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Research Article

Evaluation Method of Students' "Hierarchical" Education Management Effect Based on Data Mining

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In order to improve the accuracy of students' hierarchical education management effect evaluation, this paper proposes a method of students' hierarchical education management effect evaluation based on data mining. Firstly, the effect of data mining technology in the evaluation of students' "hierarchical" education management effect is analyzed, and the abnormal data of education management is eliminated by cosine determination calculation method to realize the preprocessing of students' "hierarchical" education management data. Then, establish the index system for the evaluation of students' "hierarchical" education management effect, design the association rules for the evaluation of students' "hierarchical" education management effect according to the Apriori algorithm, calculate the evaluation index weight according to the analytic hierarchy process and the average method of expert opinions, and realize the consistency test of the evaluation index weight according to the judgment matrix. Finally, the effect evaluation of students' "hierarchical" education management is realized through data mining. The experimental results show that the accuracy of this method is up to 98.8%, and the evaluation time is only 1.05 s, which shows that this method can effectively improve the evaluation effect of education management effect.

1. Introduction

With the continuous development of computer technology, high-quality teaching resources in colleges and universities are shared and the utilization rate of teaching resources is improved. In the process of computer experiment teaching, improving the effect of education management is the goal that colleges and universities have been pursuing [1]. The effect evaluation of students' "hierarchical" education management is an important means to improve the teaching effect. Therefore, many research institutions and universities have conducted relevant research on the evaluation of computer experiment teaching effect [2, 3]. At first, some experts used to evaluate the effect of students' "hierarchical" education management. The calculation process of this method is very cumbersome, and the evaluation time is long. Due to the different preferences of each expert, the results of students' "hierarchical" education management evaluation are highly subjective and cannot objectively evaluate the teaching effect [4]. Therefore, relevant scholars have made some progress in the evaluation of educational management effect.

Reference [5] proposes a heterogeneous teaching evaluation method based on graph learning and tensor decomposition, which constructs a heterogeneous information network in a specific scene according to the data set. For a metapath, the correlation matrix is generated according to the path information in the heterogeneous graph. After combining the correlation matrices of different metapaths, the heterogeneous teaching evaluation is realized through the classical tensor decomposition algorithm and the attention mechanism. This method can improve the evaluation accuracy, but the evaluation efficiency is poor. Reference [6] puts forward the teaching effect evaluation method [6], establishes the evaluation system of college students' teaching resources, analyzes the evaluation indexes by using the grey correlation method, uses the neural network to fit the nonlinear mapping relationship between input and output through learning, and finally evaluates and analyzes the college students' teaching resources. This method can improve the evaluation efficiency, but the evaluation accuracy is poor.

Hierarchical education management is a kind of management behavior that analyzes and studies the objective hierarchical phenomenon in the field of education and implements optimized management to make the object develop more effectively. Hierarchical education management is a scientific method to reasonably decompose the objective differences within the "learning group" in the field of education according to the set objectives and standards and use the corresponding methods and strategies to manage it, so as to improve the quality and efficiency of management. The "learning group" here includes "subject knowledge group, student group, class group, teacher group, and school group." In order to further optimize the evaluation effect of hierarchical education management, with the advantage of low computational complexity of Apriori algorithm in data mining algorithm, this paper constructs the association rules of students' hierarchical education management effect evaluation and uses data mining algorithm to realize the evaluation of students' hierarchical education management effect. Experiments show that this method can effectively improve the effect of evaluation.

2. Data Preprocessing of Student "Hierarchical" Education Management

2.1. Education Management Big Data. The concept of "big data" is the result of the development of information technology, and big data is the treasure of new information technology. Compared with traditional data, big data has five characteristics: large quantity, many data structures, fast speed, difficult to identify, and low value density. These five features have brought great challenges to information technology and also produced big data systems to meet these challenges. In the era of big data, schools should also change their key work and focus on how to manage educational data. However, at present, there are still many defects in the management mechanism of education big data, such as data collection [7–10]. Education big data is a batch of data collected in the education industry according to the teaching needs of students and teachers. It comes from the process of education and should serve the development of education. These data are meaningful and valuable. Education big data should serve the development purpose of education, rather than blindly include all data. The "big" of education big data is not a large number, but a large value. The generation of educational big data mainly comes from the following two aspects: first, the data generated by teachers in the teaching process, the big data of teaching activities such as the analysis of teachers' teaching results, and the trajectory of students' behavior. Second, big data is generated in educational management, mainly including school teacher analysis, discipline ability analysis, and educational ability analysis of different schools [11, 12]. This paper mainly discusses the effect analysis of students' "hierarchical" education management.

There are still some deficiencies in the application of big data technology in the education industry. For example, there are few data sources. The data is mainly generated by some educational administration systems and management systems of the school. The manually entered data still accounts for a large proportion, and many of these data are of various structures. Second, the data cannot be fully connected. For example, in the teaching system, educational administration system, experimental management system, and so on, the data structure of these data is different, and some internal data even have contradictions and inconsistent data [13–16]. Third, there is no unified data processing center to manage data, resulting in less effective data and different data formats, which cannot meet the requirements of big data processing and analysis. Fourth, the cost and investment of the system have great limitations. The traditional big data analysis system is slow to take effect; the customized system costs a lot and takes a long time, which makes it impossible to carry out more in-depth data analysis and cannot be used for teachers' teaching and scientific research. Education big data management is a systematic work with high complexity and strong technology [17]. Under the national big data strategy, education big data management will be one of the important parts and the core element of education competitiveness. At present, there are still some problems in the application and management of big data in the field of education in China. Further analysis and research are needed.

