Research Article

Research on Optimization of Student Management Evaluation System under the Background of Big Data

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Aiming at the problem of effective management of a large number of teaching data resources, this paper puts forward an optimization method of student management evaluation system under the background of big data. Firstly, the model of student education management is constructed with big data technology, and the evaluation index of student management is standardized. Secondly, improve the student management evaluation algorithm, and optimize the student management evaluation system. Finally, the experiment proves that the optimization method of student management evaluation system under the background of big data has high practicability and fully meets the research requirements.

1. Introduction

With the rapid development of Internet, Internet of Things, and cloud computing technology, data is being generated. A large amount of data affects our work, life, and even social development in real time. At the same time, as a subversive technological revolution, big data is being gradually applied to all aspects of society. It has not only become an important factor affecting economy, politics, and culture but also played a direct and far-reaching role in promoting educational reform and innovation [1]. In the 21st century, with the continuous expansion of the scale of running schools, colleges and universities are also facing many challenges. Similarly, the difficulty of college student management is also greatly increased. Under the new situation, relying on big data technology to improve the student management mode can effectively make up for the shortcomings existing in the traditional management mode, improve the efficiency of student management, and improve the scientifiCity of student management decision-making, so as to lay a solid foundation for further deepening the reform of college student management and improving the ability of educational governance [2]. Big data technology is using data mining and machine learning means to realize a method of data analysis, such as big data technology for data processing has a good advantage, because the university student management system for a long time has accumulated a large amount of data, can be used in data mining, and find the potential rule from the data; the data can be greatly technology application in university students’ management.

Comprehensive research status shows that the research of big data technology in the management of educational resources in colleges and universities is in the development stage. Colleges and universities can use big data technology to integrate information related to education management, which can not only improve management efficiency but also strengthen the education of all staff and improve the student evaluation mechanism so as to avoid student emergencies and promote the personalized development of college students. In the application of big data technology, colleges and universities should take measures such as changing the way of thinking, standardizing the collection rules, and strengthening supervision to promote the integration of big data and student management.
2. Student Management Evaluation System in the Context of Big Data

2.1. Diversified Student Education Management Model. Combined with big data technology, build a diversified student education management model and student management model, and the horizontal and vertical combination systems dominated by the school replace the vertical and straight-line managements of “the school pays attention to the college and the college pays attention to the class.” Upgrade the functions originally realized by colleges and classes to the school level, implement the large department system, and strengthen the service and guidance to students. Generally speaking, it is to establish a student work department integrating service, guidance, and management and set up several service guidance centers relying on a comprehensive information platform [3]. The student work department is generally responsible for all kinds of affairs related to student work and has several service and guidance centers. Digital student information sharing platform provides students with all kinds of education and management information in a comprehensive and timely manner. The student work department has several centers, including the student ideological and moral education center, which is mainly responsible for student moral education and moral education, so as to create a good campus cultural atmosphere and learning atmosphere. The student affair center manages students’ status, including students’ enrollment and registration, reward, and punishment [4]. The student academic development guidance center conducts academic guidance and career development planning for students, especially freshmen; student life service center, which provides services for students’ accommodation and daily life; and student financial aid management center, which provides financial aid and work study program services for poor students such as awards, grants, and loans [5]. The mental health guidance center carries out healthy personality training, successful psychological training, and psychological problem consultation and guidance for students. The employment and entrepreneurship guidance center provides training and guidance on students’ employment and entrepreneurship skills and related knowledge and timely releases information. The diversified student education management model and student management information model are shown in Figure 1.

Different from the traditional flat and single student management mode, a diversified and three-dimensional student education management mode should be established under the complete credit system. In terms of student management, administrative class arrangement is carried out first after students enter school [6]. On this basis, in order to make up for the management inconvenience caused by students’ scattered classes, curriculum classes, apartment communities, and student associations are added to form the basic unit of student management together with administrative classes; that is, the student education management mode of “administrative class level + curriculum class + apartment community + association” is established. The organic combination of students’ multiple identities in these four organizations and environments is shown in Figure 2.

