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Research Article

Innovation of Trade Union Work in Colleges and Universities Based on Mathematical Modeling and Multivariable Optimal Design

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The constant expansion of higher education has led to the continuous increase of the teaching staff and the complexity of the work in the modern era of education, forcing the traditional colleges and universities (it is abbreviated as CU in this article) to participate in trade union activities to open up the road of innovation. What kind of method can effectively and quickly optimize trade union work (TUW) and improve satisfaction has become one of the research topics that has attracted much attention. Aiming at this problem, it has great research significance for the field of CU to participate in trade union activities. With the in-depth research on the work of trade unions in CU, the research on multivariate optimal design in the work of trade unions in CU is gradually carried out, and its advantages are of great significance for solving problems in the work of trade unions in CU. The purpose of this paper is to study the innovation of TUW mode in CU based on multivariate optimization. Through the analysis and research of the multivariate optimization idea, it can be applied to the innovation of the construction of the labor union work model in CU, and the multiobjective linear weighting method is used to solve the objective function, so as to solve the problem of improving the evaluation of labor union work satisfaction in CU. This paper analyzed the TUW in CU (it is abbreviated as TUW in this article) and the multivariate optimization design, conducted an experimental analysis on the improved TUW mode in CU, and used relevant theoretical formulas to explain. The results have shown that the overall evaluation score of the college TUW method proposed in this paper is higher than the traditional college TUW method, and the difference between the two is 18.7%. It can be seen that the university TUW based on mathematical modeling and multivariable optimal design can meet the innovation needs of university TUW, and the satisfaction and work efficiency are greatly improved.

1. Introduction

Traditional TUW must be reinvented in the contemporary era of soaring data and information at colleges and institutions. Traditional labor union work procedures have been unable to fulfill the growing needs of employees for more diverse and complex tasks. The multivariable optimization (MO) design is a new idea to solve multiobjective problems. It can solve complex problems with multiple constraints. Due to its functional advantages, it has been applied to various fields to successfully solve various target constraints. It studies how to satisfy these conditions on average while the target has multiple constraints and finally obtains the optimal solution that satisfies these conditions as much as possible. The problem of TUW in CU is actually a very typical multiobjective problem, which is limited by various conditions and factors, such as work attitude and work planning issues such as the number of meetings in the trade union work, the number of welfare payments, the number of cultural and sports activities, etc., and requires mutual coordination to obtain the final optimal solution. This method has far-reaching significance for how to improve the job satisfaction of trade unions in CU under the condition of multiobjective constraints. In recent years, some scholars have applied multivariate optimization thinking to the problem of TUW innovation, but their satisfaction with the work of trade unions

in CU is not high. Therefore, it is of great significance to apply the thinking of MO in this paper to solve the problem of innovation in the work of trade unions in CU.

At present, with the gradual complication of TUW in CU, more and more scholars have explored the work of trade unions in CU. Among them, Burrows J explored the history of the first union in the British film industry for an understanding of the history of union work in colleges [1]. In order to improve the cohesion of employees in the work of trade unions in CU, Larsson B examined the extent of sectoral and regional aggregation trends that exist in trade union cooperation networks and whether there are differences between sectors in terms of structure, density, and central participants [2]. Vazquez-Bustero D adopted an integrated complementary approach to analyze the effectiveness morbidity and contingency framework of participatory labor practices (HIWP) of Spanish manufacturers and applies it to a labor framework study of university unions [3]. To improve the effectiveness of university unions, Christian looked into how social customs affect unions, which are one of the most fundamental forms of collective action [4]. In order to study the influencing factors of union activities in universities, Adascalitei D examined the impact of the economic crisis and the impact on collective bargaining [5]. However, these studies on TUW did not innovate the TUW in CU.