The position and function of data mining in the education system are shown in Figure 1.

As shown in Figure 1, the application of association rules [18], text mining, and other technologies in data mining to the education system can present the found useful knowledge and information to educators and push learning suggestions according to the learners' learning situation.

In order to solve the problem of classifying teachers according to the teaching evaluation data of college students, the specific experimental flowchart is shown in Figure 2.

According to Figure 2, first, clean the collected data and delete abnormal data to ensure the authenticity and reliability of subsequent experimental results. Then, cluster the data, divide the data into several categories, and get all the data of these categories of teachers, respectively. Then, according to several types of data obtained by clustering as input samples, combined with cosine similarity to calculate network parameters, we can accurately evaluate the effect level of education management.

2.2. Abnormal Data Elimination. In the activities of students' teaching evaluation, the data we collected are not all normal data, but there are some abnormal data. There are many reasons for these data. For example, if a student hates a teacher very much, he will give a very low evaluation to the teacher. Or I like a teacher's character very much and give the highest score to the teacher's evaluation, which may be obviously inconsistent with the evaluation of other students. These evaluations are not objective evaluations. If these data are directly used for analysis and calculation, the experimental data will be inaccurate, and the teaching management level

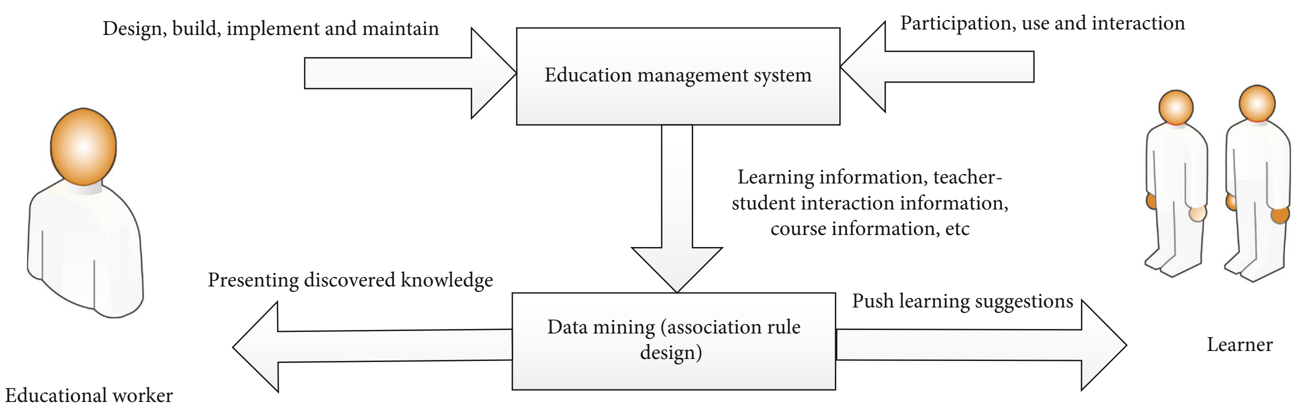

Figure 1: Position and function of data mining in education system.

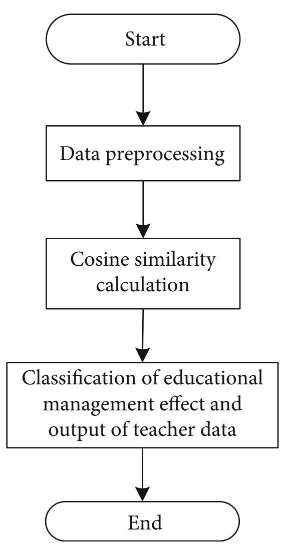

Figure 2: Specific process.

of the teacher cannot be accurately judged later [19]. So we must deal with these data and delete them. In this way, the results of later data operation and analysis will be guaranteed. The specific implementation is as follows:

(1) Students' teaching evaluation data are classified according to each teacher

(2) Improve cosine similarity calculation. Generally speaking, cosine similarity algorithm is not sensitive in value, which leads to inaccurate calculation results. Therefore, we should solve this problem. Insensitivity is reflected in such a situation: let the students evaluate the teacher. The full score is 4, and the dimension is 2. The scores of a and b are $(2, 1)$ and $(3, 2)$, respectively. Using the cosine similarity algorithm, the calculation result is 0.998. The calculation results show that the two scores are very similar. However, after looking at specific problems, a obviously does not like the teacher, while b prefers it. Because the algorithm is not sensitive to values, it leads to a large error in the results. It is considered that both students like the teacher or neither likes it. Therefore, the problem that the value is not in line with the reality needs to be solved

At this time, we need to adjust the formula of cosine similarity: we transform all the sample data and subtract a value, which is generally the average value [20–23]. Assuming that the full score is 5 and the average value of each dimension is 3, a and b are $(2, 1)$ and $(5, 4)$, respectively, then adjusted to $(-1,-2)$ and $(2, 1)$, and then calculated by the algorithm, the result is -0.8, which is a negative value, and the value is relatively large, indicating that the scores of the two students are quite different, which is in line with the actual situation, indicating that this method is more realistic.

