



# The Research on Adjustment of University Students in Financial Hardship

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**Abstract:** Funding university students in financial hardship is one of the most important works in education field of China. This paper researches how to adjust the level of students in financial hardship with considering the effect of dormitory culture construction (DCC) and consumption. An evaluation system with considering self-satisfaction, moral performance, academic performance, academic potential, volunteering outside the dormitory, and dormitory hygiene performance is established to measure the effect of DCC and, applying the binary Logistic regression model, the validity of the system is examined. On the basis of taking subjective evaluation and objective quantitative factors into full consideration, the Analytic hierarchy process model is then utilized for the estimation of the effect of DCC, combined with the analysis of campus consumption behavior questionnaire, students' consumption behavior is divided into 4 categories by K-means clustering algorithm, meanwhile, the average value for each category can be calculated. This paper takes the necessary consumption as the base, determine the adjustment strategy according to the ranking of the effect of DCC to make our funding work more reasonable and efficient. The data from South-Central Minzu University is used to check the model, The comparison of the results before and after adjustment is shown in this paper, and the comparison results reveal that our model has a good stability and can recognize the growth of students.

**Keywords:** Dormitory Culture Construction, Binary Logistic Regression Model, Analytic Hierarchy Process, K-means Clustering

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## 1. Introduction

Funding university students in financial hardship is one of the most important works in China, accurate identifying and dynamic adjusting of their levels of hardship are the two key points. Nowadays, universities identify students in the following levels of financial hardship: "High", "Middle", "Low" as well as "None of above" when they enrolled in September, after that, the level of hardship will be adjusted according to the performance of students in every term. Identifying students in financial hardship based on their growth background is a proven and effective method [1]. However, there is still no uniform standard on how to adjust the financial hardship level of students according to their performance in school, many scholars try to solve this problem by researching their consumption on campus, and

produce some valuable results [2-4], but the effectiveness of this method has declined due to the popularity of mobile payments (such WeChat pay and Alipay pay), which means that it's necessary to add some other elements to make the results from the model much more reliable.

The value of the state grants is not just financial aid, but also helping students have a better future. To have a better future, the students should establish correct moral values, cultivate active learning consciousness and good working habits. Strengthening dormitory culture is widely accepted to achieve the goal since the good dormitory culture plays an important role in management, service, and education [5]. Many scholars have demonstrated the necessity and significance of dormitory culture construction (DCC) from the aspects of formation of values, academic performance, behavioral habits and interpersonal relationships [6-10].

Thus, measuring the effect of DCC for students comes first, then consider their consumption, finally, adjust the level of financial hardship. This method has the following three benefits:

Providing some new ideas for doing a good job in student financial aid. Traditional identification and adjustment methods are often limited to a narrower view of consumption, overemphasizing financial assistance but ignoring ideological and learning assistance to students.

Expanding the effective coverage of DCC. Nowadays, many universities have carried out the construction of dormitory culture, but the way to evaluate the effect is more qualitative than quantitative. An evaluation system for the effect of DCC can help enhance students' collective sense of belonging, stimulate students' enthusiasm for participating in DCC, and expand the effective coverage of DCC.

Enriching the dimension of cultural construction in universities. The dormitory culture is an important part of the university culture. The traditional dormitory culture is limited to inspections and evaluations for sanitation. However, the paper break through the limitations of traditional dormitory cultural construction activities by constructing a dormitory culture evaluation system that includes ideological attitudes, learning awareness and labor habits.

The paper is organized as follows: Section 2 constructs an evaluation system for the effect of DCC, with considering the students' performance in their dormitories; Section 3 determines adjustment strategy of students in financial hardship with considering the effect of DCC and students' consumption; Finally, the conclusions are given in section 4.

## 2. The Evaluation System for the Effect of DCC

Students are the main participants and beneficiaries of DCC. The evaluation system should fully stimulate the enthusiasm of students to participate DCC and reflect how students grow under DCC. At the same time, this evaluation system should stick to the principle of combining subjective evaluation with objective quantified evaluation.