Educational management mode is the concretization of the operation of educational management theory. What kind of educational management theory has what kind of educational management mode. Educational management mode is the intermediary and bridge between educational management theory and educational management practice. The study of educational management model is of great significance to optimize educational resources and improve educational quality. “From the ancient and modern educational development history of the East and the west, the creation, selection and rational application of educational management mode are of great significance to educational activities themselves [7]. The improvement of educational quality, the optimal allocation of educational resources and the exertion of educational role are all related to the selection and application of educational management mode.” The mode is the intermediary between theory and practice [8]. The management mode reflects the relationship structure between the internal elements of the management system. No management can get rid of the mode. Educational management is inseparable from the creation, selection, and rational application of educational management mode [9]. By studying different educational management models and describing their operation process and exploring the common characteristics of educational management models on the basis of grasping their characteristics, we can further understand the change, development, and operation law of educational management models and realize the scientization of educational management. The specific operation is shown in Figure 3.

The fundamental purpose of implementing the student self-management model is to enable students to open their horizons, hands, and feet and fully carry out self-learning and self-exploration in the teaching environment. It is not for the so-called “burden reduction” advocated in the initial implementation stage of quality education, but to more scientifically and reasonably comply with the law of student development and make high school education meet the social requirements of the new era [10]. High school education can lay the foundation for cultivating talents who can adapt to the society and make contributions to the society. From the perspective of the impact of the development of the times on high school education, high school education has obviously undertaken more far-reaching responsibilities and significance than before. In line with the purpose of giving full play to the subjective role of students and respecting students’ personalized development, improving students’ comprehensive quality in line with the requirements of the times also has higher requirements for teachers’ education and teaching level in all aspects. As a school level, we should vigorously promote the diversified development of teacher training. The content of traditional teacher training mainly involves three main aspects, such as teacher ethics education, concept training, and professional training [11]. Under the mode of student independent management, the school’s training for teachers, in terms of content and form, should first ensure that the fundamental and basic teacher quality training is carried out steadily, and in view of the reform of school development management, under the
requirements of fully promoting all-round development of students, teachers also need to change their role, change the educational concept with teaching as the core, and give scientific and targeted guidance to students from the actual needs of students’ development.

2.2. Student Management Evaluation Algorithm Based on Big Data. Student evaluation is a true portrayal and growth record of students’ learning experience in school and life experience in the stage of receiving high school education. Student evaluation is not only the achievement of high school education but also a part of student education. From the perspective of students, evaluation is a summary of their experience in each stage of high school [12]. The results presented by phased evaluation will greatly affect their future performance. Simply put, for example, the evaluation full of praise is easy to make students become arrogant and complacent, do not want to make progress, lack of recognition for students, can not be encouraged, and can not play the role of incentive mechanism in promoting students’ development. What is more, it will have a negative psychological impact on students, produce inferiority complex, and lose the driving force to move forward. Providing students with objective, true, scientific, and reasonable evaluation is very important for student education [13]. It is also very important for students to correctly understand themselves, understand their relationship with the external environment, and actively manage themselves. With the reform of the development of high school, the role orientation of high school education in society is constantly changing to a deeper level, and
the tasks of high school education are evolving to a more diversified and deeper level. High school education is to constantly adapt to the development of society and cultivate corresponding talents to meet the needs of social development on the basis of respecting people’s subjective development [14]. The diversification of social forms leads to the diversification of students’ learning, extracurricular activities, social practice, and other aspects. The voice of diversified evaluation requires that students’ activities should be diversified when evaluating students, diversified evaluation subjects, and diversified evaluation forms, including self-improvement of the evaluation itself. Through the overall planning of these contents, we can establish a scientific and reasonable student quality evaluation system [15]. As a guarantee mechanism for student management, it is an important part of the student independent management mode. For the various work contents involved in the previous student affairs, it is necessary to present the results of each part of the elements of the quality evaluation system as a theoretical demonstration and practical basis for the progress of students’ independent management. The indicators are shown in Table 1.

By studying the experience and lessons of scientific research management in universities at home and abroad, the present situation of scientific research management in universities is analyzed, and relevant theoretical achievements are collected, based on which the scientific research management system of universities is constructed [16]. The indicators are shown in Table 2.