In this paper, in order to solve the insensitive problem of cosine calculation, the average value is calculated first. Each teacher has multiple pieces of data of students' teaching evaluation, and the various values of each dimension of each teacher are averaged. Then, replace the original attribute value with the new attribute value [24]. The new attribute value is to subtract the average value of each teacher's score from the original relevant score value. Assume that a and b are $(2, 2)$ and $(4, 4)$, respectively, and assume that the average value is 3. After replacement, they become $(-1,-1)$ and $(1, 1)$, respectively. The cosine similarity calculation formula is shown in

$$\cos(\theta) = \frac{\sum_{i=1}^{n}(x_i \times y_i)}{\sqrt{\sum_{i=1}^{n}(y_i)^2} \times \sqrt{\sum_{i=1}^{n}(y_i)^2}}. \quad (1)$$

In the above formula, x_i represents the scoring value of students to teachers, and y_i represents the scoring dimension of students to teachers. The improved cosine similarity calculation formula is shown in

$$\cos(x, y) = \frac{\sum_{i=1}^{n}((x_i - a) \times (y_i - a))}{\sqrt{\sum_{i=1}^{n}(x_i - a)^2} \times \sqrt{\sum_{i=1}^{n}(y_i - a)^2}}, \quad (2)$$

where a is the calculated average value of each column of data.

It can be seen that after adjustment, the cosine similarity calculation formula is in line with the actual situation and solves the problem of numerical insensitivity. It can be seen from the formula shown above that the denominator in the formula does subtraction, so it may lead to the situation that the denominator may be 0. If each item of a student's evaluation value is equal to the average value of the corresponding evaluation item, the denominator of the calculation formula is zero, which is a great mistake [25]. According to this situation, we need to modify the sample data: (1) test before replacement. If an item of a classmate's evaluation value is equal to the average value of the corresponding evaluation item, modify the evaluation value of this dimension of the classmate; that is, add 0.000001 to the original evaluation value, so as to solve the situation that the denominator is zero. Suppose a sample data $a_x, x = 1, 2, \cdots, n$ its original evaluation value is $(2, 3)$, and the average value of each dimension is 2. Obviously, the evaluation value of the first dimension of sample data a is the same as the average value of the first evaluation item. At this time, just change sample data a to $(2.000001, 3)$. This solves the problem that the denominator cannot be zero and will not greatly affect the calculation. The adjusted calculation formula is as follows:

$$\cos(x, y) = \frac{\sum_{i=1}^{n}((x_i + 0.000001 - a_x) \times (y_i + 0.000001 - a_x))}{\sqrt{\sum_{i=1}^{n}(x_i + 0.000001 - a_x)^2} \times \sqrt{\sum_{i=1}^{n}(y_i + 0.000001 - a_x)^2}}. \quad (3)$$

As mentioned above, we need to calculate the average value of each dimension of the evaluation data, so we need to construct a sample for comparison. The sample used for comparison is the average value of each taper in the sample, set as A, that is,

$$A = \left(\frac{1}{N}\sum_{i=1}^{N} x_{i1} - a_1, \frac{1}{N}\sum_{i=1}^{N} x_{i2} - a_2, \cdots, \frac{1}{N}\sum_{i=1}^{N} x_{\text{in}} - a_n \right), \quad (4)$$

where N is the total number of samples, n is the sample dimension, x_{ij} is the evaluation value of column j of the ith sample data, and a is the average value of the sample data.

The following is the process of cleaning up abnormal data.

The abnormal data detection algorithm of education management is described as follows:

(i) Input: sample file of student evaluation data, abnormal student evaluation threshold Q

(ii) Output: student evaluation sample data after clearing the abnormal sample data file

(1) Combine the teaching evaluation data of the college into a large file

(2) Replace the data of students' teaching evaluation according to certain rules, $A = 4, B = 3, C = 2, D = 1$

(3) Calculate the average value a of each teacher's attribute evaluation in the sample data

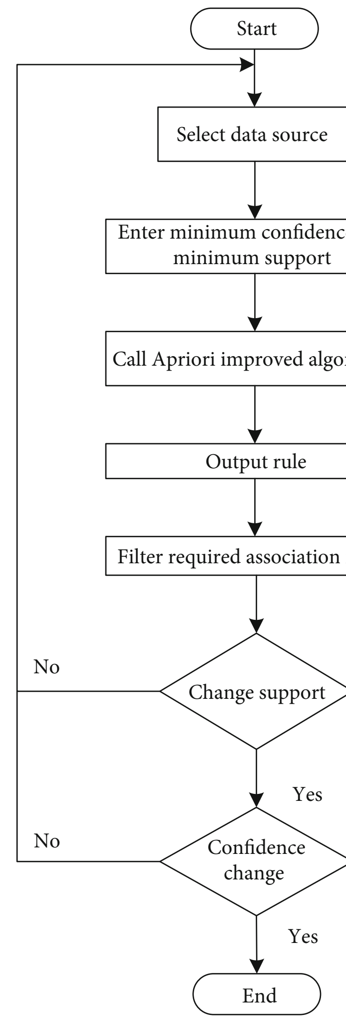

Figure 3: Apriori algorithm flowchart.

