Applied logistic model to quantitative analysis of university student management

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Abstract. With China's emphasis on education and the constantly reform of education system, the management of students has been constantly improved. Colleges and universities are the places to train higher talents. The management of students should follow the educational reform in order to optimize the management mode and improve the management system. Based on the idea of Logistic regression, this paper establishes the evaluation model of college students' management work. In order to fully improve the accuracy of the model, students' satisfaction with the management of dormitory, bathhouse, library, canteen and other places is taken as the independent variable, and the overall school management satisfaction is taken as the dependent variable. Through the comparison of Logistic regression prediction and actual survey results, the accuracy and practicability of the model are tested, which is of great reference significance to the management of college students.

1. Introduction
With China's economic development entering the new normal, the in-depth popularization and development of network culture, the educational environment of college students has been profoundly changed. Student management work in colleges and universities is a fundamental task. Exploring the new methods and new way to solve the problem, running through all links of personnel training of the ideological and political education, working in efforts to emancipate the mind to promote university students' management work quality development is a vital task to be solved [1].

To solve the above problems, in 2012, Fang Liang, Hou Qifeng and Shi Lei introduced the feasibility and scientificity of the quantitative analysis scheme by using the method of hierarchical analysis and cluster analysis and taking the identification of poor students and the allocation of financial aid as examples [2]. In 2017, Zhu Xiaoman took Liaoning University of Science and Technology as an example to construct the student education management evaluation system. According to the annual assessment, the program evaluates the working status of students, which is divided into two categories: key work and routine work, accounting for 30% and 70% of the weight respectively. Three key first-level indicators reflecting the work of students' education and management are determined in the key work [3]. Later in 2020, Liang Xing, Guo Qianyu combined four basic principles (quantitative and qualitative, scientific and targeted, operability and comparability, classification and orientation) to design six class colleges and universities student management work performance evaluation indicators, consistency test result is obtained by analytic hierarchy process (AHP) software YAAHP, the pass rate is 100%. Their study shows the average college student management work to make effective guidance
for analysis [4]. However, it is still difficult for the previous management scheme models to be transferred to specific implementation. This paper will establish logistic model to conduct quantitative analysis on the management work of college students, so as to make the management scheme more objective, complete, comprehensive and applicable.

2. Logistic regression model of college student management evaluation

In the research stage of college student management program, the evaluation problem of management service can be simplified as the determination of "satisfied" and "dissatisfied", and can be expressed as "1" and "0", which becomes a typical discrete variable prediction problem. The discrete variable is relatively simple, but there are many factors that affect the management of students. This paper takes the satisfaction of dormitory, bathhouse, library, canteen and other aspects of school management as the dependent variable of the model, and the overall school work satisfaction as the dependent variable.

The selection of the dependent variables and independent variables of the student management work evaluation model can be expressed in mathematical.

Set the dependent variable symbol as

\[ y^{(i)} (1 \leq i \leq m) \]  

(1)

Where, \( i \) stands for the \( i \)th student surveyed, \( m \) stands for the total number of students. It is clear that \( y^{(i)} \) meets \( y^{(i)} \in \{0,1\} \). When students are satisfied with the management work, \( y^{(i)} = 1 \). When students are not satisfied with the management work, \( y^{(i)} = 0 \).

Set the independent variable symbol as

\[ x^{(i)} (1 \leq i \leq m, 1 \leq j \leq n) \]  

(2)

Where, \( j \) represents the \( j \)th independent variable factor, \( m \) and \( n \) represent dimensions of independent variables, that is, the number of major factors considered to affect student.

Establish the relationship between independent variables and dependent variables, limit the intermediate variable to \( z \), and its expression is

\[ z = \sum_{j=1}^{n} \theta_j x_j = \theta_1 x_1 + \theta_2 x_2 + \ldots + \theta_n x_n \]  

(3)

Where, \( \theta_j \) is the constant coefficient of the independent variable. This formula represents the sum of the values of each variable and the score of its weight, and represents the degree of influence of these factors on student management.

In order to facilitate operation, equation (3) can be reduced to Equation (4):

\[ z = \mathbf{\theta}^T \mathbf{x} \]  

(4)

Due to \( y^{(i)} \in \{0,1\} \), The judgment of and "0" and "1" can be expressed with probability, so the appropriate functional relationship \( h_{y_j}(x) \) between independent variable and dependent variable should be selected to describe the value probability of dependent variable, see equation (5) and equation (6)

\[ P(y=1 \mid x) = h_{y_j}(x) = \frac{1}{1 + e^{-z}} = \frac{1}{1 + e^{-\mathbf{\theta}^T \mathbf{x}}} \]  

(5)

\[ P(y=0 \mid x) = 1 - h_{y_j}(x) = 1 - \frac{1}{1 + e^{-z}} = 1 - \frac{1}{1 + e^{-\mathbf{\theta}^T \mathbf{x}}} \]  

(6)

Where, \( P(y=1 \mid x) \) states \( y=1 \), probability of satisfaction, \( P(y=0 \mid x) \) states \( y=0 \) probability of dissatisfaction, \( 0 < h_{y_j}(x) < 1 \). The above two expressions indicate that when \( z \) is positive and large, \( P(y=1 \mid x) = 1 \). When \( z \) is negative enough, \( P(y=0 \mid x) = 0 \). Therefore, it can be judged
whether students' management work is satisfied by selecting appropriate probability value [5].

3. Results and discussion

3.1. Data sources and indicators
This survey is mainly aimed at college students. In the form of questionnaire survey, questionnaires are designed for college students in combination with the actual situation, and self-filled anonymous survey is conducted [6]. The number of questionnaires issued is 500, and 500 are actually recovered. The designed independent variables are classified as dormitory, bathhouse, library, canteen, and other aspects of school management.