The judgment matrix is positive and reciprocal. The derived measure is the scale of the relative importance weight of all the compared elements. It is also a proportional scale, which is defined in [0,1]. If the relative importance weight is known, the judgment matrix can be expressed as follows:

$$A = \begin{bmatrix}
\frac{w_1}{w_1} & \frac{w_1}{w_2} & L & \frac{w_1}{w_n} \\
\frac{w_2}{w_1} & \frac{w_2}{w_2} & L & \frac{w_2}{w_n} \\
L & L & L & L \\
\frac{w_m}{w_1} & \frac{w_m}{w_2} & L & \frac{w_m}{w_n}
\end{bmatrix}.$$  \hspace{1cm} (1)

In the above formula, the elements of the matrix are all positive numbers and meet the reciprocity. Under the condition that the judgment matrix meets the consistency, the eigenvalue problem is solved $A = \lambda_{mF}$. The normalized eigenvector is obtained to obtain the value of $\omega_m$. For complex social, economic, scientific, and technological problems, by establishing the analytic hierarchy process structure model and constructing the judgment matrix, the importance ranking weight of various schemes and measures can be determined by using the eigenvalue method for reference by decision-makers. It is very important to use big data to judge the consistency of the matrix [17]. The consistency of the judgment matrix refers to whether the judgment matrix meets the following relationship:

$$a_{ij} = A - \frac{a_{jk} - a_{ik}}{\lambda_{mF}} (i, j, k = 1, 2, \cdots, n).$$  \hspace{1cm} (2)

When the above formula is fully established, it is said that the judgment matrix has complete consistency. At this time, the maximum characteristic root of the judgment
matrix is $m = n$, and the other characteristic roots are zero [18]. Let $W_i$ be the superiority of the $i$th scheme for a target at the lowest level, and the matrix $A$ with the weight number calculated by any two subtargets as the element is called the judgment matrix.

$$W = \begin{pmatrix} W_1 & W_1 & \cdots & W_1 \\ \frac{a_{ij}W_1}{W_1} & \frac{a_{ij}W_2}{W_1} & \cdots & \frac{a_{ij}W_n}{W_1} \\ \frac{W_2}{a_{ij}W_1} & \frac{W_2}{a_{ij}W_2} & \cdots & \frac{W_2}{a_{ij}W_n} \\ \cdots & \cdots & \cdots & \cdots \\ \frac{W_m}{a_{ij}W_1} & \frac{W_m}{a_{ij}W_2} & \cdots & \frac{W_m}{a_{ij}W_n} \end{pmatrix}. \quad (3)$$

The evaluation is based on the judgment and quantification of the relative importance between any two factors. The 1-9 scale method is listed in Table 3.

Then, the element $a$ of the calculation judgment matrix can be obtained:

$$a_{ij} = 1 - W_i,$$
$$a_{ij} = \frac{1}{Wa_{ij}},$$
$$a_{ij} = W - a_{ik}a_{kj}. \quad (4)$$

Each column of the judgment matrix can be obtained by normalization:

\[ W = \begin{pmatrix} W_1 & W_1 & \cdots & W_1 \\ \frac{a_{ij}W_1}{W_1} & \frac{a_{ij}W_2}{W_1} & \cdots & \frac{a_{ij}W_n}{W_1} \\ \frac{W_2}{a_{ij}W_1} & \frac{W_2}{a_{ij}W_2} & \cdots & \frac{W_2}{a_{ij}W_n} \\ \cdots & \cdots & \cdots & \cdots \\ \frac{W_m}{a_{ij}W_1} & \frac{W_m}{a_{ij}W_2} & \cdots & \frac{W_m}{a_{ij}W_n} \end{pmatrix}. \quad (3) \]
Table 3: 1-9 scaling method.

