



Evaluation Method of Higher Vocational Online Education Effect Based on Data Mining Algorithm

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Abstract. Conventional online education effect evaluation methods in higher vocational education mainly use the random subjective evaluation framework to obtain evaluation factors, which is vulnerable to the impact of micro personalized differences, resulting in low comprehensive evaluation indicators of education effect. Therefore, a new online education effect evaluation method in higher vocational education needs to be designed based on data mining algorithms. That is to say, the online education effect evaluation system is determined, the online education effect evaluation model of higher vocational education is constructed based on the data mining algorithm. The case analysis results show that the designed evaluation method for online education effect of higher vocational education has good evaluation effect, high comprehensive evaluation index, reliability and certain application value, and has made certain contributions to the follow-up optimization and reform of online education of higher vocational education.

Keywords: Data Mining Algorithm · Vocational School · On-line · Education · Effect Evaluation

1 Introduction

Education is entering the era of “Internet+”, with more emphasis on the cultivation of skilled and application-oriented talents [1], which puts forward higher requirements for the talent education model of higher vocational colleges. The precision teaching mode is to improve the traditional teaching method [2] with the help of advanced multimedia equipment and network technology, reasonably integrate rich teaching resources, and push different teaching resources to different students through the precise positioning of different student groups [3], so as to truly realize the full sharing of teaching resources. The precise teaching mode breaks through the time and space constraints of the traditional teaching mode [4], supports teachers to carry out various teaching activities online, opens up new channels for students’ learning after class, and also enriches the ways of communication and interaction between teachers and students [5], creates an independent and relaxed learning environment more suitable for contemporary college

students, and effectively stimulates students' enthusiasm and interest in learning, A "interactive" teaching mode [6] with efficient interaction between teachers and students has been established.

For a long time, in the teaching evaluation system of higher vocational education, the evaluation of students' learning effect mainly adopts summative evaluation, that is, after a certain stage of teaching activities in the curriculum, teachers adopt the "generic" evaluation scheme [7], and finally give quantitative evaluation results, ignoring the individual differences of students, so it is difficult to teach students in accordance with their aptitude. The talent training goal of higher vocational colleges is to provide highly skilled talents [8] for the society. However, many skills cannot pass several examinations or show accurate quantitative results. If we equate the examination results with the teaching effect evaluation, we can judge that the learning achievements of vocational college students by the quantitative results ignore the differences of students and the actual needs of society for each post [9]. This teaching effect evaluation model has greatly affected the talent cultivation effect of vocational colleges.

The traditional teaching effect evaluation model mainly includes the forms of on-site supervision, student evaluation, and teaching materials inspection. Teachers' teaching objectives, teaching strategies, teaching implementation, and teaching evaluation run through the whole process of teaching activities [10]. Limited by time, manpower, and other factors, it is difficult for schools to fully understand the whole process of teachers' teaching. Therefore, it is difficult to make an objective and fair evaluation of each teacher's teaching effect. This traditional teaching effect evaluation model has a certain randomness and subjectivity. It focuses on the macro "face" assessment and ignores the micro personalized differences, which can easily reduce students' enthusiasm for learning, also restrict the improvement of teaching quality, and can not achieve the talent training goal of higher vocational colleges to provide highly skilled talents for society and industry. In order to solve the existing problem of education effect evaluation and improve the quality of online education in higher vocational education, this paper designs an effective evaluation method of online education effect in higher vocational education based on data mining algorithm.

2 Design of Online Education Effect Evaluation Method for Higher Vocational Education Based on Data Mining Algorithm

2.1 Determine Online Education Effect Evaluation System

Classroom teaching evaluation is to use mathematical modeling methods to interpret data or materials on a quantitative basis, or to conduct empirical evaluation on a quantitative basis to distinguish between high and low grades. Generally speaking, the rating scale is a standardized scale for evaluating classroom teaching behavior. In this paper, numerical scale method is used to design [11]. The advantage of this scale is that it is easy to form and quantify, and it is the most frequently used scale among all evaluation scales. The evaluation scale mainly focuses on the evaluation of teachers' teaching process. Generally, the teaching process is divided into several indicators. Each level indicator is divided into thousands of level two indicators, and some even have three indicators [12].

