*}, Yi Sun²
{61805038@qq.com¹, 251625789@qq.com²}

Shandong Institute of Commerce and Technology, Jinan, Shandong Province, 205103

Abstract. In this paper, javaweb technology is used to develop the teacher evaluation and analysis system. The Java integrated development tool is IntelliJ IDEA 2020, the project management tool Maven 3.5.0, and the database is MySQL 7.8. The framework is developed as springboot framework. In the aspect of system data analysis, AHP method is used and related algorithms are designed to analyze the influencing factors of teacher evaluation and build a system to judge teacher evaluation in a scientific way.

Keywords: Hadoop; Big data; Analytic hierarchy process; springboot; evaluation system

1 Introduction

Recently, China has paid more and more attention to the education of higher vocational colleges, so the innovation of higher vocational education mode in the current era has been put forward with new requirements. Among them, the routine educational work of evaluating teachers has also been continuously expanded and deepened. But many higher vocational colleges still adopt manual evaluation mechanism in teacher evaluation system, so it is difficult to make the most accurate and comprehensive evaluation of teaching quality. We should find ways to solve the current predicament. [1] The emergence of big data has undoubtedly greatly promoted the development of educational informatization. With the development of big data technology, more and more information management systems in colleges and universities are not poor, but there is a lack of relevant platforms to reasonably evaluate teachers' ability. And the data forms of different systems have low data value due to clutter. [2] The evaluation system of teachers in higher vocational colleges based on big data can solve the above problems.

2 Key technologies

2.1 Hadoop

The hadoop platform developed by Apache community is a storage and processing platform based on hardware cluster and distributed deployment. At the same time, hadoop is a standard for computing work in the big data industry. These three systems are built around three core components. HDFS combined with Hbase, yarn combined with zookeeper, mapreduce combined with memory computing spark and directed graph processing Tez, etc. Now,

hadoop cluster is basically mature and stable. [3] The Hadoop can make full use of various computing models and data mining technologies to form a complete ecosystem of big data storage, computing, processing and presentation.

2.2 Vue

The javaweb system designed in this paper needs a JavaScript framework, and the software used in this paper is vue.js The vue is an old progressive JavaScript framework released as early as 2014, and it adopts a bottom-up incremental development method, and the front-end design software adopts a special MVVM model. [4]

2.3 Hierarchical analysis method

The AHP method is called The analytic hierarchy process and translated as construction hierarchy analysis in Chinese. The method was obtained from Professor Thomas L. Saaty, USA. This analysis method is applied to the analysis of decision-making problems with multiple evaluation criteria and uncertain circumstances. The decision makers can use the AHP method to determine the priority and quantify the criteria according to the importance of the criteria and the decision variables, so as to scientifically calculate the best decision-making way. AHP the characteristic of the is can use less and quantitative information to the decision thinking process of mathematical calculation, in the process of decision makers need to make the nature of the problem influencing factors and their internal relationship in-depth analysis, AHP hierarchy analysis can be more objective, guidelines or no structure characteristics of simplified processing. Therefore, this paper uses AHP hierarchical analysis to conduct comprehensive evaluation of teachers. The calculation implementation code of this function is shown in Figure 1.

```

>>%{AHP
disp(This matrix consistency is acceptable );
A=input(A=' ');
[n, n] = size(A);
x = ones(n, 100);
y = ones(n, 100);
m = zeros(1, 100);
m(1) = max(x(:,1));
y(:,1)=x(:, 1);
x(:,2) = A*V(:,1);
m(2) = max(x(:,2));
yV(:,2)= x(:, 2)/m(2);
p=0.0001;
k=abs(m(2)-m(1));

while k>p
i=i+1;
x(:,i)= A*vV(:,i-1);
m(i) = max(:,i);
yV(:,i) = x(:,i)/m(i);
k=abs(m(i)-m(i-1));
end
a = sum(y(:, :),1);
w = y(:,i)/t = m(i);disp(w);
%consistency check
CI= (t-n)/(n-1);
CR = CI/RI(n);
if CR<0.10
disp(This matrix consistency is acceptable)