The multiobjective optimization design can be used in the innovation of TUW in CU, and it has a good performance in the accuracy and diversity of obtaining the optimal solution. Among them, Ye et al. developed a MATLAB platform for evolutionary multiobjective optimization to appropriately benchmark existing algorithms [6]. To facilitate the study of large-scale multiobjective and multiobjective optimization, Ran C addressed many test flaws based on a multiobjective optimization system [7]. In order to solve the proposed uncertainty multiobjective programming, Zhong S proposed an interactive uncertainty satisfaction method involving the flexible needs of decision makers [8]. In order to improve the multiobjective optimization algorithm, Bossek et al. proposed various test functions, which were used in literature research [9]. To improve the efficiency of multiobjective problem handling in university collaborative work, Ali proposed a new method, called LibFinder, to ensure that reuse opportunities are not missed during software maintenance and evolution [10]. These methods improve the efficiency and accuracy of multiitem problem processing to a certain extent, but their complexity is relatively high.

In order to solve the abovementioned innovation problems of TUW in CU, this paper uses multiobjective optimization design to analyze the work of trade unions in CU and simulates the effect of working methods to achieve the effect of improving the job satisfaction of trade unions in CU. The innovation of this paper is using mathematical modeling and multivariable optimal design to analyze the innovation of TUW in CU and introducing how it plays a role in the innovation research of college labor union work based on mathematical modeling and multivariable optimal design. This paper expounds the proposed TUW in CU. Through experiments, it is found that the TUW of the college has better effect and higher efficiency, which greatly improves the satisfaction of TUW in CU.

2. Innovative Methods of Trade Union Work in Colleges and Universities

2.1. Content and Organization of This Article. With the deepening of TUW in CU, the traditional work mode of trade unions in CU cannot meet the needs of current faculty and staff, and the existing defects and insufficiencies are increasingly prominent. In some colleges and universities, there is insufficient research, the work plan is not clear, the work effect is not good, and the satisfaction is not high. Therefore, it is very important to innovate the work of trade unions in CU to improve employee satisfaction [11]. The current [12] work situation of trade unions in CU is shown in Figure 1.

Through the investigation, it is found that the current innovative research on TUW in CU based on mathematical modeling and multivariable optimal design is not complete. Therefore, this paper proposes to innovate the TUW in CU based on mathematical modeling and multivariable optimal design [13]. Multivariate optimal design can study the interaction of multiple variables. This paper has analyzed the related methods of labor union work and multivariate optimization in CU, applied multivariate optimization design to the innovation of labor union work in CU, and put forward a new method of labor union work in CU. Through the comparative test experiment between it and the traditional college TUW, it shows that the college TUW based on mathematical modeling and multivariable optimal design is more effective than the traditional method [14]. The organization [15] of the full text is shown in Figure 2.

2.2. Mathematical Modeling and Multivariable Optimal Design

2.2.1. Multivariate Optimization Design. From the perspective of improving the job satisfaction of trade unions in CU and reducing cost consumption, this paper considers the innovation of TUW in CU. The employee's satisfaction with the work of the trade union in CU is mainly affected by the structure of the work of the trade union. Workers first set the overall work requirements, which makes the trade union work not only meet the complete job requirements, but also achieve the purpose of improving employees' satisfaction with the university trade union work. The multiobjective optimization algorithm optimizes the two variables of employee satisfaction and the least cost consumption. After determining the specific work arrangement plan, the labor union work practice is carried out according to the optimized work plan.

2.2.2. Establishment of a MO Model for the Innovation of TUW in CU. In this paper, the multivariate optimization design is introduced into the design of the TUW model in innovative CU, and the multivariate optimization is analyzed below. Multivariate optimization requires simultaneous optimization without explicitly balancing two or more objective

Figure 1: The work of trade unions in CU.

Figure 2: Full-text content organization.