Subjective evaluation is reflected in the students' satisfaction with the atmosphere of their dormitory, because their satisfaction directly determines the enthusiasm of students to participate in DCC. The more satisfied students are with the dormitory atmosphere, the more actively they will participate in DCC, and vice versa. Objective evaluation is reflected in how students grow up under the educational

influence of DCC, as we mentioned in the introduction, it should include correct moral values, cultivate active learning consciousness and good working habits.

According to the preliminary investigation from the school, this paper revises and expands the indexes discussed in [5, 9-12], after considering the subjective and objective factors, this paper constructs the evaluation system by those factors as follow: self-satisfaction, moral performance, academic performance, academic potential, volunteering outside the dormitory, dormitory hygiene performance. The definitions and assignments are as follows:

**Self-satisfaction:** It is the only subjective indicator, which reflects students' satisfaction with their dormitory. Each member in the dormitory can score it from 10 to 0 respectively. The self-satisfaction of a dormitory is the arithmetic mean of the members' scores.

**Moral performance:** The moral performance reflects whether it is a qualified person as education should serve to breed qualified people. Everyone's initial value is 5 points, if he/she is punished by the school or the government, 3 to 5 points will be deducted respectively, if he is commended by the school or the government, 3 to 5 points will be added respectively. It should be emphasized that the commendation is limited to the moral category. The moral performance of a dormitory is the arithmetic mean of the members' scores.

**Academic performance:** It is assigned the arithmetic mean of grade point average (GPA) of the dormitory members.

**Academic potential:** This index is set to make up for the deficiencies of the academic performance indicator, because a student's pre-enrollment academic base will affect academic performance. Academic potential cares about students' academic progress, and it is assigned the arithmetic mean of GPA growth rate for dormitory members.

**Volunteering outside the dormitory:** It reflects students' efforts to serve the society. The score will be added 1 point for each hour of volunteering activities per student, with a maximum of 10 points. Similarly, volunteering outside the dormitory is the arithmetic mean of the members' scores.

**Dormitory Hygiene Performance:** It is assigned the scores of university health inspection, with the highest and the lowest points from 10 to 0 respectively.

This paper considers the binary Logistic regression model to test whether the evaluation system can be used to measure the effect of DCC or not. From the investigation of 256 students from 64 dormitories at SCMZU, the results of binary Logistic regression model are shown in Table 1.

*Table 1. The results of binary logistic regression model (via SPSS).*

Variables in the Equation	B	S. E.	Wald	df	Sig.
Self-satisfaction	-0.138	0.049	14.477	-0.138	0.000
Moral performance	-0.067	0.097	0.869	-0.067	0.000
Academic performance	-0.545	0.080	86.313	-0.545	0.000
Academic potential	-0.320	0.075	23.431	-0.320	0.000
Volunteering outside the dormitory	-0.238	0.062	26.150	-0.238	0.000
Dormitory Hygiene Performance	-0.374	0.092	26.086	-0.374	0.000
Constant	-0.339	0.076	22.868	-0.339	0.000

It can be seen from Table 1 that all the P-value of indexes are less than 0.05, which means that they can be used to distinguish whether the effect of DCC is good or not under the confidence level of 95%. So, using the evaluation system which indexes are shown in Table 1 can measure the effect of DCC.

### 3. The Adjustment Strategy Based on AHP and K-means Clustering Model

#### 3.1. AHP: Measuring the Effect of DCC

Analytic Hierarchy Process (AHP) is a decision-making model that combines qualitative and quantitative. It decomposes the relevant elements related to the decision into three levels: target, criteria and schemes. After analyzing the interrelated influences and subordinate relationship between the elements, the problem can be attributed to determine the weight of the bottom level (scheme level) in relation to the top level (target level) [13].

As the study analyzed in sec. 2, this paper builds a hierarchy diagram, where the effect of DCC is the target layer, and subjective and objective are the criteria layer, the six indicators in Table 1 are the scheme level. as shown in Figure 1.