(4) Calculate the target sample A in the sample data

(5) Replace the values of each column attribute in the sample data one by one

(6) Calculate the improved cosine distance similarity value

(7) If the cosine value is less than the threshold Q, judge that the sample data is abnormal sample data and delete it from the file

3. Evaluation of Students' "Hierarchical" Education Management Effect Based on Data Mining

3.1. Principle of Apriori Algorithm. The effect evaluation of education management based on data mining mainly uses the improved Apriori algorithm of association rule technology to mine the data source. Firstly, the user specifies the data source and two mining parameters (minimum support threshold and minimum confidence threshold). The Apriori algorithm is implemented by Java and encapsulated

Table 1: Evaluation index system of students' "hierarchical" education management effect.

Target layer	Primary index	Secondary index	Index number
Evaluation index system of educational management effect	Teaching equipment	Experimental equipment	x_1
		Teaching resources	x_2
		Laboratory network speed	x_3
	Teaching management	Experiment management system	x_4
		Experimental setup	x_5
		Experimental report management	x_6
	Teacher teaching	Number of teachers	x_7
		Teaching model	x_8
	Student learning	Learning style	x_9
		Student satisfaction	x_{10}
	Social reputation	Training objectives	x_{11}
		Students' practical ability	x_{12}
		Enterprise evaluation results	x_{13}

into components. The mining is realized through function call, and finally, the mining association rule results are displayed [26]. The flow of Apriori algorithm is shown in Figure 3.

3.2. Design of Evaluation Index of Students' "Hierarchical" Education Management Effect Based on Data Mining. Education management evaluation system is a platform for teaching management departments and teachers to understand and improve teaching quality. It is mainly to organize teaching quality evaluation and collect evaluation data of evaluation objects. The quality of teaching evaluation results is affected by teaching quality evaluation factors. Different teaching quality evaluation indexes have different effects on the evaluation results. Therefore, the key to building a teaching quality evaluation system based on data mining is to clarify the teaching quality evaluation indexes. The establishment of evaluation indicators must respect the principles of objectivity, guidance, feasibility, and scientificity. In the whole education management evaluation system, we must realize diversified teaching evaluation subjects, such as student evaluation, peer evaluation, expert evaluation of educational administration supervision group, and self-evaluation of teachers. Combined with relevant literature, the indicators of the data mining education management evaluation system designed this time mainly include three levels: teaching attitude (student evaluation, peer evaluation, supervision evaluation, and personal evaluation), teaching content (student evaluation, peer evaluation, supervision evaluation, and personal evaluation), teaching methods, and teaching effects.

In order to objectively evaluate the effect of "hierarchical" education management of students, firstly, establish the index system of "hierarchical" education management effect evaluation of students and establish the evaluation index system of "hierarchical" education management effect of students as shown in Table 1 based on the principles of science, comprehensiveness, objectivity, operability, and easy data collection.

Table 2: Test environment of education management effect evaluation experiment.

Parameter	Configuration
CPU	AMD
RAM	8 GB
Hard disk	500 GB
OS	Windows
Programming tools	Java

After the establishment of the comparative judgment matrix index system, experts need to judge and compare the factors of the primary index layer and the secondary index layer, so as to construct the judgment matrix. For the first-level indicators, the evaluation scope is determined by the level, and the actual evaluation results are determined by the students as the main body of teaching. The secondary indicators need to be evaluated according to the actual teaching effect, which can be divided into five evaluation categories.

(i) Class A: the evaluation status is excellent, all indicators of teaching effect are in line, and the score is 80-100 points

(ii) Class B: the score is 80-80 for individual indicators and 80-80 for individual indicators

(iii) Class C: the evaluation status is good, which can meet most evaluation indexes, and the score result is 40-60 points

(iv) Class D: the evaluation status is qualified, which can only meet a few evaluation indicators, and the score result is 20-40 points

Table 3: Symbol meaning.

Symbol	Meaning
TP	The number of samples that are actually positive and divided into positive, the real number
FP	The number of samples that are actually negative but divided into positive, false positive
TN	The number of samples that are actually negative and divided into negative, true negative
FN	The number of samples that are actually positive but divided into negative is false negative

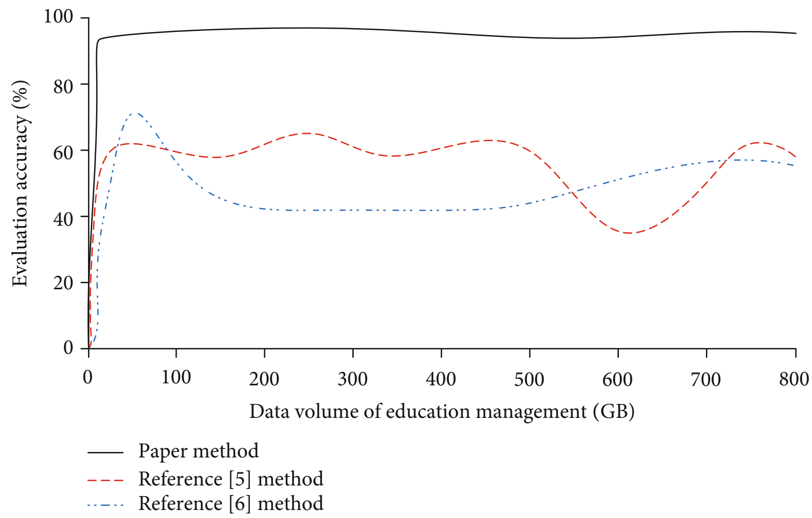

Figure 4: Correct rate of education management effect evaluation.

