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Research on The Application of Data Mining in Evaluation of Curriculum Teaching

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Abstract: - The effectiveness of moral education is the fundamental standard to test all the work in colleges and universities, evaluation of curriculum teaching is very important for teachers to accurately master students' learning effects .Data mining technology has great advantages in curriculum evaluation. Guided by the concept of OBE (Outcomes-based Education), this paper obtains evaluation data through data mining from the goal of talent training. The data is processed through data collection, data integration, data selection, data cleaning, data conversion ,then the AHP(Analytic Hierarchy Process)-FCE(Fuzzy Comprehensive Evaluation) analysis model is constructed for empirical analysis, and the educational effect of big data and accounting courses is evaluated. Carrying out evaluation of curriculum teaching can promote teaching, improve the quality of personnel training, and achieve the goal of educating people.On the one hand, evaluation of curriculum teaching can provide an empirical basis to improve the talent training quality. On the other hand, it can provide theoretical reference for other majors to carry out curriculum teaching evaluation.

Keywords: Evaluation of Curriculum Teaching(ECT), Data Mining(DM), Analytic Hierarchy Process(AHP), Fuzzy Comprehensive Evaluation Method(FCEM).

I. INTRODUCTION

The current research on the application of big data in curriculum evaluation mainly focuses on two aspects:The first is to carry out the evaluation of the teaching process based on information platforms such as Rain Classroom and Cloud Class.Taking the course of electrical and electronic technology as an example, Zhao Dong constructs the intelligent teaching structure of "basic support layer－application service layer－data presentation layer". Through the Rain Classroom teaching platform, he implements mixed teaching, collects and analyzes students learning data [1]. Zhou proposed to use KickUp, BigEnglish and other big data analysis tools to collect and analyze data in the teaching process, and conduct post-feedback and revision [2].Ning puts forward the teaching big data recorded in real time on the intelligent classroom platform, realizes the curriculum evaluation, and constructs the whole process comprehensive ideological and political education teaching evaluation system supported by big data [3]. Liu has constructed the ICOP(indicator-concept-object-process)"four evaluation" model of curriculum evaluation. With the help of information platforms such as Rain Classroom and Cloud Class, he has collected information in an all-round way and evaluated the basic education curriculum [4]. Based on the evaluation of teachers` and students`, Cui Kai constructed the teaching index system of practical training courses, and used Minitab software to evaluate the teaching quality of practical training courses from the aspects of teaching preparation and design, classroom teaching implementation and students ' learning effect [5].

The second is to evaluate the course teaching through big data technologies such asdata mining and statistical analysis. Han proposed that big data technology has obvious technical advantages in curriculum evaluation. Applying the big data can promote the transformation of evaluation focus to the demand side, and the multi-type characteristics of big data can promote the diversity of evaluation subjects and objects[6].Lin Jing believes that big data technology can promote the transformation of teaching to informatization, and proposes to build a perfect data acquisition and education platform to make data a tool for information feedback. From data analysis, teachers can clarify the defects of students ' knowledge and carry out students ' personality education, to further improve the effectiveness [7].Jiang believes that we can use big data technology and methods to obtain data on teaching procedure and studying process, and to construct a process-based curriculum quality evaluation system. Taking Tieling Teachers' College as an example, the quality evaluation system of E-learning courses in higher vocational colleges is constructed by using AHP method [8].Through literature review, it is not difficult to find that the current big data is mainly used for the collection and feedback of teaching activity process data in curriculum evaluation, and there are few studies on curriculum evaluation from the perspective of teaching output results.

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II. THE APPLICATION VALUE OF DATA MINING IN EVALUATION OF CURRICULUM TEACHING

A. Broaden the Sources of Curriculum Evaluation Data

Today's world has begun to move towards the digital-intelligent era. Big data information technology monopolizes all areas of the social industry with efficient and accurate information means, so that the entire social decision-making gradually moves from "empirical decision-making" to "data-assisted decision-making"[9].While providing online and offline mixed teaching methods, information-based teaching platforms such as "Chaoxing" and "Cloud Class" can collect a lot of data about teaching procedure, for example, the rate about class attendance, micro-course video viewing time, etc., for teachers to analyze and feedback in real time, and adjust teaching methods and strategies[10].Except that, we can also use big data technology to evaluate the teaching effect of course, such as using questionnaire star to collect data on the degree of recognition of students' ability by employers and the effect of students' curriculum education[11].Based on the big data platform, the teaching effect of the course can be obtained, which can broaden the data source channels of the course evaluation, collect the data before-in-class-after-class, and realize the promotion of teaching by evaluation through the statistical analysis of the data of students' all-round learning situation, so as to improve the quality of high talent training.

