Optimization of Office Layout of Education and Training Institutions Based on SLP

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Abstract. With the development of society, training institutions have become an indispensable part of the progress of the times. The control of teaching quality and cost of training institutions are important influencing factors of training institutions. This paper takes the functional layout of an education and training institution as the research object, uses SLP layout theory as the basis for simulation and design, conducts layout design of each functional area, conducts simulation analysis of the personnel flow relationship, non-flow relationship and comprehensive relationship of the training institution. Finally, After correcting the design, a scientific and reasonable layout is designed. In the end, the layout plan of the training institution reduced the floor space by 22.13% and increased the reserved space by 93.8 ㎡, which provided the possibility to add functional areas in the future, thus increasing the flexibility of the layout of the training institution.

Keywords: training institution; management optimization; SLP; layout design

1 Introduction

With the further development of social sciences, both the country and families attach great importance to educational activities, so commercial activities in education have become more and more diverse[1][2]. Training institutions are also one of the products of the development of educational commercial activities, and they are also the fastest growing an industry. In the face of relevant national policies, more and more people are beginning to pay attention to and enter the training business circle. Therefore, how to gain a foothold and develop in this market with more wolves and less meat will be a major issue facing the training business community[3].

For training institutions, teaching quality and cost control are important factors that affect whether the company can operate normally[4]. Teaching quality is the decisive factor that determines whether an enterprise can develop in the long term and is the most fundamental issue affecting the source of students. Cost control is one of the main factors that determine whether an enterprise can operate, recover its investment and generate benefits[5].

At present, most training institutions are in the form of small workshops[6]. Most of their purposes are to take advantage of the opportunity to get a share of this industry, so they treat training as a commodity by discounting, giving away classes and other real economy marketing models to attract people[7]. customer. In fact, education and training is not a

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commodity, but a service. What customers ultimately focus on is not whether it is affordable or not, but whether they can be satisfied with the quality of the service. If you regard it as a commodity and adopt an operation model that only looks at quantity, it can only exist for a short period of time and cannot become a masterpiece.

As a training institution, the most important thing is to retain customers. However, in the training industry, almost every training institution currently faces the problem of being recognized and praised by society when operating on a small scale. Induced by the benefits it brings, institutions begin to transition from quality to quantity[8]. When the number of students reaches a level that is no longer consistent with the scale of the original enterprise, they will expand the scale to meet the current demand. After the scale is expanded, many transformations will occur[9]. The problems faced by institutions include a decline in teaching quality, original customers leaving the institution, a serious reduction in the number of students, and rising costs after transformation. Institutions have to continue to focus on quantity and adopt commodity marketing methods to expand enrollment. Attracting customers through various activities or physical objects and making a short-term transaction will prompt the company to face the problem of replenishing students at any time, resulting in excessive costs and having to reform or exit the industry[10].

In summary, scholars have conducted relatively little research on the layout of training institutions, especially on the use of SLP to solve this problem. Therefore, it is necessary to apply the SLP method to study training institutions and enrich the research methods of this content. This article uses the SLP space layout theory to strengthen the connection between the key functional areas of the training institution, so that the company can effectively control key teaching activities, costs and teaching quality in the further development process.

2 Company profile

Dezhi Education mainly focuses on training for junior high school students and senior high school students, and mainly provides homework guidance during holidays, weekends and evenings. From 2013 to 2016, it provided services to more than 300 students and achieved good service results, which was recognized by a wide range of students and parents. According to statistical forecasts from 2013 to 2016, it is expected that the daily flow of students will reach 400 in 2018. While ensuring the quality of teaching, 10-15 teachers will be needed in order to continue to provide student training with high quality and quantity in 2018. services while expanding its own scale. Therefore, SLP theory was used to make relevant plans for the new campus. The purpose of this planning: Service quality management personnel can effectively control training activities and training quality, facilitate the flow of most personnel, use space reasonably and effectively, and at the same time effectively ensure the safety of students and staff at school.

The school has functional areas such as teaching area, canteen, principal's office, teacher's office, teacher's dormitory, student dormitory, information management room, conference room, etc. Taking into account the increase in the number of students, it is no longer the simple small workshop model of the past, and how to arrange the number of students to exceed 400 requires careful thinking. According to previous data compilation, on the premise of ensuring the quality of teaching, each class can have a maximum of 20 people and a

maximum of 5 classes a day, which is equivalent to a class that can serve 100 students a day and accommodate a total of 400 students, so a design is needed The four classes are named four functional areas: Teaching Area A, Teaching Area B, Teaching Area C, and Teaching Area D.