(v) Class E: the evaluation status is unqualified, which basically cannot meet the evaluation index, and the score result is 0-20 points

3.3. Design of Association Rules for the Effect of "Hierarchical" Education Management of Students. The Apriori algorithm is a rule that describes many potential relationships between data items in the database. It belongs to a database traversal algorithm. The Apriori algorithm has two stages to realize. Specifically, it scans the database for many times, then counts the support of each itemset, and then finds the frequent itemset according to the minimum support given by the user, so as to finally produce the result of association rules.

The most fundamental idea of this algorithm is as follows. Based on some properties of frequent itemsets, the iterative search method from the bottom to the top is adopted, and the former set k will be used in the latter set $k+1$. The first step is to scan the database, calculate the specific number of each item, filter out the items with less support than the minimum value, and then get a frequent itemset, which is regarded as L_1. Next, based on L_1, locate the set L_2 corresponding to the two frequent itemsets, and based on L_2, locate the set L_3 corresponding to the three frequent itemsets. Continue to repeat, and finally, L_k of the frequent k itemsets cannot be found. Correspondingly, the search process of each L_k requires a complete scan of the entire database.

For the Apriori algorithm, it consists of two steps: connection step and pruning step:

(1) Connection step: in order to find the frequent itemset $L_k (k \geq 2)$, first connect L_{k-1} with itself to generate the set C_k of candidate K itemsets. Let l_1 and l_2 be itemsets in L_{k-1}, that is, $l_1 \in L_{k-1}$, $l_2 \in L_{k-1}$. The Apriori algorithm assumes that the items in the transaction or itemset are arranged in dictionary order, and let $l_i[j]$ represent the j-th item in l_i. For the $k-1$ itemset l_i, the corresponding items are sorted as $l_i[1] < l_i[2] < \cdots l_i[k-1]$. The connection between L_{k-1} and itself is represented by $L_{k-1} \infty L_{k-1}$. If the first $k-2$ elements in $l_1 \in L_{k-1}$ and $l_2 \in L_{k-1}$ are the same, l_1 and l_2 are said to be connectable, that is, $l_1[1] = l_2[2] \wedge l_1[1] = l_2[2] \wedge \cdots \wedge l_1[k-1] < l_2[k-1]$. The condition $l_1[k-1] < l_2[k-1]$ can ensure no repetition, and finding frequent itemsets in the order of $l_1, l_2, \cdots, l_{k-1}, l_n$ can avoid the search and statistics of impossible itemsets in the transaction database. The result itemset connecting l_1 and l_2 is $l_1[1] = l_2[2] \wedge l_1[1] = l_2[2] \wedge \cdots \wedge l_1[k-1] < l_2[k-1]$. The condition $l_1[k-1] < l_2[k-1]$ can ensure no repetition, and finding frequent itemsets in lkln order can avoid the search and statistics of impossible itemsets in the transaction database. The result itemset connecting l_1 and l_2 is $l_1[1], l_1[2], \cdots, l_1[k-1], l_2[k-1]$

TABLE 4: Evaluation efficiency of students' "hierarchical" education management.

Education management data volume (GB)	Evaluation time of students' "hierarchical" education management/s		
	Reference [5] method	Reference [6] method	Paper method
100	22.18	23.88	0.22
200	32.56	36.21	0.39
300	48.26	52.18	0.42
400	53.19	68.28	0.68
500	66.21	70.36	0.82
600	78.92	82.91	1.05

(2) Pruning step: suppose that the set generated by the candidate K itemset is called C_k, which can create a frequent K itemset called L_k. Here, C_k can be regarded as a superset of L_k, which means that infrequent sets can be allowed in C_k members. On the contrary, each frequent itemset L_k must exist in C_k. Scan the database, then count and analyze the number of candidate itemsets in C_k, and finally, determine L_k. However, it is worth noting that there may be many elements in the C_k set, which puts a lot of pressure on the later calculation. This requires the compression of C_k. The most likely thing is the nature of frequent itemsets we know: frequent k itemsets will certainly not contain those infrequent $(k-1)$ itemsets. Therefore, if a subset of $(k-1)$ items in the candidate k-itemset called C_k is not included in L_{k-1}, it means that the subsequent set will not be frequent, and then, it will be excluded from the set C_k. This subset test can be fully applied to the hash tree operation of frequent itemsets

3.4. Determination of Index Weight. The evaluation system of educational management effect mainly includes the establishment of indicators and weights. This design is determined as 13 Level 3 indicators. Therefore, the weights of evaluation indicators will affect the overall evaluation results to a great extent. The weight is the importance of the index in the whole evaluation system. The greater the weight value, the greater the impact of the index on the evaluation results of teaching quality. Considering the actual situation of the research object in this paper, the combination of analytic hierarchy process and expert opinion average method is selected to determine the corresponding weight of indicators at all levels.