B. Enrich the Research Perspective of Curriculum Teaching Evaluation

The digital era has given vocational education a new mission. Big data has become a new driving force for economic transformation and development and a new opportunity to reshape the country's competitive advantage[12]. It uses data flow to lead technology flow and talent flow. Using the big data technology in evaluation of teaching efficiency is still less, especially the research on curriculum evaluation from the perspective of talent training output is still less[13].Based on the concept of OBE, this paper uses big data technology to collect and analyze the data of big data and accounting course teaching from the perspective of talent training output, which can enrich the research perspective of course teaching evaluation and provide new ideas for other majors to carry out course teaching evaluation research.

C. Broaden the Application Scope of Big Data Technology in the Development of Higher Education

Big data comes from the behavior data of massive users, which is a data set. The strategic significance of big data is not to master huge data information, but to professionally process and apply these data. In the past, the teaching effect was mainly evaluated by the final exam results and teachers' feelings, which was subjective. With the application of information-based teaching platforms such as Xuexitong and Moso Teach, plenty of data about teaching process such as students' attendance, homework, discussion and learning results can be collected, analyzed, processed and fed back in real time by means of the platform. Now, the related research about the big data technology`s application in higher education mainly focus on this. However, in addition, big data technology still has a huge application space in the evaluation of teaching results. For example, questionnaires are distributed through information platforms such as Xuexitong (students, teachers)platform to investigate and collect students' learning achievement data, and questionnaires are distributed through platforms such as questionnaire stars (enterprises, experts) to investigate and collect evaluation data of enterprises and experts on students' learning achievements. Based on the concept of OBE, starting from the goal of talent training, this study distributes questionnaires to enterprises, teachers, students and experts through the information platform to evaluate the effect of curriculum education and broaden the range of application in higher vocational education.

III. THE APPLICATION OF DATA MINING IN EVALUATION OF CURRICULUM TEACHING

Data Mining (DM) is a decision support process, which extracts the key data to assist decision-making by extracting, transforming, analyzing and modeling a large amount of data in the database. Through data mining, it can help teachers find problems in curriculum evaluation, predict trends, and make decisions. Through the mining of teaching data of big data and accounting major, this paper evaluates efficiency of courses, finds out the problems and deficiencies in the teaching process, and assists the development of professional teaching activities. As shown in the following figure, Figure 1 shows the process of data mining and analysis.

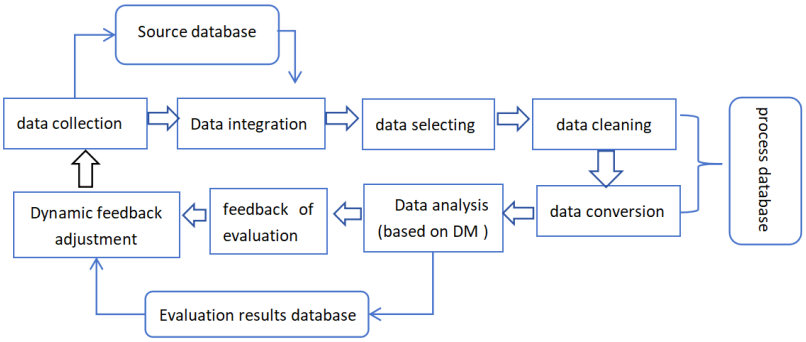

Figure 1: Data Mining and Analysis Process

A. Data Collection

To comprehensively promote curriculum construction, it is necessary to integrate value shaping, knowledge imparting and ability training. Therefore, from the perspective of achievement output, the evaluation content of curriculum teaching effect includes not only moral literacy, but also the knowledge level and ability level, and the evaluation subject should also cover enterprises, teachers, students and experts. In view of the large amount of data and the diversity of evaluation subjects, this paper collects data through two platforms: one is the Xuexitong platform[14]. On the one hand, the relevant teaching process data are obtained from the Xuexitong platform for enterprises, experts and teachers to evaluate the course`s efficiency. On the other hand, the teachers issue questionnaires to 605 people in the 20th, 21st, 22nd and 23rd grades of big data and accounting majors through the Xuexitong platform to obtain the evaluation data of students on the teaching effect of the course. The second is questionnaire star. Through the questionnaire star platform, questionnaires were distributed to 10 front-line teachers of big data and accounting, 2 course construction experts, 4 course teaching masters and 5 enterprise tutors.