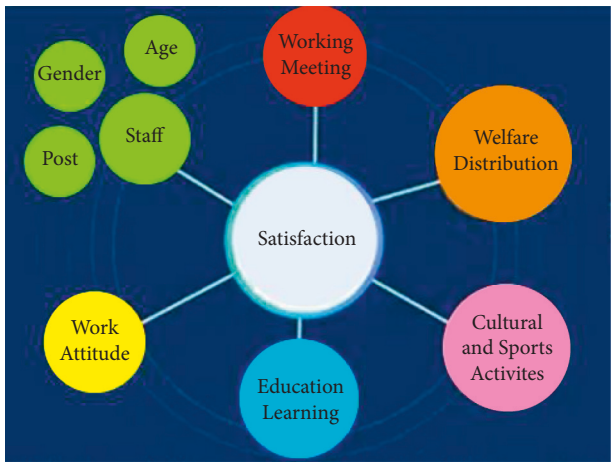

Figure 3: Factors affecting the job satisfaction of college unions.

functions. According to the idea of MO, the mathematical model description of MO is obtained as shown in formulas (1) and (2):

$$M \text{ in } f(g) = [f_1(g), f_2(g), \ldots f_k(g)], \tag{1}$$

$$s.t.\, h_i(g) = 0, \quad i = 1, 2\, L, y\, x \in R_n. \tag{2}$$

Among them, $f(g)$ is the MO objective function of university TUW innovation; $h_i(g)$ is the constraint condition for MO of university TUW arrangement; let n represent the number of decision variables in TUW; let k represent the number of optimization functions; and y represent the number of constraints. If only the job satisfaction of college unions is optimized, the optimal solution is the one that maximizes the value of the objective function under the given constraints. If multiple objectives such as job satisfaction and cost consumption of college unions are optimized at the same time, the optimal solution is a PO solution set. It refers to the ideal state of resource allocation, the optimal state of which means there is no room for improvement. That is, this improvement is the best path and method to achieve its best state.

Applying multivariate optimization to the innovation of TUW in CU requires attention to the use of the following concepts.

Pareto dominates, and its basic conditions are shown in formula

$$\begin{aligned} f_i(g_0) &\le f_i(g_1), \quad \forall i = 1, 2, \ L, k; \\ f_i(g_0) &< f_i(g_1), \quad \exists i = 1, 2, \ L, k. \end{aligned} \tag{3}$$

g_0 is the solution and dominates $g_1 x^0 p g^1$.

For Pareto optimal (PO) or Pareto noninferior optimal, its basic conditions are shown in formula

$$\exists g^1 : g^1 p g^0. \tag{4}$$

Among them, g_0 is the PO solution.

The PO solution set can be expressed by formula:

$$Q_s = \left\{ g^0 | \exists g^1 q g^0. \right\}. \tag{5}$$

Among them, Q_s represents the set of all PO solutions, which means that it can simultaneously satisfy multiple objective variables such as optimizing the job satisfaction of trade unions in CU and reducing cost consumption [16].

The Pareto front or equilibrium surface is the region formed by the objective function values corresponding to all PO solutions. That is, the objective function value corresponding to the Pareto optimal solution is the Pareto optimal frontier. It can be expressed by formula (6) as

$$W_f = \left\{ f(g) = (f_1(g), f_2(g), Jf_k(g)) | g \in q_g \right\}. \tag{6}$$

Among them, W_f represents a region, the Pareto front or equilibrium surface, which is formed where all Pareto optimum solutions are represented by the objective function values.

In this paper, the multiobjective linear weighting method is used to solve the MO problem in TUW in CU. Multiobjective linear weighted method addition is to first assign different weight coefficients to each objective function, then apply corresponding weights to all multifunctions, and then add them to form a new objective function. For multivariate optimization problems, the traditional solutions are to use hierarchical sequential methods and adaptive function methods. Hierarchical sequence method refers to the method of classifying and addressing multiple purposes according to their importance.

The mathematical expression of the multiobjective linear weighting method can be specifically expressed by formulas (7) and (8):

$$\max \sum_{i=1}^{n} \delta_i f_i(g), \tag{7}$$

$$s.t. \sum_{i=1}^{n} \delta_i = 1. \tag{8}$$

Among them, δ_i is the weight added to each variable that affects employees' job satisfaction with the trade union in CU. The weight can be seen as the employee's preference for this target item that affects the job satisfaction of the college union. Therefore, to compare the amount of resources in all TUW in CU, it is necessary to unify the resource requirements of each TUW task. The required value of a unified university TUW resource is shown in formulas (9) and (10):

$$t(i,k) = \frac{T(i,k)}{t_k}, \tag{9}$$

$$t_k = \max T(i,k). \tag{10}$$

Among them, $t(i,k)$ is the number of resource requirements for the unified work project of the university trade union. After the homogenization process, the demand of each resource for any task is between [0, 1], so the demand for each resource has a certain possibility of comparison. The factors that affect the job satisfaction of college unions are reflected in various aspects. This paper summarizes and categorizes some influencing factors and puts forward the hypothesis of the influencing factors of college trade union

Table 1: Basic characteristic data of some surveyed employees (abbreviated as *E* in the table).