(1) Analytic hierarchy process: according to the nature of the problem and the overall goal to be achieved, the analytic hierarchy process decomposes the problem into different constituent factors and aggregates and combines the factors according to different levels according to the correlation, influence, and subordinate relationship between the factors to form a multilevel analysis structure model. Thus, the problem is finally attributed to the determination of the relatively important weight of the lowest level (schemes and measures for decision-making) relative to the highest level (overall goal) or the arrangement of the relative advantages and disadvantages. The "1-9 scale" analysis method adopted this time shows that this method can accurately reflect the value of the index

(2) Expert opinion averaging method: ten experts are invited to distribute the index weight

Since the middle school students are the evaluation center in the evaluation of educational management effect, this paper invites 10 college students to compare and score the index system in pairs according to the 1-9 proportional scale method. The meaning of proportional scale method is as follows: when the scale is 1, it means that the importance of the two factors is the same; when the scale is 3, it means that one factor is slightly more important than the other. A scale of 5 indicates that one factor is significantly more important than the other. A scale of 7 indicates that one factor is more important than the other. A scale of 9 indicates that one factor is extremely important compared with the other. When the scale is 2, 4, 6, and 8, it indicates the middle value of adjacent scales. The inverse value of the scale indicates that if factor x is compared with factor y to get a_{xy}, then factor y is compared with factor x to get $1/a_{xy}$. Compare the evaluation indexes to obtain the judgment matrix, such as

$$G_1 = \begin{bmatrix} \frac{A_1}{A_1} & \frac{A_2}{A_1} & \frac{A_3}{A_1} \\ \frac{A_1}{A_2} & \frac{A_2}{A_2} & \frac{A_3}{A_2} \\ \frac{A_1}{A_3} & \frac{A_2}{A_3} & \frac{A_3}{A_3} \end{bmatrix}, \quad (5)$$

$$G_2 = \begin{bmatrix} \frac{A_{11}}{A_{11}} & \frac{A_{12}}{A_{11}} & \frac{A_{13}}{A_{11}} \\ \frac{A_{11}}{A_{12}} & \frac{A_{12}}{A_{12}} & \frac{A_{13}}{A_{12}} \\ \frac{A_{11}}{A_{13}} & \frac{A_{12}}{A_{13}} & \frac{A_{13}}{A_{13}} \end{bmatrix}, \quad (6)$$

$$G_3 = \begin{bmatrix} \frac{A_{21}}{A_{21}} & \frac{A_{22}}{A_{21}} & \frac{A_{23}}{A_{21}} \\ \frac{A_{21}}{A_{22}} & \frac{A_{22}}{A_{22}} & \frac{A_{23}}{A_{22}} \\ \frac{A_{21}}{A_{23}} & \frac{A_{22}}{A_{23}} & \frac{A_{23}}{A_{23}} \end{bmatrix}, \quad (7)$$

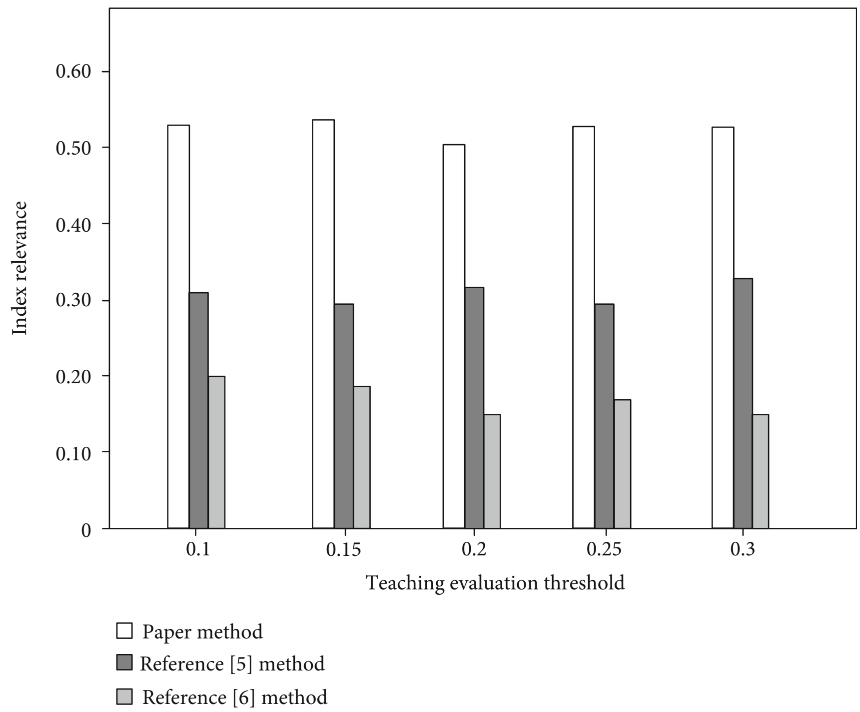

Figure 5: Correlation results.

$$G_4 = \begin{bmatrix} \frac{A_{31}}{A_{31}} & \frac{A_{32}}{A_{31}} & \frac{A_{33}}{A_{31}} \\ \frac{A_{31}}{A_{32}} & \frac{A_{32}}{A_{32}} & \frac{A_{33}}{A_{32}} \\ \frac{A_{31}}{A_{33}} & \frac{A_{32}}{A_{33}} & \frac{A_{33}}{A_{33}} \end{bmatrix}, \quad (8)$$

where G represents the weight of each judgment matrix after calculation.