B. Data Integration

The data obtained through the Xuexitong platform and the questionnaire star will be collated, summarized and retained to form a source database.

C. Data Selection

Based on the OBE concept, this paper evaluates the teaching effect of the course from three aspects : knowledge, ability and literacy. Therefore, in terms of data selection, Python technology is used to obtain relevant research data such as daily operations and project results from the source database for different evaluation subjects. Use to improve the quality and efficiency of data analysis.

D. Data Cleaning

Clean up the useless data crawled by Python and the incomplete questionnaire obtained in the questionnaire survey. If an option in a questionnaire is not filled out, such as gender, professional and other information, it can continue to be used ; if most of the options in the questionnaire are not filled in, the questionnaire is invalid and can be discarded. After cleaning up, 548 valid questionnaires are obtained.

E. Data Conversion

The qualitative data in the database is converted into quantitative data for later data analysis.In order to facilitate the later fuzzy comprehensive evaluation, qualitative indicators such as "very agree", "relatively agree", " agree ", "not agree", "disagree" are converted into 5,4,3,2,1. The data will be cleaned up and transformed to form a process database for this study, which is convenient for data analysis in the later stage.

F. Data Analysis

Because the evaluation of the teaching effect of the course is subjective, the AHP—FCE evaluation method is used to evaluate the teaching effect of the course.Firstly, the qualitative evaluation index is processed by AHP to obtain the weight of each evaluation index, and then the total score of the evaluation index system is calculated by FCE, and then the problems existing in the course teaching process are found.

G. Feedback of Evaluation Results

The evaluation results are fed back to the relevant personnel to clarify the direction and focus of teaching reform.

H. Dynamic Feedback Adjustment Mechanism

Teaching is a process of continuous adjustment. The teaching effect of the course is evaluated regularly, and the teaching activities are adjusted in time according to the results of the evaluation. The evaluation, feedback and adjustment are formed into a database of evaluation results, which is used as a useful reference for the next round of teaching activities. Cycle back and forth to form a long-term dynamic adjustment mechanism, constantly improve and improve professional teaching activities, and ultimately enhance personnel training quality.

IV. CONSTRUCTION OF THE EVALUATION OF CURRICULUM TEACHING SYSTEM OF BIG DATA AND ACCOUNTING COURSES BASED ON OBE CONCEPT

The major of big data and accounting cultivates the all-round development of morality, intelligence, physique, art and labor. It has a solid scientific and cultural foundation and knowledge of financial accounting and management accounting. It has the ability of analysis, prediction, decision-making, control and evaluation of enterprise financial accounting and management accounting. It has good scientific literacy and humanistic literacy such as Chinese traditional excellent culture. It has the accounting professional ethics of "love and dedication, honesty and trustworthiness, integrity and self-discipline, objective and fair, adherence to standards, improvement of skills, participation in management, and strengthening service"[15]. It has craftsman spirit and information literacy. High-quality technical and skilled talents who can be engaged in enterprise brokerage business accounting, enterprise accounting risk control, financial audit and other work. Based on the OBE concept, starting from the training objectives of big data and accounting professionals, a curriculum teaching evaluation system with multi-subject participation of experts, teachers and students is constructed.

A. Preliminary Construction of Teaching Evaluation System

Define abbreviations and acronyms the first time they are used in the text, even after they have been defined in the abstract. Abbreviations such as IEEE, SI, MKS, CGS, sc, dc, and rms do not have to be defined. Do not use abbreviations in the title or heads unless they are unavoidable.