Each level indicator is described and graded. Users of the evaluation scale for classroom teaching effect evaluation include teachers, students and administrators. According to the above basic principles, this paper has built an online education effect evaluation system, as shown in Fig. 1 below.

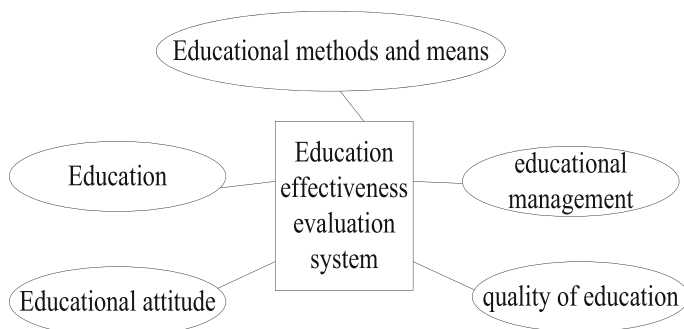


Fig. 1. Online education effect evaluation system

It can be seen from Fig. 1 that the hierarchical structure of teaching effect is to decompose complex problems into various components of elements, and divide these elements into several groups according to different attributes to form different levels. The elements at the same level, as criteria, dominate some elements at the next level, while they are also dominated by elements at the upper level. This dominance relationship from top to bottom forms a hierarchy. The top level usually has only one element, which is usually the predetermined goal or ideal result of the analysis problem. The middle level is generally the criteria and sub criteria level. The lowest level includes the decision-making scheme [13]. The governing relationship of elements between levels is not necessarily complete, that is, such elements can exist, which do not dominate all elements of the next level. Moreover, the number of layers is related to the complexity of the problem and the level of detail needed to be analyzed. There are generally no more than 9 elements in each level, because one level contains too many elements, which will make it difficult to compare and judge pairs. A good hierarchy is extremely important for solving problems. Hierarchical structure is based on the decision-makers' comprehensive and in-depth understanding of the problems they face. If they are hesitant about the division of levels and the determination of the dominant relationship between levels, it is better to re analyze the problem and clarify the relationship between the various parts of the problem to ensure that a reasonable.

The most basic form of the hierarchy model is a tree with one node connected to several nodes. In the hierarchy model, the node of the upper layer is a variable, which is determined by the variable of the lower layer. According to the actual situation of vocational colleges, this paper analyzes and decides the final evaluation indicators based on the situation of our college through experienced teachers, expert group members, leaders of teaching management, and members of the teaching supervision group. The evaluation indicators include five parts: teaching methods and means, teaching situation, teaching attitude, teaching management, and teaching quality.

1. Evaluate teaching methods and means in accordance with the school's teaching policies, reflecting the integration of theory with practice in teaching. In teaching evaluation, attention should be paid to whether teachers' teaching methods and means can be close to reality, and the combination of theory and practice should be emphasized. Flexible and diverse teaching methods can stimulate students' interest in learning and improve teaching effectiveness [14]. The interaction between teachers and students in teaching, based on the student-centered teaching principle, expands the scope of knowledge, better provides employment for students, and cultivates sustainable skilled talents for society.
2. Teaching situation evaluation is the evaluation of a teacher's teaching situation. The evaluation factors include whether the curriculum outline meets the requirements of the curriculum system, and whether the teaching objectives and content of the course are reasonable. Meanwhile, considering that students come from all over the country, whether Mandarin can be used for teaching is an important factor to ensure that students can understand and participate in the classroom. The rectification of teaching materials is also a part of the evaluation of teaching situations. Based on the actual situation, textbooks are compiled to better adapt to teaching characteristics and make the teaching content conform to the principles of students' sufficiency and applicability.
3. The main evaluation factors of teaching attitude include whether the teacher carefully prepares lessons before teaching, the preparation of teaching aids, the rigor of teaching attitude, the clarity of teaching content, and the moral cultivation and exemplary role of the teacher. Teachers should demonstrate a positive attitude during the teaching process, guide students to actively participate, stimulate their enthusiasm for learning, and set an example to become students' role models.
4. The evaluation of teaching management mainly includes classroom discipline management, strict requirements for student management, and after-school tutoring. Teachers should have good classroom management skills to ensure that students can listen quietly and abide by discipline. In addition, teachers should also provide after-school guidance, including homework guidance, practical training guidance, practical operation guidance, mathematical modelling guidance, etc., to help students consolidate their knowledge and solve problems.
5. Teaching quality evaluation is an overall evaluation based on teaching quality, mainly including students' learning situation, ability development, learning outcomes (including theory and practice), and students' preferences for courses. The teacher's teaching effect is good, and students naturally enjoy this course and are willing to work hard. This way, students' learning situation will improve, their grades will also improve, and their abilities will also be enhanced.