```

Fig. 1. Hierarchical analysis method implementation code

3 Development process

According to the application requirements of the above-mentioned related application technologies, the configuration and deployment of the development environment of teachers' assessment and evaluation system in higher vocational colleges are completed. The system development environment is arranged in two aspects. The server computer of Hadoop cluster adopts linux CentOS 6.7(x86_64) version of linux, and a hadoop 2.7 big data cluster composed of five node servers is established. [5] For the development environment of JavaWeb application, Apache Tomcat 9.0 is selected as the Web server, IntelliJ IDEA 2020 as the Java integrated development tool, Maven 3.5.0 as the project management tool and MySQL 7.8 as the database. The front-end development tool is vue.js, and the back-end development framework is springboot framework. [6]

4 Function realization

In this system, the teacher evaluation method is AHP, which uses JAVA language to realize logic. In this part, the concrete implementation steps of AHP method will be elaborated in detail. Based on the in-depth analysis of teachers' characteristics, this paper concludes that the main points of teachers' evaluation are teachers' evaluation of first-level indicators A, second-level indicators of teaching attitude B1, teaching content B2, teaching method B3 and teaching

effect B4. The three-level indicators include 10 indicators, such as serious attitude, skilled lecture content and vivid language. [7] B1 and B2 each have three indicators, B3 and B4 each have two indicators. Firstly, the judgment matrix is established, and the consistency of the matrix is checked. The specific matrix is shown in Table 1. According to the data, this paper constructs the judgment matrix of four secondary indexes B1, B2, B3 and B4. In the matrix, the secondary indicators compare their relative importance pairwise, thus constructing the matrix.[8]

Table 1. Standard matrix values(source:originate)

A	B1	B2	B3	B4
B1	1	2	4	2
B2	1/2	1	2	3
B3	1/4	1/3	1	1
B4	1/4	1/4	1/3	2

After building a good evaluation system, it is necessary to build a judgment matrix. The factors at the same level are compared with the criteria on the upper level, and the factors in the series are compared at the same level. For example, in this paper, the target layer A is compared with the criterion layer B, and the criterion layer B is compared with the first-level index layer C, etc. According to the result of the matrix, judge the relative importance of the element to the element at the next higher level. Based on the matrix results, the relative weights under different criteria can be calculated. Such as the formula for the geometric average of each row in the matrix is shown in Formula 1. [9]

$$\bar{w}_i = n \sqrt[n]{\prod_{j=1}^n a_{ij}}, i = 1, 2, 3, \dots, n \quad (1)$$

And then, the relative weight of each index element can be obtained by normalization calculation, which is also the approximate value of the required feature vector. During this process, the maximum eigenvalue of the established index matrix can also be calculated. The calculation formula is shown in Formula 2.

$$\lambda_{\max} = \sum_{i=1}^n \frac{(AW)_i}{nw_i} \quad (2)$$

For matrix A in this paper, the maximum eigenvalue calculated is. After calculating the maximum eigenvalues and eigenvectors of the judgment matrix, it is necessary to check the consistency of weights and combinations, and sort the test results. Besides checking the eigenvector and value corresponding to λ_{\max} , it is also necessary to calculate the consistent ratio index. When the index value $c.r < 0.1$, it is proved that the system can meet the requirements. The key parameter of consistency test is C.I. The formula of C.I is $C.I = (\lambda_{\max} - n)/(n-1)$, and the ratio is $C.R = \frac{C.I}{(R.I)C.I} = 0.0029 < 0.1$, which means that the consistency of system calculation can pass the consistency test. In addition to the judgment of secondary indicators, the judgment matrix and consistency test of more subdivided tertiary indicators are needed. Similarly, the weight of the third-level index can be calculated as. Therefore, we randomly selected a teacher's score for analysis. Teacher A's scores were 83, 100, 73, 80, 85, 90, 100, 87,

80 and 100, and the comprehensive evaluation score calculated according to the AHP system was 86.382. [10]

The indicators in this paper provide data visualization services, such as teacher A's second-level indicators, teaching attitude B1, teaching content B2, teaching method B3 and teaching effect B4. After calculating the scores, you can choose the visualization form to show them, as shown in Figure 2, which shows the radar chart of the scores of each score and the proportion of positive evaluation, in which teaching attitude B1=86.65, teaching content B2=92.36, teaching method B3=88.93 and teaching effect B4=92.45, and the praise score is 97.63.