1) Construction of First-level Indicators: According to the talent training goal of big data and accounting major, based on the concept of OBE "reverse design and forward implementation", the first-level indicators of the teaching evaluation system of big data and accounting major are divided into three dimensions : "knowledge dimension", "ability dimension" and "literacy dimension". The first-level indicator system is shown in Figure 2:

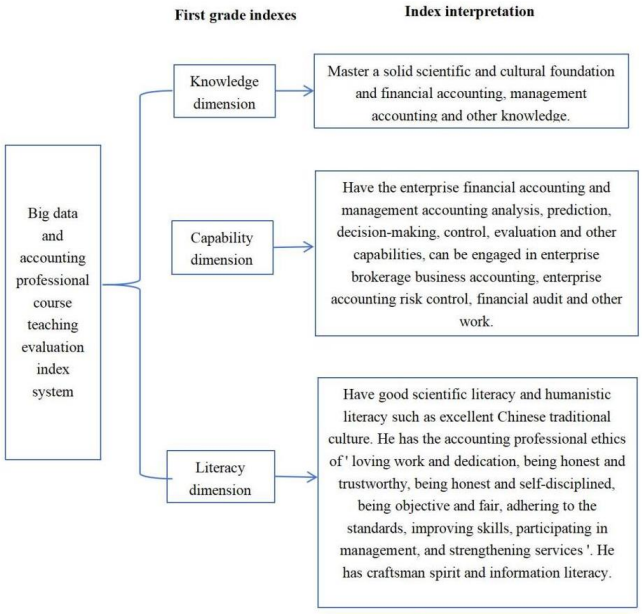

Figure 2: First-level index System

2) Construction of Secondary Indicators: According to the talent training goal of big data and accounting major, the talent training goal is subdivided from the knowledge level, the ability level and the literacy level, and the two-

level index system is constructed. The teaching evaluation system of big data and accounting major is preliminarily constructed, as shown in Figure 3:

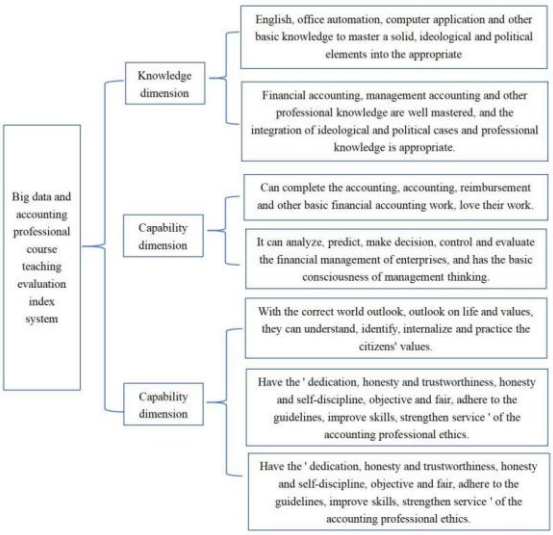

Figure 3: Secondary Index System (initial construction)

B. Modification and Reconstruction of Curriculum Teaching Evaluation System

Because the course is mainly carried out in colleges and universities, the evaluator needs to have a profound theoretical basis and rich practical experience. Therefore, this paper invites 10 front-line teachers of big data and accounting major, 2 course construction experts, 4 course teaching masters and 5 enterprise tutors to form an expert group to modify the teaching evaluation index system of big data and accounting major. According to expert feedback, in the knowledge dimension, in addition to mastering basic knowledge such as computers and professional knowledge, we should also understand national events, economic development trends and accounting-related laws and regulations ; in the dimension of ability, under the background of digital intelligence, students majoring in big data and accounting should also have the ability to use big data tools to obtain and analyze financial data.

Therefore, the original knowledge dimension and ability dimension are modified and adjusted. The modified index system is shown in Figure 4:

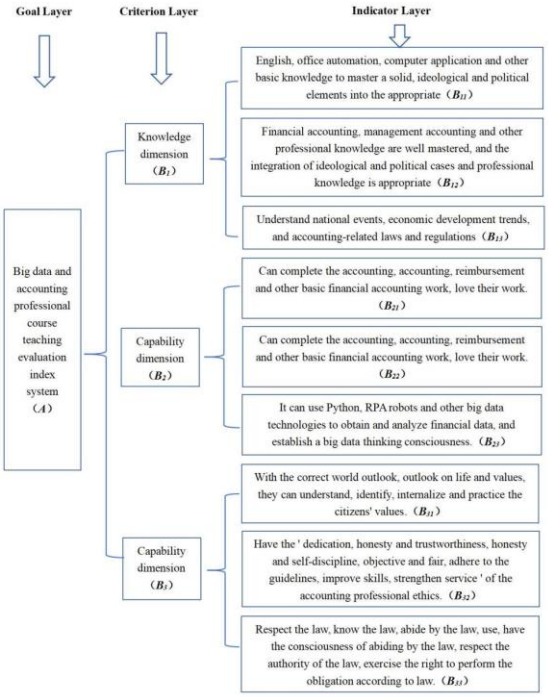

Figure 4: Teaching Evaluation System of Big Data and Accounting Courses

V. Empirical Analysis of Teaching Evaluation System of Big Data and Accounting Based on Data Mining

A. Determine the Index Weight Based on the Analytic Hierarchy Process

1) Introduction of Analytic Hierarchy Process: Analytic Hierarchy Process (AHP) is a subjective evaluation method proposed by American operations researcher Saaty in the early1970s.This method decomposes the research target into multiple levels of targets, forms a target tree, and compares the elements in the same level to establish the relative importance between the two elements, establishes a judgment matrix, and calculates the importance weight of each index through the matrix.Through the method of fuzzy quantification of qualitative indicators, the single ranking (weight number) and total ranking of each level are calculated, so as to optimize the decision-making of multi-objective and multi-index multi-scheme.

2) Construct Judgment Matrix: The construction of the judgment matrix is to determine the weight of each criterion layer to the target by comparing the elements with each other. According to the 1-9 scale method proposed by Saaty (as shown in Table 1), 10front-line teachers, 2 course construction experts, 4 course teaching masters and 5 enterprise tutors are invited to compare the indicators in pairs to determine the judgment matrix, as shown in Table 2-5 :

Table 1: Saaty1-9 Scale

scale	implication
1	It means that the two elements have the same importance compared.
3	Indicating that the former is slightly more important than the latter compared to the two elements.
5	It indicates that the former is more important than the latter when comparing the two elements.
7	Compared with the two elements, the former is more important than the latter.
9	It indicates that the former is more important than the latter when comparing the two elements.
2，4，6，8	Represents the intermediate value of the above adjacent judgment
The reciprocal of 1-9	Indicates the importance of the corresponding two-factor exchange order comparison

Table 2: First-level Index Judgment Matrix

A	B1	B2	B3
B1	1	1/5	1/7
B2	5	1	1/2
B3	7	2	1

Table 3: Secondary Index (knowledge dimension) Judgment Matrix

B1	B11	B12	B13
B11	1	1/4	1/4
B12	4	1	1/4
B13	4	4	1

Table 4: Secondary Index (ability dimension) Judgment Matrix

B2	B21	B22	B23
B21	1	1/2	1/5
B22	2	1	1/4
B23	5	4	1

Table 5: Secondary Index (literacy dimension) Judgment Matrix

B3	B31	B32	B33
B31	1	1/2	1/3
B32	2	1	1/2
B33	3	2	1

3) Judgment Consistency: The specific steps are as follows :

a) Calculate the m-dimensional vector: $M_i = \sqrt[m]{\prod_{j=1}^{m} a_{ij}}$.

b) The vector standardization is the weight vector, that is, the weight is obtained: $w_i = \frac{\overline{w}_i}{\sum_{j=1}^{m} \overline{w}_i}$.

c) According to the obtained weight matrix, the maximum eigenvalue is calculated: $\lambda_{max} = \frac{1}{n} \sum_{i=1}^{n} \frac{(AM)_i}{w_i}$.

d) According to the maximum eigenvalue, the C.I : $C.I. = \frac{\lambda_{max} - n}{n-1}$.

e) By looking up the table, we get the value of R.I., when n = 3, R.I. = 0.58, calculate the value of C.R. : $C.R. = \frac{C.I.}{R.I.}$.