3.2. Statistical analysis

Figure 1. Dormitory management satisfaction survey results.
In terms of dormitory, 22%, 24% and 28% of the students are dissatisfied with the standards of dormitory staff hygiene inspection and the management of dormitory safety measures, as well as with the daily management of dormitory staff. The proportion of small, within the normal range. In terms of the strict use of high power in the dormitory and the paid use of excessive electricity in the dormitory, the proportion of students who are dissatisfied with the following attitude is 50% and 46% respectively. Both reached and nearly half, indicating management problems.

According to the above survey results, in terms of the use of prohibited items and the paid use of excess electric quantity, a reasonable explanation should be made from the perspective of students and try to get their understanding. Other aspects as well as in the case of stay satisfaction, further improve the work, such as a school at the time of hiring dormitory staff should pay special attention to carefulness and compassion, the sense of responsibility, which can facilitate interaction between students.
Figure 2. Bathhouse management satisfaction survey results.

In terms of the management of bathhouses, students who are dissatisfied with the infrastructure, opening time, sanitation and cleaning, and property protection during bathing occupied 58%, 46%, 58%, 60%, 64%, and 52% respectively. Most of them are more than half, indicating that there are serious problems in the management of the school bathhouse.

The results of the above survey, taken as a whole, are extremely severe. In addition to the facilities are not perfect, the cleaning is not good enough, the hot water supply time cannot meet the needs of most students, and the property protection of students while bathing is dissatisfied. The solution should be to improve the infrastructure, improve convenience and comfort, ensure daily cleaning, adjust the time of water supply according to students' work and rest at school, extend the water supply appropriately during holidays, and make it more humanized.

Figure 3. Library management satisfaction survey results.

From the result of the questionnaire, the students are satisfied with library management. The ban on occupying seats in the library received more than 76% of the satisfaction evaluation, and even 30% of the students gave the evaluation of "very satisfied", 70% of the students also express satisfaction with
the library facilities, but 52% of the students are dissatisfied with the speed of book update. In this regard, the library should strengthen the update of books, which is helpful for students to grasp the latest knowledge and understand the frontier development results of the subject, which is of great significance to students’ academic development.

Figure 4. Canteen management satisfaction survey results.

In terms of the canteen, 0% of the students is "very satisfied", 52% are "dissatisfied" and 48% are "terrible", more than half are negative. Suggestions are made accordingly: the purchase price of the canteen should be published in a timely manner, so that the selling price can be better understood by students. The canteen's weekday satisfaction survey is also mediocre, with 60% of students dissatisfied. In this regard, the supervision mechanism of canteen service personnel should be further improved, and can be long-term supervision, not seasonal, which is not conducive to promoting the enthusiasm of service personnel to improve their attitude, and ultimately not conducive to serving students.

Figure 5. Other aspects of school management satisfaction survey results.
In other aspects of school management, the student counselor has done a good job in helping students with their study and life, arranging professional courses, and fairness in granting scholarships. 10% of the students are very satisfied with the three types of management work, with the following attitudes being dissatisfied: 22%, 24% and 28%, respectively, which is a relatively normal proportion. Students' satisfaction with the measures of paying for the use of the gym during non-class hours is low, and 56% of the students hold the attitude of dissatisfaction or below, indicating that students' demands for physical activity after physical education class could not be met. Universities can add more sports venues without management costs, such as outdoor basketball courts, badminton courts, tennis courts, etc., to weaken students' demand for sports stadiums when they need to carry out daily sports activities, and at the same time increase students' opportunities to exercise and improve their physical fitness.

3.3. Evaluation of logistic model prediction

![Comparison between the actual value of college students' management satisfaction survey and the predicted value of Logistic regression.](image)

Figure 6. Comparison between the actual value of college students' management satisfaction survey and the predicted value of Logistic regression.

In order to verify the correctness of the model, the survey results of another 50 respondents are taken and put into the model. The overall management satisfaction of the school is judged again, and the predicted average value is taken to compare with the actual average value. As shown in figure 6, the average accuracy of the test results of satisfaction is 92.70%, showing a high accuracy, indicating that this model has a high reference value for the management of college students.

Detailly, the survey of “very satisfied” option meets the prediction most. The relative error reaches as high as 97.33%, the “general” and “terrible” option show the lack of accuracy, the prediction value is 88.30% and 85.87%, which is more than 10%. However, the prediction still shows the characteristic of the indicator. The distribution of students' is similar to the overall trend of university management. The average proportion of dissatisfaction in the management of dormitory (except the staff of the dormitory administrator), bathhouse, canteen and the overall management of the school are 48.0%, 57.2%, 43.5% and 56.8% respectively. Dormitory, bathhouse and canteen, as areas closely connected with students' daily life, can provide students with convenience and comfort as much as possible, which can greatly affect students' overall satisfaction with school management. At the same time, in the satisfaction survey of fees, most students are dissatisfied with or even very dissatisfied with the attitude. It is suggested that while standardizing the fee standards, universities should be transparent about the handling measures, deepen the communication between universities and students, and avoid unnecessary misunderstandings so as to gain students' understanding of school management.

4. Conclusions
The management of students in ordinary colleges and universities is the basic work and foundation of their development. Effective student management can provide a solid foundation for the sustainable development of ordinary colleges and universities, and also provide a guarantee for their development in various aspects. The degree of student management can be objectively determined according to various satisfaction indexes. This paper establishes Logistic regression model by setting the satisfaction of management work of dormitory, bathhouse, library and canteen as qualitative and quantitative indicators, and makes a comprehensive and objective evaluation of the satisfaction of management work in colleges and universities successively. The validity and accuracy of the model is proved and an important reference for university management is provided.

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