Project	E 1	E 2	E 3	E 4	E 5
Gender	Male	Male	Female	Female	Male
Age	20–30	51–60	20–30	31–40	41–50
Length of service	0–5	20+	6–10	6–10	11–20
Post	Lecturer	Professor	Administration staff	Lecturer	Security guard

Table 2: Survey data on the development of some TUW.

Project	E 1	E 2	E 3	E 4	E 5
Number of working meetings per month	0–2	5+	3–4	3–5	0–2
Number of monthly benefit payments	3–5	0–2	0–2	0–2	3–5
Number of cultural and sports activities organized per month	3–5	0–2	0–2	5+	3–5
Number of educational learning organizations per month	5+	3–5	0–2	5+	0–2

job satisfaction. The predetermined factors that affect the job satisfaction of college unions are shown in Figure 3.

As shown in Figure 3: The assumptions put forward on the factors that affect the job satisfaction of college unions have the basic characteristics of employees. At this time, the optimal solution set can be obtained by solving the MO model of the university TUW through the multiobjective linear weighting method, such as the number of work meetings, the number of welfare distribution, the number of cultural and sports activities, and the number of education and training.

3. Experimental Results

Data Sources: The data of this experiment comes from two colleges A and B that have passed the 90-day experimental test with different unions. The trade union of University A adopts the multivariable optimized TUWing method, and the trade union of University B adopts the traditional university TUW method. After the experiment is over, the experimental effect data is collected in the form of a questionnaire survey. A total of 300 questionnaires were distributed, and 279 were recovered, with 276 valid and a 92 percent successful recovery rate. The questionnaire survey mainly focuses on the basic characteristics of the tested employees, the labor union work situation of the surveyed universities, and their satisfaction evaluation for the school labor union work. The questionnaire survey is broken down into three sections, each with multiple subitems. The content of the first part is the basic characteristics of the surveyed employees. The content of each attribute and part of the data are shown in Table 1.

Among them, this part of the questionnaire is arranged as a single-choice question, and the tested employees choose the option that conforms to the actual situation according to the actual situation. The items in this parameter table are composed of 4 attributes, namely, employee gender, employee age, employee length of service, and employee position.

The second part is about the development of TUW in the surveyed schools. The content of various attributes and some data are shown in Table 2.

The second part of the questionnaire is set to multiple-choice questions, and there are four items in total, namely: the number of monthly work meetings; the number of monthly welfare payments; the number of cultural and sports activities carried out per month; the number of educational and learning activities organized per month. The answer options are set to 0–2 times, 3–5 times, and more than 5 times.

The third part of the questionnaire is the employee's satisfaction rating for the work of the school's trade union. The content of each item and part of the data are shown in Table 3.

This part is to collect employee satisfaction with the work of trade unions in different CU, and there are 5 items in it, namely: satisfaction with holding work meetings; satisfaction with welfare distribution; satisfaction with carrying out cultural and sports activities; satisfaction with organizational education and learning; satisfaction with overall union work. The evaluation scale is 5-level evaluation; 1 is very dissatisfied and 5 is very satisfied.

According to the model and method constructed in the article, the calculation is carried out, and through the appropriate structural allocation for each work of the trade union in CU, it is expected that "the lowest input cost and the highest satisfaction evaluation" can be achieved.

Significant influence of employee characteristics and job satisfaction of university trade unions: This experiment collected employee characteristics and trade union job satisfaction evaluation scores through a questionnaire survey and used algorithms to process and analyze the data to obtain a significant influence of employee characteristics and university trade union job satisfaction. The specific analysis results are shown in Figure 4.