The results are shown in Table 6-9 (rounded data) :

Table 6: Consistency Judgment of First-level Index Matrix

A	B_1	B_2	B_3	weight	AW	AW/w_i	$\lambda_{max}=$ 3.0363	*C. I.=* 0.0182	*D. R.=* 0.0313	Consistency test results
B_1	1	1/5	1/7	0.0751	0.2312	1.0269				pass
B_2	5	1	1/2	0.3332	1.0044	1.0047				
B_3	7	2	1	0.5917	1.7836	1.0047				

Table 7: Matrix Consistency Judgment of Secondary Indicators (knowledge dimension)

B_1	B_{11}	B_{12}	B_{13}	weight	AW	AW/w_i	$\lambda_{max}=$ 3.0409	*C. I.=* 0.0204	*D. R.=* 0.0352	Consistency test results
B_{11}	1	1/4	1/4	0.1013	0.3260	0.9593				pass
B_{12}	4	1	1/4	0.2553	0.8214	0.7222				
B_{13}	4	4	1	0.6434	2.0699	1.3593				

Table 8: Matrix Consistency Judgment of Secondary Indicators (ability dimension)

B_2	B_{21}	B_{22}	B_{23}	weight	AW	AW/w_i	$\lambda_{max}=$ 3.0246	*C. I.=* 0.0123	*C. R.=* 0.0212	Consistency test results
B_{21}	1	1/2	1/5	0.1168	0.3534	1.0082				pass
B_{22}	2	1	1/4	0.1998	0.6043	1.0082				
B_{23}	5	4	1	0.6833	2.0668	1.0082				

Table 9: Matrix Consistency Judgment of Secondary Indicators (literacy dimension)

B_3	B_{31}	B_{32}	B_{33}	weight	AW	AW/w_i	$\lambda_{max}=$ 3.0092	*C.I.=* 0.0046	*C.R.=* 0.0079	Consistency test results
B_{31}	1	1/2	1/3	0.1634	0.4918	1.0031				pass
B_{32}	2	1	1/2	0.2970	0.8936	1.0031				
B_{33}	3	2	1	0.5396	1.6238	1.0031				

4) Calculate the Comprehensive Weight of Indicators: The weight of the first-level index calculated above is multiplied by the weight of the second-level index to calculate the comprehensive weight value of the index layer relative to the target layer. The weight of each index of the evaluation system is shown in Table 10:

Table 10: Evaluation System Weight

Goal Layer	Criterion Layer	Indicator Layer			
	Evaluative dimension	weight	Evaluation Index	Same level weight	comprehensive weight
Big data and accounting professional course teaching evaluation index system **(*A*)**	Knowledge dimension**(*B_1*)**	0.0751	English, office automation, computer application and other basic knowledge to master a solid, ideological and political elements into the appropriate**(*B_{11}*)**	0.1013	0.0076
		0.0751 0.3332 0.5917	Financial accounting, management accounting and other professional knowledge are well mastered, and the integration of ideological and political cases and professional knowledge is appropriate**(*B_{12}*)**	0.2553	0.0192
		0.0751 0.3332 0.5917	Understand national events, economic development trends, and accounting-related laws and regulations**(*B_{13}*)**	0.6434	0.0483
	Capability dimension**(*B_2*)**	0.3332	Can complete the accounting, accounting, reimbursement and other basic financial accounting work, love their work.**(*B_{21}*)**	0.1168	0.0389
		0.0751 0.3332 0.5917	Can complete the accounting, accounting, reimbursement and other basic financial accounting work, love their work.**(*B_{22}*)**	0.1998	0.0666
		0.0751 0.3332 0.5917	It can use Python, RPA robots and other big data technologies to obtain and analyze financial data, and establish a big data thinking consciousness.**(*B_{23}*)**	0.6833	0.2277
	Capability dimension **(*B_3*)**	0.5917	With the correct world outlook, outlook on life and values, they can understand, identify, internalize and practice the citizens' values.**(*B_{31}*)**	0.1634	0.0967
			Have the ' dedication, honesty and trustworthiness, honesty and self-discipline, objective and fair, adhere to the guidelines, improve skills, strengthen service ' of the accounting professional ethics.**(*B_{32}*)**	0.2970	0.1757
			Respect the law, know the law, abide by the law, use, have the consciousness of abiding by the law, respect the authority of the law, exercise the right to perform the obligation	0.5396	0.3193

			according to law.(***B*****33**)		

B. Evaluation of Teaching Effect Based on Fuzzy Comprehensive Evaluation Method

1) Establish the factor set of comprehensive evaluation: The factor set is a common set composed of various factors that affect the evaluation object, which is usually represented by U.According to the established teaching evaluation system of big data and accounting courses, the factor set of comprehensive evaluation is established,

$$\boldsymbol{U} = (\mathrm{U}_{11}, \mathrm{U}_{12}, \mathrm{U}_{13}, \mathrm{U}_{21}, \mathrm{U}_{22}, \mathrm{U}_{23}, \mathrm{U}_{31}, \mathrm{U}_{32}, \mathrm{U}_{33}).$$

Among them, the evaluation index set formed by 9 evaluation indexes on behalf of the index layer, such as the first evaluation index representing the knowledge dimension:"English, office automation, computer application and other basic knowledge are well mastered, and ideological and political elements are properly integrated".