In summary, the evaluation of online education in higher vocational education should comprehensively consider multiple factors such as teaching methods, teaching contexts, teaching attitudes, teaching management, and teaching quality, in order to comprehensively evaluate the effectiveness and quality of online education and provide effective guidance and support for the sustainable development of higher vocational education.

2.2 Building the Evaluation Model of Online Education Effect in Higher Vocational Education Based on Data Mining Algorithm

The data mining education effect evaluation model built in this paper belongs to the gray relational model, so it needs to be processed: dimensionless processing. Due to the difference between the dimension and value of the measurement data, the data of each index cannot be compared, so dimensionless processing must be used to eliminate the dimension. In this paper, the range method is used for dimensionless processing. Calculation of correlation coefficient of comparison series and reference series. Calculate the correlation degree [15]. The traditional calculation formula of correlation degree is to calculate the average value of correlation coefficient, which does not fully reflect the importance of each index in the overall index evaluation system, resulting in inaccurate results. Therefore, this paper multiplies the correlation coefficient of each index by the weight, and adds them to obtain the final correlation degree r_k , as shown in (1) below.

$$r_k = \sum_{i=1}^m \zeta_k \omega_k \quad (1)$$

In formula (1), ζ_k Represents the correlation coefficient, ω_k Representing the evaluation weight, in order to further improve the evaluation accuracy of the university teaching quality evaluation model, it is necessary to build an effective evaluation system before designing the university teaching quality evaluation model. Firstly, according to the actual teaching quality of colleges and universities, the informatization evaluation dimension is selected to determine the relevant index types of the evaluation index system; Secondly, in order to ensure the operability of indicators, this paper divides the specific factors that affect the teaching quality of colleges and universities, and constructs indicator groups, as shown in Fig. 2 below.

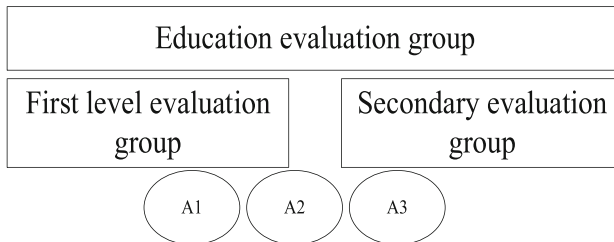


Fig. 2. Schematic Diagram of Indicator Group

It can be seen from Fig. 2 that the specific scope of teaching quality evaluation can be judged from Fig. 1, which effectively improves the accuracy of teaching quality evaluation in colleges and universities [16].

In this paper, data mining technology is used to design an algorithm for evaluating the teaching quality of colleges and universities. This algorithm can mine data rules according to the identification relationship between various data, and judge the degree

of its impact on teaching quality S , as shown in (2) below.

$$S = \frac{\sqrt{D_A - (D_B + E)}}{V^2} \quad (2)$$

In formula (2), D_A Represents the value of comprehensive influencing factors, D_B Represents the value of primary influencing factors, E Represent the weight of teaching quality information, V Represents the judgment coefficient.