As shown in Figure 4: In the analysis of the significance of the impact on the job satisfaction of the trade union in CU, the coefficient of the significance of the impact of the characteristics of the staff on its significance is distributed between -0.1 and 0.1, which is due to the impact of the characteristics of the staff on the job satisfaction of the trade

Table 3: Scores of some employees on the job satisfaction evaluation of the trade union.

Project	E1	E 2	E 3	E 4	E 5
Satisfaction rating for the conduct of work meetings	5	4	5	3	2
Satisfaction rating for benefit distribution	3	3	4	1	1
Satisfaction rating for carrying out the problem activity	3	4	3	2	4
Satisfaction ratings for organizational education learning	4	3	4	4	3
Overall satisfaction rating for union work	4	3	5	3	2

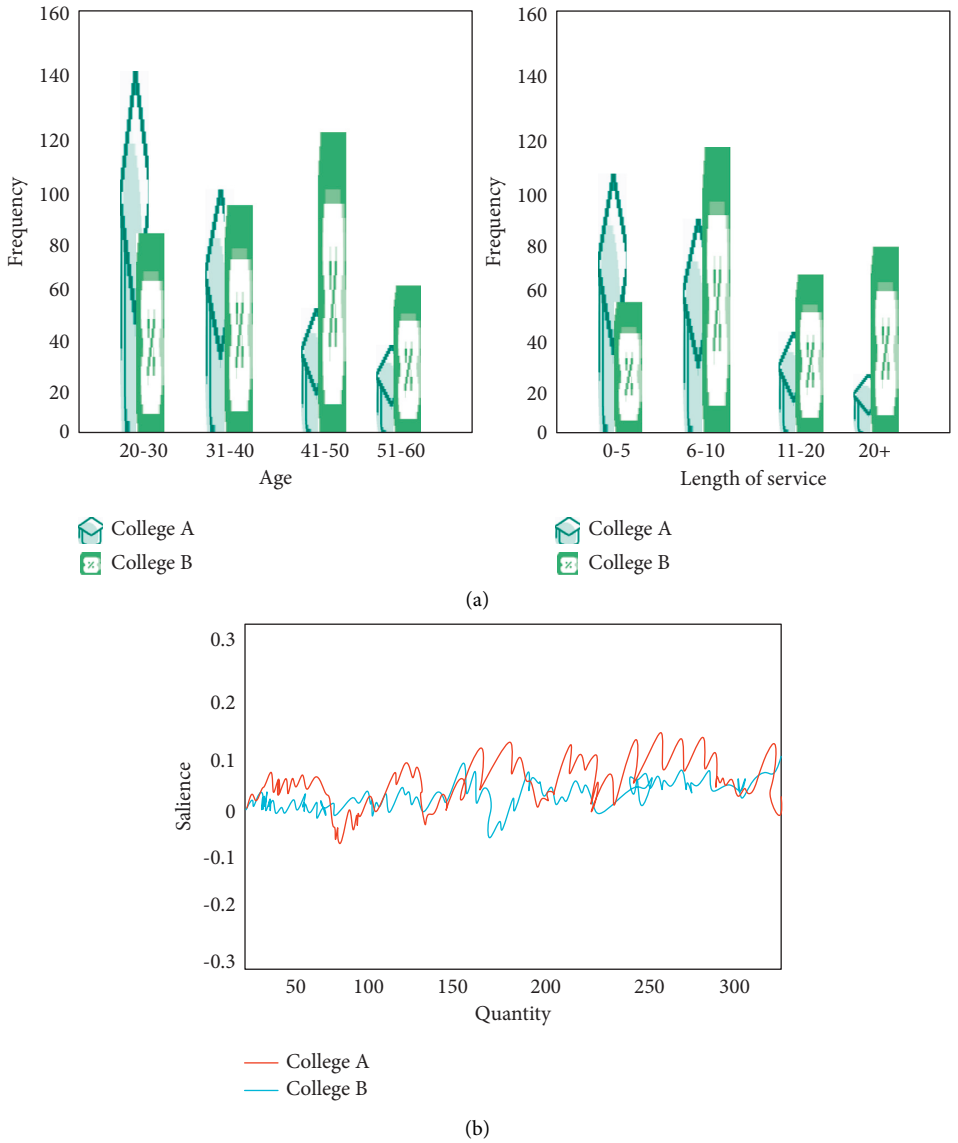

Figure 4: The distribution structure of employee characteristics and the significant influence of the job satisfaction of college unions. (a) Basic characteristic structure of employees in different CU. (b) The significant influence of the basic characteristics of employees on the job satisfaction of the union.

union. It can be seen that the characteristics of employees are not the key factors influencing the job satisfaction of college unions.

Comparison of the development of TUW in CU and its influence on satisfaction: After analyzing and comparing the development of various work in the trade union of CU with the significance of the impact of employees on their satisfaction, the specific results are shown in Figure 5.

As shown in Figure 5: In the analysis of the significance of the impact on the job satisfaction of the trade union in CU, the coefficient distribution of the significance of the work meeting on its impact is between -0.8 and 0. This is because employees are tired of meeting after work, so too many meetings lead to dissatisfaction; and increasing relaxation activities and issuing benefits can improve employees' work enthusiasm and relax their mood. It can be