2) Establish the Evaluation Set of Comprehensive Evaluation and Determine the Evaluation Matrix: The evaluation set is a set of various results that the evaluator may make to the evaluation object, which is usually represented by V.According to the evaluation habit, the evaluation set was established, which respectively indicated "very agree (5 points)", "relatively agree (4 points)","agree (3 points)" , "not agree (2 points) ", "disagree (1 point)".

If the degree of membership of the i element in the factor set $\boldsymbol{U}$ to the $\boldsymbol{j}$ element in the evaluation set $\boldsymbol{V}$ is expressed as a percentage of the number of each evaluation in the element, an evaluation matrix is constructed based on this. Through the collection and analysis of the questionnaire data, the following judgment matrix is constructed :

$$R=\begin{bmatrix} 0.5 & 0.2 & 0.2 & 0.1 & 0 \\ 0.4 & 0.2 & 0.2 & 0.2 & 0 \\ 0.2 & 0.1 & 0.3 & 0.2 & 0.2 \\ 0.5 & 0.2 & 0.1 & 0.1 & 0.1 \\ 0.4 & 0.3 & 0.2 & 0.1 & 0 \\ 0.3 & 0.1 & 0.2 & 0.2 & 0.2 \\ 0.7 & 0.2 & 0.1 & 0 & 0 \\ 0.5 & 0.2 & 0.2 & 0.1 & 0 \\ 0.7 & 0.1 & 0.1 & 0.1 & 0 \end{bmatrix}$$

3) Fuzzy Comprehensive Evaluation: The index vector determined by the analytic hierarchy process is composed of the factor weight vector, which is represented by $\boldsymbol{A}$:

$$\boldsymbol{A}=(0.0076, 0.0192, 0.0483, 0.0389, 0.0666, 0.2277, 0.0967, 0.1757, 0.3193)$$

By multiplying the factor weight vector with the evaluation matrix $\boldsymbol{R}$, the fuzzy vector $\boldsymbol{B}$ is obtained :

$$\boldsymbol{B} = \boldsymbol{A} * \boldsymbol{R} = (0.5146, 0.1471, 0.1593, 0.1199, 0.0591)$$

After determining the fuzzy vector, according to $\mathrm{F} = \mathrm{B} * \mathrm{V}^{\mathrm{T}}$, determine the evaluation result of the target layer, which is the score of the corresponding element in the evaluation set V, that is,$\mathrm{V}^{\mathrm{T}} = (5, 4, 3, 2, 1)$,so the evaluation result of the target layer is :

$$\boldsymbol{F} = \boldsymbol{B} * \boldsymbol{V}^{\boldsymbol{T}} = (0.5146, 0.1471, 0.1593, 0.1199, 0.0591)*(5, 4, 3, 2, 1)=3.9382$$

According to the maximum membership principle of fuzzy comprehensive evaluation, it is considered that the teaching effect of big data and accounting courses is better, accounting for 51.46 %. It can be considered that the efficiency of course is generally excellent, but the overall final evaluation result is 3.9382 points. There are still links that need to be improved.

VI. CONCLUSION

Based on the concept of OBE education, this paper constructs the evaluation system of curriculum teaching and teaching from the goal of talent training. By using data mining technology to evaluate the teaching effect of the course, we found that experts and teachers believe that students not only need to have basic knowledge such as accounting, but also need to master the learning and application of big data technologies such as Python and RPA robots, accounting professional ethics and legal literacy, which points out the direction for our future practical teaching.Through the evaluation of the effect of curriculum education, teachers can be helped to better carry out teaching and cultivate high-quality technical and skilled talents to meet the requirements of the times.At the same time, it also points out the direction for the future application of big data technology such as data mining in teaching and teaching evaluation.

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