<table>
<thead>
<tr>
<th>Scale</th>
<th>Definition (compare factors I and j)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>The former is as important as the latter</td>
</tr>
<tr>
<td>3</td>
<td>The former is slightly more important than the latter</td>
</tr>
<tr>
<td>5</td>
<td>The former is more important than the latter</td>
</tr>
<tr>
<td>7</td>
<td>The former and the latter are strongly important</td>
</tr>
<tr>
<td>9</td>
<td>The former and the latter are absolutely important</td>
</tr>
<tr>
<td>2, 4, 6, 8</td>
<td>Between the above two adjacent cases</td>
</tr>
<tr>
<td>Reciprocal</td>
<td>The two objectives are compared in reverse</td>
</tr>
</tbody>
</table>

\[
\tilde{a}_{ij} = \frac{a_{ij}}{\sum_{j=1}^{n} a_{ij}} - W. \tag{5}
\]

Add the normalized matrix of each column by row:

\[
M_i = S \sum_{j=1}^{n} \tilde{a}_{ij}. \tag{6}
\]

Normalize the vector \( K = (K_1, K_2, \ldots, K_n)^T \), then:

\[
W_i = \frac{M_i}{\sum_{j=1}^{n} S + K}. \tag{7}
\]

Calculate the nth root of the product of elements in each row of judgment matrix \( A \):

\[
\bar{W}_i = W_i \sqrt[n]{\prod_{j=1}^{n} a_{ij}}. \tag{8}
\]

The decision-making of college student managers has great subjectivity, which is mainly reflected in the selection of students in some activities. For example, when holding a selection, students believe that the school has roughly understood the standards, requirements, and rules for selection, election, and activities, so the selection will be relatively objective and fair [19]. However, in the process of specific implementation, the subjective consciousness of some university managers may occupy a large part. They often take their own teaching experience and management experience as an important basis for judgment, which affects the selection results. Using student management data can well screen the relevant conditions. Due to the complexity of big data technology and the diversity of people’s understanding, it is impossible to require every judgment to be completely consistent, but it is required to be consistent to a certain extent [20]. The consistency of the constructed judgment matrix needs to be tested in turn. According to the explicit decision-making problem, the hierarchical structure diagram is established as shown in Figure 4.

A complete scientific research evaluation index system includes two parts: evaluation indexes at all levels and the weight of corresponding indexes. Both are indispensable and form an organic whole. Index is the most basic element of evaluating the evaluated object. The change of each index will cause the change of evaluation results. Scientific research evaluation index is the concretization of scientific research evaluation goal and the specific factor constituting the goal. The index leaving the goal is meaningless, and the goal without index is unrecognizable. The three-level indicators in the scientific research evaluation index system are the specific reflection of scientific research input and output. Weight is the value that reflects the relative importance of each index in the whole index system. In the scientific research evaluation index system, different evaluation indexes play different roles in the whole evaluation system. In order to make each index play its due role, different evaluation indexes should be given different weights. The key to construct the scientific research evaluation index system is to ensure the scientificty and rationality of the index system. When selecting indicators, we should determine the evaluation objectives, evaluation standards, and evaluation priorities according to the school level positioning, long-term development objectives and overall planning, scientifically screen indicators for different evaluation objects and different evaluation contents, reasonably give evaluation index weights, and establish a scientific and reasonable evaluation index system. The scientific research evaluation index system constructed in this study is divided into three levels, and its structure is shown in Figure 5.

The implementation of a scientific and effective democratic decision-making mechanism in school management can form a practical and referential guidance for students’ civic democratic consciousness education. In all aspects of specific affairs related to school management, according to the scientific and democratic decision-making mechanism, the school enables students to fully understand the trend of school management, express problems related to their vital interests through practical and effective ways, supervise various affairs of school management, and enable students to participate in school life. As a member of the school, we should fully participate in school management affairs, make students fully understand their rights and obligations, help students better form civic consciousness in social life, and have political and practical significance for the education of students’ civic democratic consciousness. Students’ democratic consciousness is the need of socialist democratic politics. It is also the need of building a harmonious society. More importantly, it is to cultivate the needs of future qualified citizens for the development and progress of the whole society. It is an important part of promoting the comprehensive and diversified development of students.