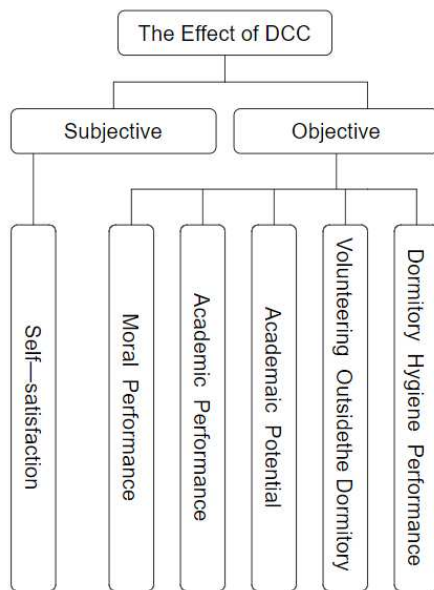


Figure 1. The hierarchy diagram.

After determining the pairwise comparison matrix between criteria layer and target layer, we interviewed a number of staff members with rich experience in dormitory management and combine their opinions to obtain the pairwise comparison matrix.

$$H_1 = \begin{pmatrix} 1 & 1/4 \\ 4 & 1 \end{pmatrix}.$$

the normalized eigenvector corresponding to the maximum characteristic root of  $H_1$  is  $w_1 = (0.2, 0.8)$ . That is to say, the

weight between subjective evaluation and objective quantification is 0.2 and 0.8, respectively.

Because the subjective evaluation corresponds to only one scheme, the weight of this scheme (self-satisfaction) is 1. We next determine the pairwise comparison matrix of the scheme level to the subjective evaluation criteria level and calculate the weights for each scheme. We use the expert scoring method and obtain that:

$$H_2 = \begin{pmatrix} 1, 1, \frac{1}{3}, \frac{1}{2}, \frac{1}{3} \\ 1, 1, \frac{1}{5}, \frac{1}{3}, \frac{1}{2} \\ 3, 5, 1, 2, 1 \\ 2, 3, \frac{1}{2}, 1, \frac{1}{2} \\ 3, 2, 1, 2, 1 \end{pmatrix}$$

The maximum characteristic root of matrix  $H_2$  is 5.116, and the corresponding normalized eigenvector is:

$$w_2 = (0.1, 0.09, 0.34, 0.19, 0.28),$$

they are the weights corresponding to each index.

Then, this paper needs to perform a consistency test, only the matrix and results passing the consistency test are acceptable.

We use  $\lambda_{max}$  and to represent the largest eigenvalue of an  $n$ -th order matrix  $H$ , we say that the matrix  $H$  passes the consistency check, if  $CR = \frac{CI}{RI} < 0.1$ , where  $CI = \frac{\lambda_{max} - n}{n-1}$ , and the value of  $RI$  is shown in Table 2.

Table 2. The relationship of  $RI$  and  $n$  [13].

$n$	1	2	3	4	5	6	7
$RI$	0	0	0.58	0.9	1.12	1.24	1.32

Remark 1: if  $n = 1$  or  $2$ , The matrix is directly judged to passing the consistency check.

It is easy to verify that both  $H_1$  and  $H_2$  pass the consistency check.

Finally, this paper obtains those weights of six indicators

$$\begin{aligned} w &= w_1 \cdot \begin{pmatrix} 1 & 0 \\ 0 & w_2^T \end{pmatrix} \\ &= (0.2, 0.8) \begin{pmatrix} 1 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0.1 & 0.09 & 0.34 & 0.19 & 0.28 \end{pmatrix} \\ &= (0.2, 0.08, 0.072, 0.272, 0.152, 0.224). \end{aligned} \quad (1)$$

The results show that:

- The weight of academic potential is 0.272, which is the largest. It shows that we are more concerned with student's progress, rather than absolute performance, which can reflect the helpfulness of financial aid. This is consistent with the purpose of financial aid and proves that our result is reasonable.
- The weight of dormitory hygiene performance is 0.224, which is the second largest. This is a very intuitive test index for the effectiveness of DCC, it doesn't need too much skill, just be done carefully, so it reflects that the

students we hope to cultivate are hardworking and down-to-earth.