Through the above data analysis and sorting, it is concluded that the system needs to design teaching area A, teaching area B, teaching area C, teaching area D, canteen, person in charge's office, teacher's office, teacher's dormitory, student dormitory, data management room, conference room 11 For each functional area, the related work unit table is compiled as shown in Table 1. At the same time, each functional area is roughly introduced in the table and its existing role is given.

Table 1. Ribbon name number and description

No.	Ribbon name	Description
1	Office of the person in charge	All teaching supervision places
2	Teacher's office	Teachers' working place after class during working hours
3	Teaching area A	Teaching place
4	Teaching area B	Teaching place
5	Teaching area C	Teaching place
6	Teaching area D	Teaching place
7	Data management room	All data collection locations
8	Meeting room	For use in all meeting spaces
9	Teachers dormitory	Teachers' living place
10	Student dormitory	Residential student accommodation
11	Canteen	All student and staff dining locations

3 SLP solution

3.1 SLP system design method

The SLP layout method proposes a dense representation method of the mutual relationships between work units, which is a process that develops from the qualitative stage to the quantitative stage. In the process of SLP system layout design, products, output, production routes, auxiliary departments and production time will be the basic elements and used as the starting point of the design work. Starting from macro theory to forming actual design plan. The detailed steps of the SLP layout method are shown in Figure 1.

The mathematical model for constructing the SLP method is shown in formulas (1) to (3).

$$S = \min\left(\sum_{i=1}^{N} R_i\right) \tag{1}$$

$$R_i \geq r_i \tag{2}$$

$$N \geq n \tag{3}$$

S represents the total minimum area of the sum of operating units(ribbons). i represents the ribbon number. N represents the total number of ribbons. R_i represents the area of the i-th ribbon. n represents the minimum number of ribbons required. r_i represents the minimum area requirement of the i-th ribbon. Formula (1) represents the sum of the minimum areas of all

ribbons. Formula (2) indicates that the area of the *i*-th ribbon cannot be less than the specified minimum value. Formula (3) indicates that the total number of ribbons cannot be lower than the required minimum value.

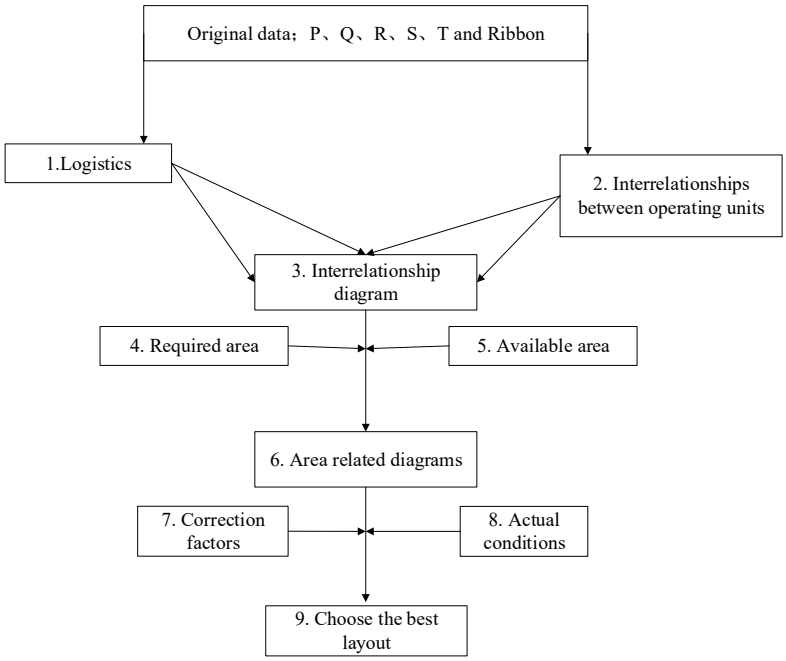

Fig. 1. SLP system design method

3.2 Student flow analysis

Through analysis of relevant data from the institution, it is estimated that the student flow in 2021 will be 400, with 10-15 teachers and 4 other staff members. The initially determined functional areas include teaching area, canteen, principal's office, teacher's office, teacher's dormitory, student dormitory, data management room, and conference room. Under the premise of ensuring the quality of teaching, each class can have a maximum of 20 people and a maximum of 5 classes a day. This is equivalent to a class that can serve 100 students a day and accommodate a total of 400 students. Therefore, 4 classes need to be designed. The four functional areas are named Teaching Area A, Teaching Area B, Teaching Area C, and Teaching Area D. Through the above data analysis and sorting, it can be concluded that the training institution needs to design teaching area A, teaching area B, teaching area C, teaching area D, canteen, person in charge's office, teacher's office, teacher's dormitory, student dormitory, data management room, conference room 11 functional areas.