2.3. Optimization of Student Management Evaluation System. The era of big data reveals three characteristics: more, more complex, and better. If we continue to process big data with traditional thinking, big data will only increase the capacity, and our workload will increase accordingly. When working on big data, we should change our thinking mode. First, we should form the thinking pattern of “everything is data.” Secondly, in the application process, we should use the thinking mode of big data to solve the problem of big data. Only when managers improve their
understanding and change their thinking can they promote the development of big data applications. Data collection is the source of data and the source of all work. In the process of data collection, schools should first respect the wishes of students and carry out data collection with the knowledge of students. Secondly, schools should establish a reasonable screening mechanism, extract the essence, remove the dross, eliminate false and useless information, avoid data pollution, and lay a solid foundation for data processing in the future. The architecture of college student education management evaluation system based on MFA is divided into four layers. The four-layer architecture is used to separate the business, which is convenient for the maintenance and modification of the system. The four layers are user application layer, business evaluation layer, data service layer, and database layer, as shown in Figure 6.

User application layer: this layer is the user interaction layer, which adopts the B/s development mode of Visual Studio 2010 framework. After the user sends a request, it carries out business processing and data transmission through the big data engine. Business evaluation layer: this layer is the business core of the system. Through the established evaluation index factor set, the student evaluation factors are analyzed hierarchically. Through the evaluation factor index set, the dynamic big data model is used to evaluate the quality of a single student evaluation factor, and then, the comprehensive evaluation model is used to evaluate the quality of a single student evaluation factor and the factors evaluated by all students. Data service layer: data access layer is the channel of data exchange between database layer and business logic layer, which is composed of data access components and data access services. Database layer: the data layer includes all physical data of the evaluation model. The evaluation model includes evaluation factor model database, evaluation factor weight model database, associated factor model database, comprehensive evaluation and analysis model database, and auxiliary meta database of the system.
Department of student education management evaluation in colleges and universities based on MFA

Target layer

Primary evaluation factors

Moral education

- Not to pocket the money one has picked up
- Do boldly what is righteous
- Helping the disabled and the poor
- Academic record

Intellectual education

- Publish one’s thesis
- Obtain a patent

Sports

- Participate in school level competitions
- Participate in provincial competitions

Other

- Student cadres
- Participate in activities
- Get funding

Secondary evaluation factors

Figure 7: Analytic hierarchy process of evaluation factors.

Figure 6: Student evaluation management platform based on big data.
According to the principle of analytic hierarchy process, the evaluation factor indexes of the student evaluation system are analyzed in hierarchy. The student evaluation system includes first-class factors such as morality, intelligence, and physique. Under each first-class evaluation factor, it is divided into second-class evaluation factors (or multilevel evaluation factors). Not only the first-class evaluation factors have different weights but also the secondary evaluation factors (or multilevel factors) below the primary evaluation factors have corresponding weights, as shown in Figure 7.

The college student education management evaluation system based on big data adopts the combination of single evaluation and comprehensive evaluation in the evaluation of students. In the design of each single evaluation factor, weight, evaluation method, analysis, and statistics of evaluation results, the training objectives and actual performance of students of different grades and levels should be considered. Considering not only the integrity of the comprehensive evaluation but also the superiority of an evaluation factor, the relationship between the evaluation result and each factor is complex and nonlinear, and because each factor has different influence on the final evaluation result, it is difficult to express the relationship between the evaluation result and each factor by mathematical expression. Big data can realize any complex
nonlinear mapping function, which makes it especially suitable for solving problems with complex internal mechanism. Therefore, this paper establishes the evaluation model by combining big data with fuzzy comprehensive evaluation. After fully considering the characteristics of the two evaluation methods, a comprehensive evaluation model is established. The comprehensive evaluation model of the system is shown in Figure 8.