Combine the subjective and objective factors that affect the teaching effect to comprehensively evaluate the teaching effect. Therefore, these subjective and objective factors are combined to realize the comprehensive evaluation of teaching effect, which is recorded as the evaluation factor LM, and its calculation formula is as follows:

$$\mathrm{LM}_i = \mathrm{XOFM}_i + (1 - X)\mathrm{SFM}_i. \quad (9)$$

Among them, LM_i represents the teaching effect measurement value of the ith evaluation object, as shown in formula (9). i from 1 to n, n is the number of evaluation objects; X represents the weight value of objective factors; ($1 - X$) corresponds to the weight value of subjective factors.

$$\mathrm{OFM}_i = \frac{\mathrm{OFC}_i - \min\{\mathrm{OFC}_i\}}{\max\{\mathrm{OFC}_i\} - \min\{\mathrm{OFC}_i\}}. \quad (10)$$

OFM_i represents the objective factor measurement value of the ith evaluation object, as shown in formula (11). OFC_i is the average value of objective factors of the ith evaluation object.

$$\mathrm{OFC}_i = \sum_{j=1}^{s}\left(\mathrm{OFC}_{ij} OW_j\right). \quad (11)$$

OFC_{ij} represents the j-th objective factor value of the ith evaluation object, OW_j corresponds to the weight ratio of the j-th objective factor, and s is the number of objective factor parameters.

$$\mathrm{SFM}_i = \sum_{k=1}^{m}(\mathrm{SFW}_{ik}\mathrm{SW}_k). \quad (12)$$

SFM_irepresents the subjective factor measurement value of the ith evaluation object, as shown in formula (8). SFW_{ik} is the kth subjective factor value of the ith evaluation object, SW_k is the weight of the kth subjective factor, and m is the number of subjective factor parameters. In addition, the weights of subjective and objective factors and the weights between subjective and objective evaluation factors can be set according to the specific conditions of the evaluation object and the needs and preferences of different evaluation subjects. However, in the same evaluation system, once the weights are set, they need to be unified.

U is the eigenvector, which is generally the largest eigenvalue in the judgment $\mu_{\max}$. Corresponding to max, the consistency test of the judgment matrix shall be carried out according to the following steps:

(i) The consistency index CI is calculated as

$$\mathrm{CI} = \frac{\mu_{\max} - m}{m - 1}, \quad (13)$$

where m represents the number of columns or rows of the judgment matrix

(ii) Search the corresponding average random consistency index RI, that is, according to the positive reciprocal matrix of order 1 to 10, repeat 1000 calculations to obtain the specific value of the average random consistency index RI

(iii) Calculate the consistency ratio CR, as shown in

$$\mathrm{CR} = \frac{\mathrm{CI}}{\mathrm{RI}}. \quad (14)$$

To judge whether the consistency of the matrix is reasonable and acceptable, it is necessary to ensure that the consistency proportion value is less than 0.1. At this time, the eigenvector can be regarded as a factor to weigh the vector. Each index at the same level is divided into different levels according to the importance or excellence, and the quantitative value is assigned to determine whether the constructed judgment matrix meets the conditions of complete consistency.

Generally, in order to reflect the real situation of the effect of education management, the weight of the evaluation index is appropriately adjusted by using the variable weight synthesis method. The variable weight synthesis mode is

$$\begin{cases} W(a_1, a_2, a_3, \cdots, a_m) = \dfrac{\sum_{j=1}^{m} \lambda_j^{(0)} a_j^{\gamma}}{\sum_{k=1}^{m} \lambda_k^{(0)} a_k^{\gamma-1}}, \\ 0 < \gamma \le 1, \end{cases} \quad (15)$$

where λ_j and a_j represent the weight and evaluation value of the j-th index, respectively; γ is expressed as a parameter. If the evaluator (student) is conservative in evaluating the effect of education management, in this case, the impact of various indicators will be considered too much. At this time $\gamma < 1/2$. If the evaluator (student) is more open-minded and can tolerate some teaching defects, then $\gamma > 1/2$. If $\gamma = 1/2$, then the weight of the evaluation index is the same as the constant weight comprehensive mode, as shown in

$$W_0 = \sum_{j=1}^{m} \lambda_j^{(0)} a_j. \quad (16)$$

The use of constant weight comprehensive evaluation cannot clearly show that a certain evaluation index is "qualified" or "unqualified." It is easy to ignore some details in the evaluation of English teaching effect, resulting in inaccurate evaluation results. Through continuous practical analysis, the parameterγ is 0.2, which can be widely used in the evaluation of educational management effect. Compared with the comprehensive evaluation method of analytic hierarchy process combined with variable weight evaluation method and analytic hierarchy process combined with constant weight evaluation method, it can better reflect the impact of individual index changes on the overall evaluation results γ. The value shows the demand for balance. For individual indicators, the lower the tolerance of shortcomings, the smaller the parameter value.