When applying the data mining algorithm to complete the analysis of evaluation factors, we need to pay attention to the calculation changes in different stages. In data mining and data preparation, we must compare with the real college teaching quality data to achieve data interaction and ensure the effectiveness of mining information. Different feature units may appear when using the above algorithm for decision-making. In order to ensure the optimization of decision-making [17], the model designed in this paper combines CR theory to optimize the model. The designed decision-making model can be used Charnes Cooper transformation. At this time, the expression model obtained is optimal, and the expression model can be used for decision-making to ensure the optimization of decision-making results. Correlation evaluation error factor at this time e As shown in (3) below.

$$e = \frac{1}{g} \sqrt{f} \quad (3)$$

In formula (3), g Represents the grey relational evaluation index, f It represents the actual correlation degree. This formula can effectively calculate the gray correlation value of each evaluation factor, and compare the relevant evaluation factors inside the model with the actual gray correlation value. If the comparison value is higher than 1.00, it proves that there is an error factor. Otherwise, it proves that there is no error factor, which can achieve effective evaluation. At this time, the online education effect data mining evaluation model is built K As shown in (4) below.

$$K = \frac{\Delta y}{\Delta x} - \sqrt{\frac{\Delta x}{\Delta y}} \quad (4)$$

Formula (4) Total, Δx Represents the output value of teaching quality, Δy It represents the comprehensive income of teaching quality. When applying the evaluation model to evaluate, we need to pay attention to the comprehensive input, that is, we need to bring all the factors that affect the decision-making of teaching quality evaluation into the overall evaluation, or treat the evaluation process as a decision-making whole, so as to ensure that the input of each internal weight is consistent with the decision-making amount, and improve the comprehensive evaluation level of the model. It is found in the actual use that the model is also linear programming. Therefore, the model can be further optimized according to the linear programming standard of the model [18], and all decision units can be extracted for comprehensive solution to ensure that the decision units within the decision model are consistent with the actual DEA, so as to achieve high-precision teaching quality assessment. In the actual assessment process, There may be impact

on the accuracy of dynamic assessment, so it is necessary to calculate the correlation coefficient of dynamic assessment r , as shown in (5) below.

$$r = \frac{1}{n} \sum_{k=1}^n \xi(k) \quad (5)$$

In formula (5), n Represents the evaluation reference coefficient, $\xi(k)$ Represents the standard evaluation weight, and basic evaluation indicators can be generated by combining the above dynamic evaluation correlation coefficient g , as shown in (6) below.

$$g = \frac{\sqrt[2]{s}}{a} \quad (6)$$

In formula (6), s Represents the evaluation feedback value, a Represents the comprehensive evaluation coefficient. Decision tree is a common and important data mining method. The implementation of this algorithm is to use the top-down greedy algorithm to summarize the given data samples, extract classification rules from unordered data tuples, and recursively generate a tree structure from the top root node. Each branch node of the tree structure represents a test or selection result, Through reasonable classification of each selection result, the process continues until all attributes are traversed to finally generate a decision tree [19]. The decision tree algorithm mainly includes two processes: constructing the tree and pruning the decision tree. The former refers to taking the input training data as the function value of the established algorithm, generating each branch from the output different attribute values, and each branch continues to operate recursively to the lower level, finally forming a decision tree; For the newly established decision tree, a considerable number of branch nodes are generated because the input training sample data contains abnormal content, which is why the decision tree must be pruned. The whole decision tree process is shown in Fig. 3.

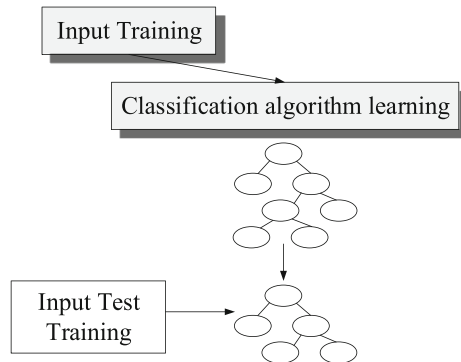


Fig. 3. Decision Tree Process

It can be seen from Fig. 3 that the non incremental data sample set in the online education process has better classification and statistics capabilities, and is more suitable for application in the field of education data mining. The ID3 algorithm is briefly

discussed below. First, the expected value of the sample can be calculated n , as shown in (7) below.

$$n = \sum_{i=1}^m P(y_i) \log_2 P(y_i) \quad (7)$$

In formula (7), $P(y_i)$ It represents the evaluation value of the sample attribute. Teaching evaluation is an important part of the teaching process. It is based on teaching objectives, formulates scientific evaluation standards, uses all effective technical means to measure the process and results of teaching and learning activities, and gives value judgments. Teaching quality is the basis for the survival and development of colleges and universities, and is also an inevitable requirement for the internationalization of higher education. Colleges and universities have accumulated a large amount of data in their daily teaching and management, but these data have not been fully utilized. Most colleges and universities only obtain the surface information of the data through statistics or sorting. They only carry out simple numerical calculation and qualitative summary of these information, and then report these surface information to teachers as the basis for promoting professional titles, appraising excellence, performance pay, etc. The internal information implied in these data has not been deeply mined and considered. How to transform these data into information that can be further used to provide decision support for school administrators is an urgent problem in college education.