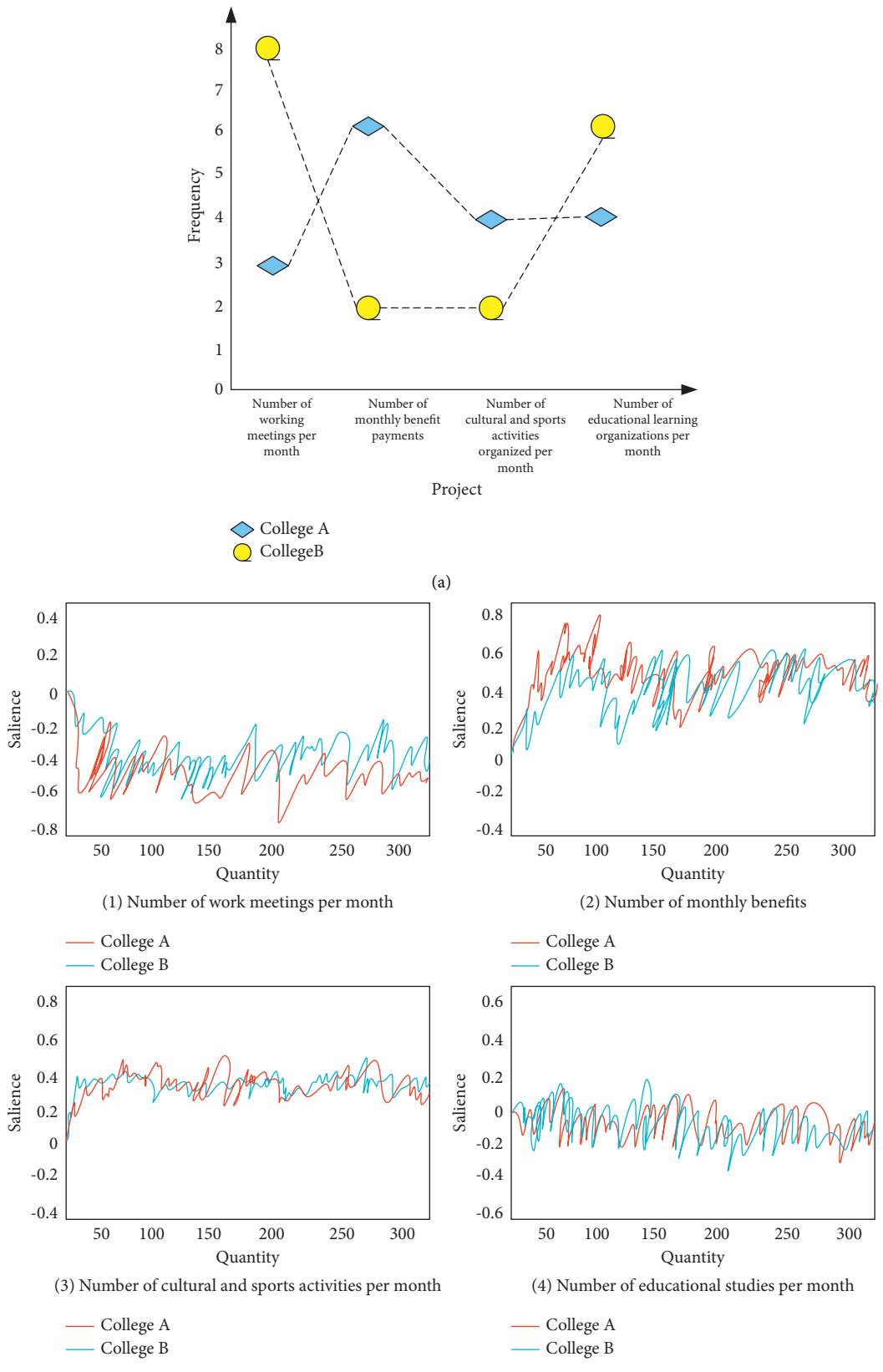

FIGURE 5: Significant analysis of the development of TUW in different universities and its impact on satisfaction. (a) Development of TUW in different universities. (b) Significant influence of TUW development items on satisfaction.