When calculating the effect of education management, it is gradually calculated from the secondary index level to the target level. The calculation results of secondary indicators are obtained by multiplying the weight and score value, and the evaluation results of education management effect are obtained by using the variable weight comprehensive model. After determining the weight of each secondary index to the target layer, it is also necessary to obtain the score of each index, calculate the overall score of education management effect evaluation, and evaluate the quality of education management effect through the score, as shown in

$$F = \sum_{i=1}^{9} R_i G_i, \quad (17)$$

where F represents the overall score of education management effect, G_i represents the relative weight of the ith index affecting the effect of education management, and R_i represents the evaluation score of the ith index, so as to realize the "hierarchical" education management effect evaluation of students based on data mining.

4. Experiment

4.1. Experimental Environment. In order to test the evaluation effect of computer experiment teaching effect of data mining, the simulation experiment is carried out in the test environment shown in Table 2. In order to make the experimental results comparable, under the same test environment, the evaluation method of Reference [5] and the evaluation method of Reference [6] are selected for comparative experiment, and the evaluation accuracy and evaluation time of education management effect are selected as the evaluation criteria of the experimental results.

The evaluation experiment of educational management effect is carried out with reference to the above parameters.

4.2. Experimental Index. The performance of the classifier is evaluated by some classification indexes, which are usually calculated according to the classification results of the classifier on a data set. The symbol table of each calculation formula is shown in Table 3.

(1) Accuracy acc: it is the proportion of the total number of correctly predicted results. However, the effect of classifier is sometimes not explained by high accuracy. The calculation formula is shown in

$$acc = \frac{TP + TN}{TP + TN + FP + FN}. \quad (18)$$

(2) Effect evaluation time: the longer the effect evaluation time, the lower the efficiency of education management effect evaluation. On the contrary, the longer the effect evaluation time, the higher the efficiency of education management effect evaluation.

4.3. Experimental Result

4.3.1. Comparison of Accuracy Rate of Evaluation of Educational Management Effect. In order to verify the evaluation effect of students' "hierarchical" education management, Reference [5] method, Reference [6] method, and this method are used to evaluate the accuracy of teaching management effect. The results are shown in Figure 4.

According to the analysis of Figure 4, the accuracy of management effect evaluation is different under different methods. When the data volume is 100 GB, the management effect evaluation accuracy rate of Reference [5] method is 60.2%, the management effect evaluation accuracy rate of Reference [6] method is 62.5%, and the management effect evaluation accuracy rate of this method is 96.8%. When the data volume is 800 GB, the management effect evaluation accuracy rate of Reference [5] method is 59.8%, the management effect evaluation accuracy rate of Reference [6] method is 58.6%, and the management effect evaluation accuracy rate of this method is 98.0%. This method always has a high accuracy of management effect evaluation.

4.3.2. Comparison of Teaching Effect Evaluation Efficiency. In order to verify the evaluation efficiency of students' "hierarchical" education management, the methods of Reference [5], Reference [6], and this paper are used to evaluate the effect of teaching management. The results are shown in Table 4.

According to the analysis of Table 4, when the data volume is 100 GB, the evaluation time of Reference [5] method is 22.18 s, the evaluation time of Reference [6] method is 23.88 s, and the evaluation time of this method is 0.22 s. When the data volume is 300 GB, the evaluation time of Reference [5] method is 48.26 s, the evaluation time of Reference [6] method is 52.18 s, and the evaluation time of this method is 0.42 s. When the data volume is 600 GB, the evaluation time of Reference [5] method is 78.92 s, the evaluation time of Reference [6] method is 82.91 s, and the evaluation time of this paper is only 1.05 s. The evaluation time of this method is much higher than that of other methods, which shows that this method has high efficiency of education management evaluation.

According to the correlation parameters under different teaching evaluation thresholds, the test results of three methods are obtained, as shown in Figure 5.

According to Figure 5, the average correlation value of Reference [5] method under various teaching evaluation thresholds is 0.15, and the correlation between the selected evaluation indicators is the lowest. The average correlation value of the method in Reference [6] is 0.3, and the correlation between the evaluation indexes obtained by this multi-index evaluation model is strong. The average correlation value obtained by this method is 0.5. Compared with the comparison method, the indicators selected by the proposed student "hierarchical" education management effect evaluation method based on data mining have the strongest correlation.

5. Conclusion

This paper proposes an evaluation method of students' "hierarchical" education management effect based on data mining. On the basis of establishing the index system of "hierarchical" education management effect evaluation of students, the association rules of evaluation are designed according to the Apriori algorithm, and the weight of evaluation index is calculated. Through the data mining method, the effect evaluation of students' "hierarchical" education management is realized. The experimental results show the following:

(1) When the amount of data is 800 GB, the management effect evaluation accuracy of this method is 98.0%. This method always has a high accuracy of management effect evaluation

(2) When the amount of data is 600 GB, the evaluation time of this paper is only 1.05 s, which shows that this method has high efficiency of education management evaluation

Data Availability

The author can provide all the original data involved in the research.

Conflicts of Interest

The author indicates that there was no conflict of interest in the study.

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