- c) The weight of self-satisfaction is 0.2, which is higher than the average. It shows that students' subjective awareness is important, because they can influence our willingness to participate in other activities.
- d) The remaining three indicators is lower than the average, but they also have their own emphases. As a whole, the weights of the six indicators vary from large to small, which can better reflect different aspects of DCC, and provide reference for students to do well in DCC from

different perspectives.

Let's use  $y_i$  to represent the value of the dormitory on indicator  $i$ , where  $i = 1, 2, \dots, 6$  denote self-satisfaction, moral performance, academic performance, academic potential, Volunteering outside the dormitory, and dormitory hygiene performance respectively. Let  $x_i$  be the normalized value, the formula is:

$$x_i = \frac{y_i - \min y_i}{\max y_i - \min y_i}. \quad (2)$$

Then we define the effect index of DCC

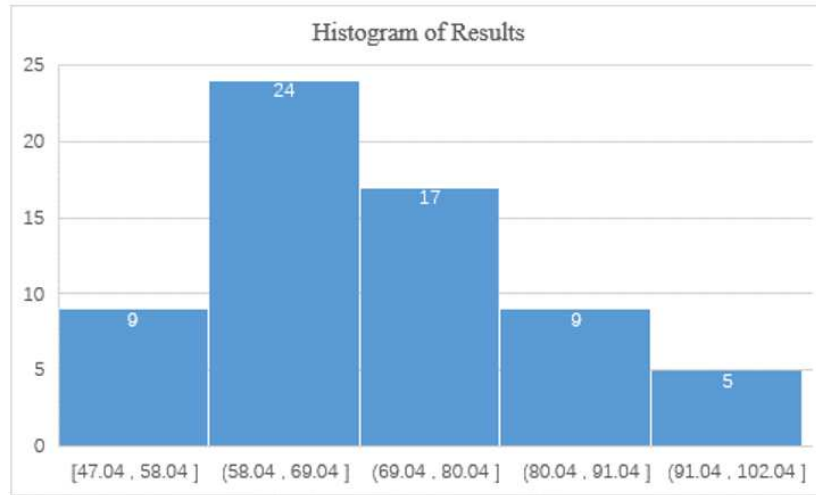
$$R = 0.2x_1 + 0.08x_2 + 0.072x_3 + 0.272x_4 + 0.152x_5 + 0.224x_6. \quad (3)$$

Using the data mentioned in section 2, the score for 64 dormitories are calculated, and the results are shown in Table 3.

**Table 3.** The basic statistical results.

Number	Maximum	Upper Quartile	Lower Quartile	Minimum	Average Value	Standard Deviation
64	96.17	78.57	63.22	47.04	70.72	12.50

Remark 2: We enlarge the result of formula (2) by 100 times in order to improve the resolution.



**Figure 2.** The histogram of results.

From Table 3 and Figure 2 we can know that:

- a) The indexes are in the interval of [47.04, 96.17], and have an obvious gradient, which shows that our model is suitable in measuring the effect of DCC.
- b) Getting a high score in the evaluation is not simple, the higher the score, the greater the difficulty, this phenomenon is similar to the classification of household financial hardship.
- c) There are nine dormitories with low scores because some dormitory members have been punished, resulting in low scores in moral performance. we found that although the weight of moral performance is low, most dormitories will not lose point in this part. Once the deductions are made, it will greatly affect the final result.

### 3.2. K-means Clustering: Classifying Students' Consumption Situation

K-mean clustering is an iterative algorithm [14], it can be

described as follow: Given observations  $z_j$ , where each observation is a  $d$ -dimensional real vector, K-means clustering aims to partition the  $n$  observations into  $k$  sets  $S_1, \dots, S_k$  so as to minimize the within-cluster sum of distance functions of each point in the cluster to its center [15]. In other words, the objective is to find:

$$\min \sum_{j=1}^k \sum_{x \in S_i} (x - \mu_i)^2.$$

where  $\mu_i$  is the center of  $S_i$ .