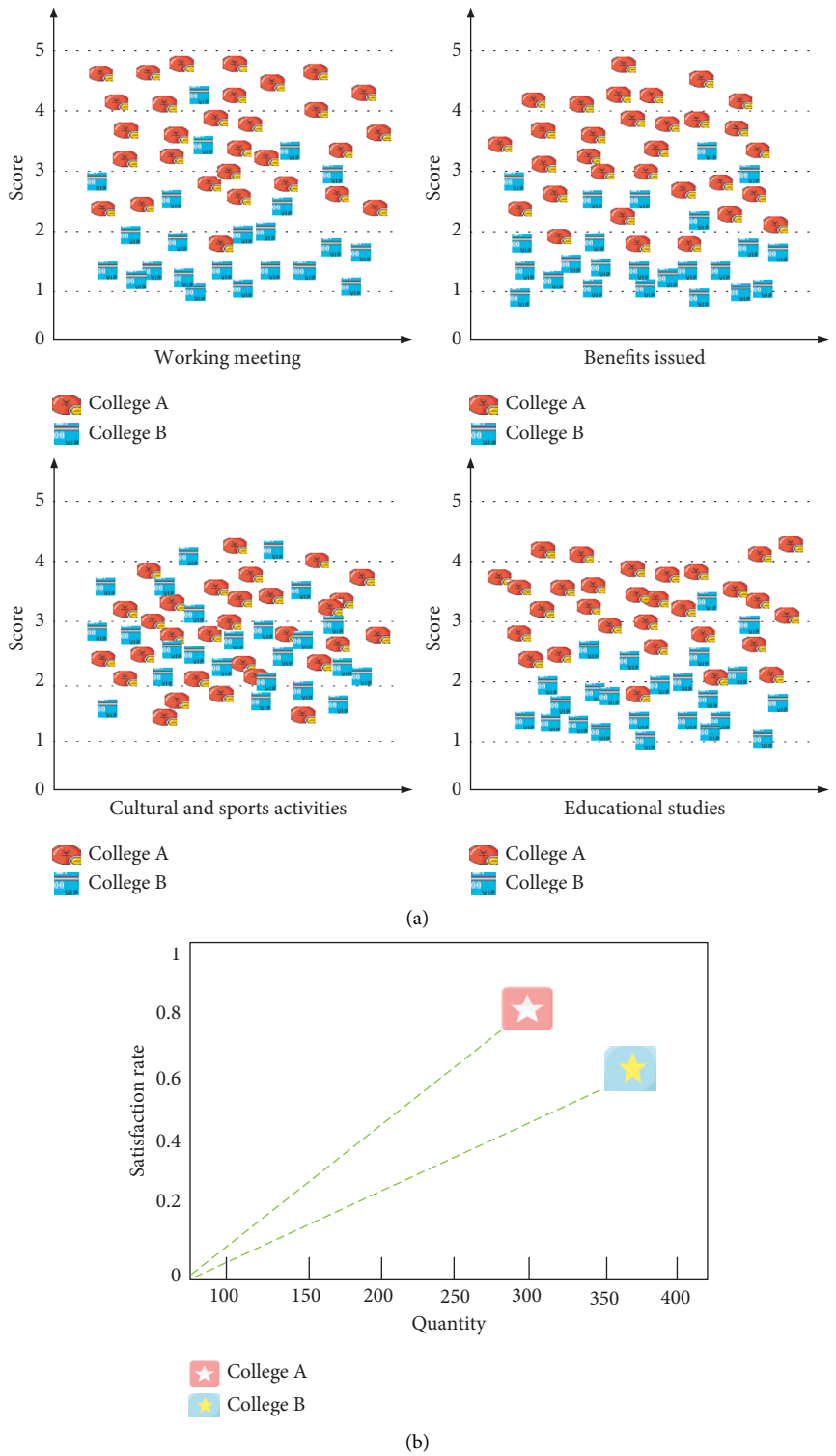

Figure 6: Evaluation of employee satisfaction with trade unions in different CU. (a) Distribution of satisfaction evaluation of various employees in TUW in different CU. (b) Overall satisfaction evaluation of TUW in different CU.

seen that the work conference has a negative impact on the work of the trade union in CU, while the welfare distribution and cultural and sports activities have a positive impact, and they are both key factors affecting the job satisfaction of the labor union.

3.1. Satisfaction Evaluation of Labor Unions in Different CU. Through the comparative analysis of the employee satisfaction evaluation of college A using innovative college TUW and college B using traditional TUW, the specific results are shown in Figure 6.

As shown in Figure 6, the data samples with a score of 3 or more are marked as satisfied with the work of the trade union in CU. It can be seen that, on the whole, the employee satisfaction of college A using the innovative college TUW is higher than that of college B using the traditional college TUW. The employee satisfaction of college A reaches 0.754, while the employee satisfaction of college B reaches 0.613. This is because the university TUW method adopted by University A is based on the multivariable optimal design, and the structure of each work has been adjusted.

Through the comprehensive experimental test, it can be seen that the employee satisfaction of college A, which adopts innovative college TUW, is better than that of college B, which adopts traditional college TUW. This shows that the comprehensive objective of the study for the multiobjective optimization design of TUW in CU is excellent. Not only is the stability strong, but the satisfaction rate of its overall plan is 18.7% higher than that of traditional TUW.

4. Conclusion