Data mining is the process of extracting hidden, unknown, but potentially useful information and knowledge from a large number of incomplete, noisy, fuzzy, random data. In the long-term teaching and management [20], with the accumulation of more and more data, people are more and more interested in mining relevant knowledge from these data. Mining association rules (knowledge) is to search for valuable relationships between data items from a given data set. This paper conducts a sample weighted average based on data mining to obtain the entropy of the evaluation data set at this time $E(D_f)$ As shown in (8).

$$E(D_f) = \sum_{s=1}^q I(N) \quad (8)$$

In formula (8), $I(N)$ It represents the value of the sample evaluation attribute, and the current data sample evaluation description proportion qe As shown in (9) below.

$$qe = - \sum_{i=1}^m p_{is} \log P(y_i) \quad (9)$$

In formula (9), p_{is} Represents the evaluation gain coefficient. By calculating the information gain of all attributes, ID3 algorithm forms the attribute with the largest gain into the test attribute in the data sample set, and then generates the branch point. This branch node is marked as an indicator attribute and classified into a given sample set.

Conduct online evaluations of teachers' teaching content, teaching level, political level, scientific research level, etc. based on the different needs of different users. Thus, students' evaluation of teachers, teachers' evaluation of teachers, and experts' evaluation of teachers have been achieved.

3 Example Analysis

3.1 Overview and Preparation

In order to verify the actual evaluation effect of the college teaching quality evaluation method designed in this paper based on data mining technology, a university is selected for example analysis, and an example analysis platform for college teaching quality evaluation is built. The CPU is 16Core, the memory is 128 GB, the disk is 3 TB, the bandwidth is 1000 Mb/s, the hard disk is 12 TB, and the operating system is CentOS 7. This paper mainly collects the teaching quality information of the film and television planning specialty of the university as experimental data. The experimental data set collected includes 300 data samples, and 20 students in the data set are randomly selected. After the case analysis environment and samples are selected, the comprehensive evaluation index of education effect can be used as the case analysis index T . As shown in (10) below.

$$T = \frac{a_0 + c_a + f_a}{U} \quad (10)$$

In formula (10), a_0 Represents reviews the evaluation coefficient, c_a Represents the qualified evaluation coefficient, f_a Represents the random evaluation coefficient, U It represents the standard evaluation parameters. The standard value of the known comprehensive evaluation index of education effect is 1.00. The closer to 1.00, the better the evaluation effect of the education effect evaluation method is. Otherwise, it proves that the evaluation effect is relatively poor.

3.2 Application Effect and Discussion

In combination with the above overview and preparations, we can analyze the evaluation methods, that is, select different education effect evaluation indicators, respectively use the online education effect evaluation method based on data mining algorithm designed in this paper, and the online education effect evaluation method based on association rules (method 1), As well as the evaluation method of online education effect of higher vocational education based on random classification (method 2), formula (10) is used to calculate the comprehensive evaluation indicators of different evaluation methods. The example analysis results are shown in Table 1 below.

It can be seen from Table 1 that the comprehensive evaluation index of the online education effect evaluation method of higher vocational education designed in this paper based on data mining algorithm under different evaluation numbers is relatively high, close to the standard index of 1.00. The conventional online education effect evaluation method of higher vocational education based on association rules (method 1), As well as the evaluation method of online education effect of higher vocational education based on random classification (method 2), the comprehensive evaluation indicators under different evaluation option numbers are relatively low, and there is a large gap with the standard indicator 1.00. The above example analysis results prove that the evaluation method of online education effect of higher vocational education designed in this