The student flow intensity with a student flow ratio of 6.3 or above is recorded as A, the flow intensity with a flow intensity of 4-6.3 is recorded as E, the flow intensity with a flow ratio of 1.8-4 is recorded as I, and the flow intensity with a flow ratio of 0-1.8 is recorded The intensity is recorded as O, and the flow levels of other flow ratios are recorded as U. In the process of assigning flow intensity, the upper limit is taken for each value range, and the lower limit is not taken. By sorting out the flow proportions and assigning values to the flow

intensity according to the above rules, the original data were further analyzed and a student flow correlation diagram was compiled as shown in Figure 2.

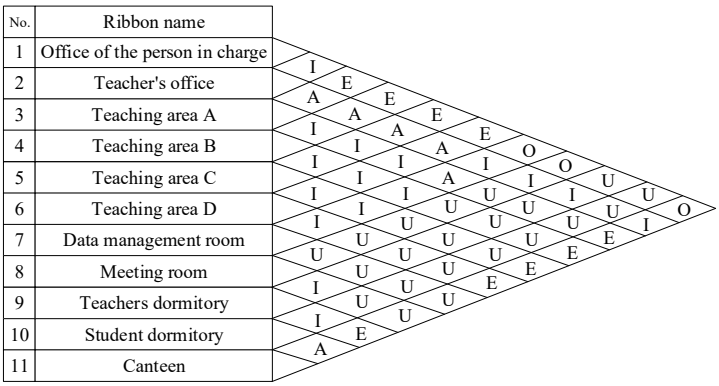

Fig. 2. Student mobility related chart

3.3 Non-current relationship analysis

In the service process provided by all training institutions, the people we participate in this activity mainly include teachers, students and related staff. In order to strengthen the control of teaching quality, the factor of student flow in the teaching place cannot be the only determining factor and should be combined with illiquid relationships and co-determination, thus requiring an analysis of illiquid relationships.

In the process of dividing the non-fluid relationship between each functional area, the main factors that affect the division include work connection requirements, work nature requirements, safety requirements, work control, supervision and management [3-4]. 1 scores 2 points, 2 scores 2 points, 3 scores 1 point, 4 scores 3 points, and 5 scores 2 points. Find the score of each key functional area pair, and record the non-current relationship grade with a score >= 7 points as A , the non-mobile grade with a score of 6 is recorded as E, the non-mobile grade with a score of 3-5 is recorded as I, the non-mobile grade with a score of 1-2 is recorded as O, and those who must stay away due to work factors are recorded as X. The non-current correlation diagram is prepared as shown in Figure 3.

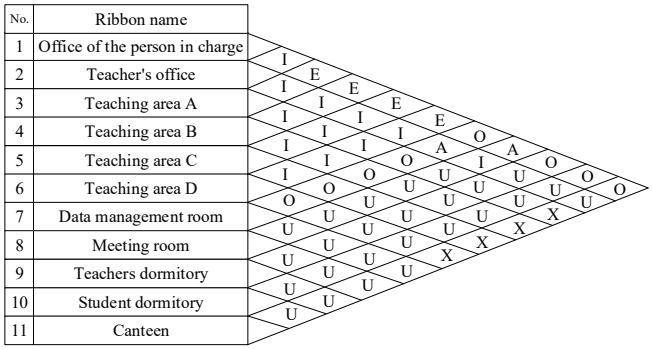

Fig. 3. Non-current correlation diagram

3.4 Comprehensive relationship analysis

In determining the interrelationships between functional areas, both the flowing interrelationships and the non-flowing relationships between functional areas have varying degrees of influence. On the one hand, these two factors have an absolute influence on the layout of each functional area. On the other hand, these two influences have different effects in degree. Therefore, in this process, the flow relationship and the non-flow relationship will be divided according to 3:1. The relationship is weighted and assigned, and the comprehensive relationship correlation diagram is compiled according to A=4, E=3, I=2, O=1, and U=0, as shown in Figure 4.