The importance of dealing with the problem of multitasking objectives has gradually increased, and the innovation of the work of trade unions in CU has intensified. The requirements of employees for the work of trade unions in CU are also getting higher and higher. The innovation of TUW in CU is inseparable from the contribution of multivariable optimal design. Multivariate optimization has been widely used in many fields because of its functional advantages. This paper conducts an overall analysis through the design of TUW and MO in CU and then analyzes their functions with relevant principle formulas; through the significant analysis of the impact of employee characteristics and university trade union job satisfaction, it is obtained that employee characteristics are not the key influence information on satisfaction. The analysis of the work development shows that the conference has a negative impact on the work of the trade union in colleges and universities, while welfare distribution and cultural and sports activities have a positive impact; this paper compares the innovative university TUW with the traditional university TUW through case simulation and draws the following conclusions: based on multiobjective optimization, the job satisfaction evaluation of trade unions in innovative universities is higher than that of traditional universities, and the work efficiency of trade unions can be improved. Therefore, it is very necessary to study TUW in CU based on mathematical modeling and multivariate optimal design. It achieves the purpose of improving the job satisfaction of trade unions in CU, but there may be some uncertain factors, such as the instability of the test environment, the difference of operators, etc., which makes the results of this experiment not completely accurate and reliable with certain differences.

Data Availability

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

Conflicts of Interest

The author declares that there are no conflicts of interest.

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