Table 1. Application Effect

| Evaluation option number | Standard | This paper | Method 1 | Method 2 |
|--------------------------|----------|------------|----------|----------|
| X1 | 1.00 | 0.95 | 0.45 | 0.65 |
| X2 | 1.00 | 0.91 | 0.41 | 0.54 |
| X3 | 1.00 | 0.92 | 0.52 | 0.42 |
| X4 | 1.00 | 0.93 | 0.56 | 0.65 |
| X5 | 1.00 | 0.92 | 0.49 | 0.53 |
| X6 | 1.00 | 0.95 | 0.55 | 0.56 |
| X7 | 1.00 | 0.96 | 0.62 | 0.69 |
| X8 | 1.00 | 0.93 | 0.51 | 0.54 |
| X9 | 1.00 | 0.92 | 0.52 | 0.68 |
| X10 | 1.00 | 0.97 | 0.63 | 0.56 |

paper based on data mining algorithm has good evaluation effect, reliability and certain application value.

Further analyzing the performance of the method proposed in this article, the two datasets were randomly divided into three groups, and the output speed of the evaluation results was used as a comparison indicator. The comparison of the test results of the three methods is shown in Table 2:

Table 2. Evaluation Result Output Speed/ms

| Data set | Group | The method of this paper | Method 1 | Method 2 |
|-------------------|-------|--------------------------|----------|----------|
| 3DMatch data set | 1 | 12 | 57 | 37 |
| | 2 | 13 | 59 | 39 |
| | 3 | 11 | 62 | 45 |
| 3DRegNet data set | 1 | 14 | 66 | 55 |
| | 2 | 12 | 68 | 56 |
| | 3 | 15 | 65 | 58 |

Analyzing Table 2, it can be seen that the evaluation results output speed of the method in this article is the fastest, with an average of 12.83 ms, while the evaluation results output speed of Method 1 and Method 2 is relatively slow, with an average of 62.83 ms and 48.33 ms, respectively. This indicates that applying the method in this article to evaluate the effectiveness of online teaching in vocational colleges can achieve efficient evaluation results output, which is conducive to quickly achieving teaching evaluation.

4 Conclusion

With the development of the times, the country also pays more attention to the development of education. Mixed teaching, as a new teaching method, is gradually rising in China, and more and more schools have begun to use mixed learning mode. Moreover, the new learning model has also been highly praised by teachers and students. The hybrid teaching mode mainly adopts the combination of online learning and offline learning, which shows some problems difficult to understand by students in the traditional teaching mode in the form of images and three-dimensional, enhancing students' memory and expanding their imagination. For students in higher vocational colleges, using blended learning can improve their learning quality and enjoy more learning resources. Because there are many high-quality educational resources on the Internet, the new education model enables students to make full use of the resources on the Internet to improve their learning ability and help students solve learning problems. The online teaching platform can not only strengthen the interaction of learning and the cohesion of knowledge, but also play a good role in assisting and supplementing traditional teaching. This hybrid teaching mode can penetrate the characteristics of online and offline learning, constantly improve students' learning motivation, and also enhance students' learning interest. According to the current online education background of higher vocational education, this paper uses data mining algorithm to design a new evaluation method of online education effect of higher vocational education. Through case analysis, the results show that the evaluation method designed for online education effect evaluation in higher vocational education has good evaluation effect, reliability and certain application value, and has made certain contributions to improving the quality of online education in higher vocational education. This study aims to design a new method for evaluating the effectiveness of online education in higher vocational education using data mining algorithms against the current background of online education in higher vocational education. Through case analysis verification, this evaluation method has good evaluation effectiveness, reliability, and application value, making a contribution to improving the quality of online education in higher vocational education. Compared with traditional subjective evaluation frameworks, this method is based on data mining algorithms and overcomes the impact of personalized differences, providing more accurate comprehensive evaluation indicators. By determining the evaluation system, constructing an evaluation model, and generating an evaluation platform, this method has outstanding innovation in the field of online education effectiveness evaluation in higher vocational education. Personalized recommendation technology plays an important role in online education. Future research can combine data mining algorithms with personalized recommendation techniques to provide students with more personalized learning resources and paths based on their individual characteristics and learning needs, further improving the effectiveness and satisfaction of online education.

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