In the multifactor student comprehensive evaluation model, the mathematical statistics method is mainly used. By establishing the maximum membership degree of the evaluation factors in the evaluation grade set, the maximum component in the evaluation grade is determined as the final evaluation grade. By establishing the evaluation model, the evaluation grade is stored in the relationship model and associated with the evaluation factor model. If the evaluation grade can be quantified in the evaluation grade, the quantitative relationship shall be established to form quantitative indicators. If the quantitative indicators can be clearly quantified, the qualitative treatment shall be carried out. The evaluation indicators shall be classified through classification to form qualitative indicators. Combined with their own work experience and the idea of mathematical modeling, the evaluation indicators of class management shall be determined as three aspects: study style construction, daily management, and characteristic innovation. Among them, the construction of study style includes the passing rate of students’ final examination results, the passing rate of skill examination, the rate of individual awards, and the rate of star dormitories. Daily management includes organization construction and system construction: characteristic innovation includes participation in social practice, scientific and technological lectures, and professional competitions. Figure 9 shows the hierarchical structure model of the class management evaluation system.

With the emergence of big database and the formation of big data environment, around the data mining of students’ personalized education, the school can provide every college student with accurate and scientific personalized education based on big database. With the help of electronic equipment, collect the data of students’ mastery of knowledge points. Through the feedback of data, teachers can better predict students’ learning effect and adjust students’ learning progress, so as to achieve the ideal teaching effect of common progress between teachers and students. At the same time, by collecting relevant information such as students’ achievements, interests, hobbies, and skills and using big data technology, we can match them with corresponding professional posts, realize higher quality employment of college graduates, promote students’ personalized development in the future, and create a “win-win” situation between schools and students. At present, big data technology realizes the change of statistical technology from macro group to micro individual; makes it possible to track, record, process, and analyze the data of a single individual; and provides a guarantee for students’ tracking and diversified evaluation. Through the capture of students’ individual micro behavior, students’ classroom situation, community activities, extra-curricular competition participation, social practice, style, and other information can be transformed into data, which helps us to understand students’ dynamic development at any time, look at students’ development more comprehensively, and make an objective and comprehensive evaluation from all aspects of morality, intelligence, and physical beauty in real time.

3. Analysis of Experimental Results

In order to study the optimization effect of student management evaluation system under the background of big data, this paper compares and tests the evaluation effect of school teaching network resource management and compares the comparison results of traditional methods and this method, respectively. The specific experimental results are shown in Figure 10.

It can be seen from Figure 10 that the method proposed in this study is obviously due to the traditional method and has strong advantages. Internship management is the key content of student management and an important part of student management. The management content includes schools, enterprises, and other aspects. This investigation is conducted on students’ practice management. Firstly, the investigation and analysis are conducted on students’ understanding of the network practice management platform of

![Figure 10: Comparison of evaluation results of school teaching network resource management.](image-url)
colleges and universities. The investigation shows that students do not know much about the network practice platform of colleges and universities. It can be seen from the survey data that students do not know enough about the internship management platform of colleges and universities. This also shows that at present, most internships in colleges and universities still rely on the traditional way of teacher publicity, as shown in Figure 11.

It can be seen from Figure 11 that the method proposed in this study is obviously due to the traditional method and has strong advantages. Life management is also an important part of student management in colleges and universities. Good life management is the care of the school and the state for students. Good life management is also the basic guarantee of teaching, learning, and order in colleges and universities. It is of great significance to the management of college students. Life management involves all aspects. This paper investigates the application of school electronic equipment and life management platform. The survey shows that although most students do not know much about the use of school electronic equipment and life management platform, the students who do not know at all are 0. This shows that students have at least an understanding of the relevant electronic equipment of the school, as shown in Figure 12.

It can be seen from Figure 12 that the method proposed in this study is obviously due to the traditional method and has strong advantages. Based on the above experimental detection results, it is not difficult to find that, compared with the traditional methods, the student management evaluation system method proposed in this paper has high practicability in the process of practical application, and the evaluation accuracy is significantly higher, which can better realize the effective management of massive student information and fully meet the research requirements.

4. Conclusion

This study applies big data technology to the system management of college students, and the main conclusions are as follows:

(1) Use big data technology to build a student education management model and standardize the evaluation index of student management
(2) Improve the student management evaluation algorithm, and optimize the student management evaluation system

(3) Experiments prove that the optimization method of student management evaluation system in the context of big data has high practicability

Data Availability

The experimental data used to support the findings of this study are available from the corresponding author upon request.

Conflicts of Interest

The authors declare that they have no conflicts of interest to report regarding the present study.

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