We use  $m = (m_1, m_2, m_3, m_4)$  to represent the average monthly consumption of students, in which  $m_1$  represents the cost of food on campus,  $m_2$  represents the cost of food outside the campus,  $m_3$  represents the cost of school supplies, such as purchasing study materials, participating in academic exchange activities, etc., and  $m_4$  represents the cost of entertainment. The above consumption totally comes from the living expenses provided by the student himself or his family, excluding the part-time income of the student and the scholarship.

We use *K*-mean clustering to divide students' consumption into 4 categories, which map the level of financial hardship "High", "Middle", "Low" as well as "None of above". The results show that the monthly expenses for each category are CNY 896, CNY 1,180, CNY 1,405, CNY 1,860, the number of students in each category (percentage) are 8 (3.1%), 27 (10.6%), 47 (18.4%), and 174 (67.9%). This percentage is similar to the school's estimates for each level, which implies that the method is reliable.

### 3.3. The Adjustment Strategy

Now we put forward the adjustment strategy. First, according to the school's documents, the family financial hardship level of the students who have just entered the school is determined. The recognition level is divided into "High", "Middle", "Low" as well as "None of above", then at the beginning of each semester, we adjust the level according to the following guidelines:

- a) Students whose monthly average consumption does not exceed CNY 1,180 are "High" level candidates, and those whose effect index of DCC rank in the top 8 are identified as "High" level of financial hardship.

- b) Among the remaining students, students whose monthly average consumption does not exceed CNY 1,405 are "Middle" level candidates, and those whose effect index of DCC rank in the top 27 are identified as "Middle" level of financial hardship.
- c) Among the remaining students, students whose monthly average consumption does not exceed CNY 1,860 are "Middle" level candidates, and those whose effect index of DCC rank in the top 47 are identified as "Middle" level of financial hardship.
- d) The others identified as not difficult.

This adjustment strategy takes the consumption situation as the base and uses the effect of DCC to determine the level, which not only reflects the financial aid bottom line of the state grant, but also reflects the important role of the state grant in helping students become talented.

### 3.4. Results and Analysis

According to the above strategy, we get the adjustment strategy of these 256 students. The comparison of the results before and after adjustment is shown in the following table.

**Table 4.** The comparison results of initial and adjusted identification.

		Adjusted identification				Column total
		High	Middle	Low	None of above	
Initial identification	High	6	1	1	0	8
	Middle	1	17	4	5	27
	Low	1	7	25	14	47
	None of above	0	2	17	155	174
Row total		8	27	47	174	256

Table 4 shows that:

- a) The model identifies 8 students as in high level of financial hardship, in which 6, 1, 1 and 0 students are identified as in high, middle, low and none of above level in initial identification, respectively.
- b) The model identifies 27 students as in middle level of financial hardship, in which 1, 17, 7 and 2 students are identified as in high, middle, low and none of above level in initial identification, respectively.
- c) The model identifies 47 students as in low level of financial hardship, in which 1, 4, 25 and 17 students are identified as in high, middle, low and none of above level in initial identification, respectively.
- d) The model identifies 256 students as in none of above level, in which 0, 5, 14 and 155 students are identified as in high, middle, low and none of above level in initial identification, respectively.
- e) At any level, the majority of people remain unchanged, and the changes are only for a small number of students, indicating that our model has a good stability.
- f) Two students who were initially identified as "High" difficult are adjusted to "Middle" and "Low" level. The adjustment to "Middle" is because his consumption level is high, reaching CNY1, 300, which does not meet the preset conditions of extreme hardship. The adjustment to

"Low" is for that they had been punished meanwhile their dormitory hygiene is in a bad situation, it shows that our model can identify the changes of students in a reasonable way.

- g) The similar methods [16-17] have been shown to be effective, this paper improves the indexes based on DCC, and the results are more reasonable.

## 4. Conclusion

This paper discussed how to adjust the recognition level of students in financial hardships, the effectiveness evaluation system of DCC is constructed by clarifying the aim of state grant. We calculate DCC index of by AHP model: *K*-means clustering algorithm is used to classify the consumption level of students, set adjustment strategies, and make an empirical analysis. The results show that our model has both good stabilities, and the ability to examine student growth. Our model can provide help and reference value for the dynamic adjustment of students in financial hardships.

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