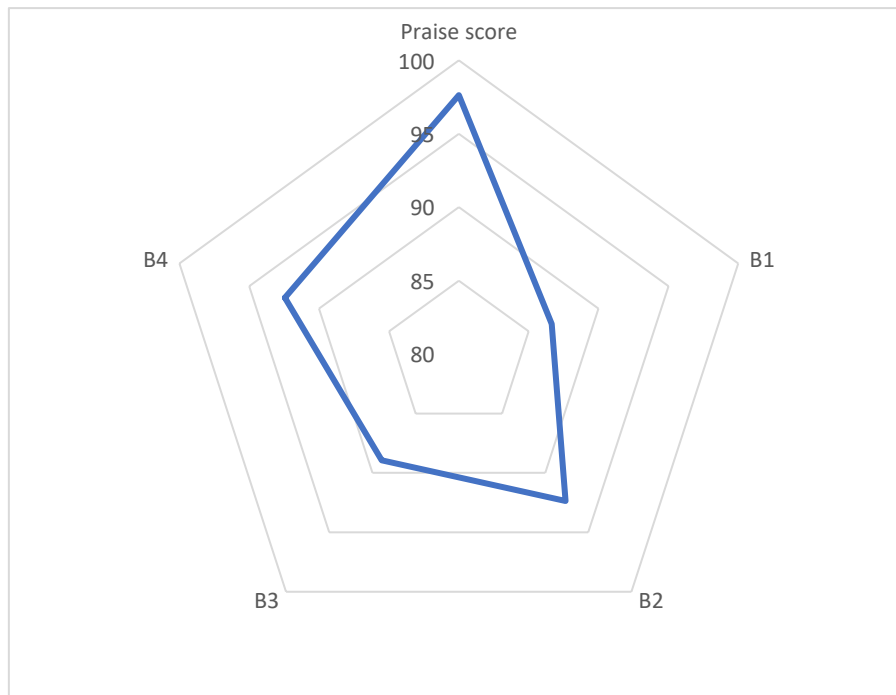


Fig. 2. Radar chart of scoring situation (source: originate)

5 Conclusion

In order to further deepen the construction of digital campus and promote the informatization process of colleges and universities, this paper studies the design and implementation of teacher evaluation system in higher vocational colleges. The related research of teacher evaluation system is beneficial to the construction of colleges and universities, and can effectively enhance the core competitiveness of teachers' teaching level, thus promoting the further development of China's education. Although this paper has made some achievements in the establishment of teacher evaluation system, it is still different from the real intelligent teacher evaluation system. In the follow-up, we will continue to improve the research content, develop a more complete teacher evaluation system, increase the research of data mining

algorithm, and try to combine artificial intelligence technology, so as to achieve a better effect of intelligent evaluation of teachers' ability and improve the level of campus informatization.

Acknowledgments. The Department of Education of Shandong Province 2021 the research and establishment project of the reform of vocational education and teaching in Shandong province.

Project number: 2021232

Title of the project: The construction and practice research of "6 + X" evaluation system in higher vocational colleges based on teachers' professional development

References

- [1] Tang Hongling, Qiu Yun.The Evaluation of Teaching Quality of Higher Vocational Teachers and Analysis of Influencing Factors.Chinese Foreign Entrepreneurs.2020.07
- [2] Li Qing, Zhao Huanhuan.The Research on Evaluation Index System of Teachers' Data Literacy.e-Education Research.2018. 10
- [3] Zhao Shuihong.The Application Research of Data Mining Technology in the Evaluation System of Secondary Vocational Teachers.Zhengzhou University.2018.10
- [4] Yang Lingzhi.The Application Research of Data Mining Technology in Higher Vocational Teacher Evaluation System.Yanshan University.2017.05
- [5] Li Huayong.Research on Teacher Evaluation Index System Based on Big Data.University governance.2021.02
- [6] Zhuang Yao.Research on the Design of Comprehensive Evaluation Index System for Primary and Secondary School Teachers.Qufu Normal University.2019.06
- [7] Zhang Weiguo, Chen Haiyan.The Research and Analysis of Big Data in Multi-evaluation System of Teachers' Teaching Quality in Higher Vocational Colleges.Modern Computer.2016.18
- [8] Deng Renfeng.The Research on the Construction Scheme of Higher Vocational Teachers' Ability Evaluation System Based on Big Data.Computer Knowledge and Technology.2021.01
- [9] Shi Peixin.Research on the Ability Model and Evaluation of University Teachers Based on Educational Big Data.Central China Normal University.2020.05
- [10] Cao Yusong, Zeng Xianquan.The Research on Teaching Evaluation Method of University Teachers Based on AHP.Journal of Xuchang University.2020.09