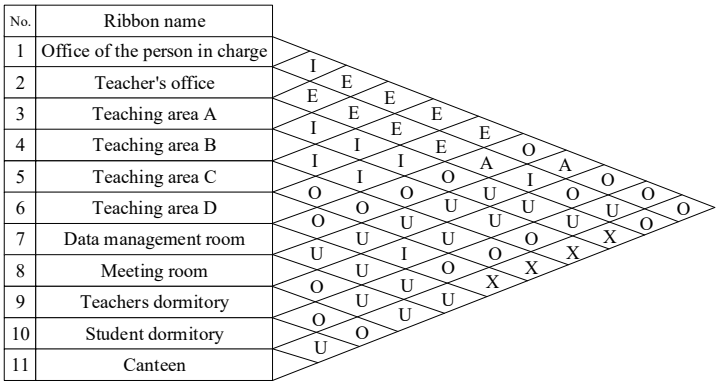

Fig. 4. Non-current correlation diagram

3.5 Layout optimization

Based on the data in Figure 3, a comprehensive proximity ranking table between pairs of units is compiled. The horizontal and vertical directions represent the functional area serial numbers, and the middle is the comprehensive relationship level and score between functional areas. Finally, the score of each functional area is calculated. and, get the final score, and sort them in descending order of comprehensive proximity. The comprehensive proximity ranking table is obtained as shown in Table 2.

Table 2. Comprehensive proximity table

No.	1	2	3	4	5	6	7	8	9	10	11
1		I/2	E/3	E/3	E/3	E/3	O/1	A/4	O/1	O/1	O/1
2	I/2		E/3	E/3	E/3	E/3	A/4	I/2	U/0	U/0	O/1
3	E/3	E/3		I/2	I/2	I/2	O/1	U/0	U/0	O/1	X/-3
4	E/3	E/3	I/2		I/2	I/2	O/1	U/0	U/0	O/1	X/-3
5	E/3	E/3	I/2	I/2		I/2	O/1	U/0	U/0	O/1	X/-3
6	E/3	E/3	I/2	I/2	I/2		O/1	U/0	U/0	O/1	X/-3
7	O/1	A/4	O/1	O/1	O/1	O/1		U/0	U/0	U/0	U/0
8	A/4	I/2	U/0	U/0	U/0	U/0	U/0		O/1	U/0	U/0
9	O/1	U/0	U/0	U/0	U/0	U/0	U/0	O/1		O/1	O/1
10	O/1	U/0	O/1	O/1	O/1	O/1	U/0	U/0	O/1		O/1
11	O/1	O/1	X/-3	X/-3	X/-3	X/-3	U/0	U/0	O/1	O/1	

Comprehensive proximity	22	22	10	10	10	10	9	7	5	7	-8
Sort	2	1	3	4	5	6	7	8	10	9	11

First, find out the job pairs 1 and 2 that rank first and second in comprehensive proximity. Based on them, find the comprehensive relationship with the functional area as I, so we get a score of 2; then find out the comprehensive relationship with the functional area with a level of A. It is 1-8, 2-7, so arrange the 8 and 7 functional areas. Since the comprehensive relationship level is A, the score is 4; then find out the comprehensive relationship level E with the functional area: 1-3, 1-4, 1-5, 1-6, 2-3, 2-4, 2 —5, 2-6, so functional areas 3, 4, 5, and 6 are arranged. Since the comprehensive level is E, the score is 3; recent fine-tuning based on the actual situation has resulted in a reasonable layout, as shown in Figure 5.

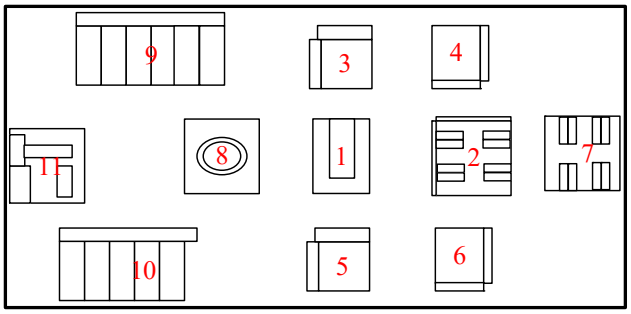

Fig. 5. Training institution layout results.

4 Evaluate

This layout has a total of 11 functional areas, and there are 8 functional categories in these 11 functional areas. From a general perspective, it can be divided into living area and teaching area. The area indicators before and after layout optimization are shown in Table 3.

Table 3. Area comparison table

No.	Area before optimization(㎡)			Area after optimization(㎡)		
1	Covered area	Actual area	Utilization	Covered area	Actual area	Utilization
2	423.8	432.8	100%	423.8	330	77.87%

From the comparison in Table 3 above, we can know that the improved area utilization rate has been reduced from the original 100% to 77.87%, and at the same time, 93.8 ㎡ of unused area has been obtained. The excess area can be used to place furniture, artwork or other activity rooms, adding reserved space for the future layout of the training institution and increasing the flexibility of the layout.

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