Campus Landscape Design and Social Space Construction in Universities: Based on Design Psychology

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Abstract: The landscape design of university campuses is not only related to the beauty and function of the university, but also to the social life and mental health of college students. In this context, the application of design psychology to the construction of university campus landscapes has increasingly attracted people's attention. This article was based on the psychology of landscape design in universities, combined with the use of social spaces in universities, and conducted in-depth research on how the campus landscape of universities affects the social behavior of college students. This article provided an in-depth analysis of the psychological foundation of university campus landscape design and, combined with practical cases, elaborated on the impact of campus environmental planning on the social behavior of college students. This article also optimized and improved the existing design ideas, and adopted corresponding improvement measures to provide reference for the development of social activities in universities. The average score for pleasure improvement before improvement was 3.5 points, and the average score after improvement was 4.7 points. The average score before security improvement was 3.8 points, and after improvement, the average score was 4.5 points. This article adopted a specific analytical framework for university campus environmental planning from the perspective of design psychology, which was conducive to promoting the construction of university campus environment.

1. Introduction

In today's increasingly concerned university education environment, landscape greening is no longer just a simple task of beautifying the campus. It involves how to use environmental factors to promote student social interaction and mental health. This article intends to start with the impact of design psychology on the creation of university campus environment, and study the problems and challenges it faces in the creation of university campus environment.

Firstly, this article systematically organizes and evaluates the current concepts of campus environment design in universities through literature research, case analysis, and field research. Secondly, combined with practical cases, it elaborates on the impact of various design schemes on the social communication behavior of college students. Finally, based on design psychology, corresponding improvement strategies are adopted. The research results of this article have certain reference significance for the creation of university campus environment.

2. Related Work

At present, research on landscape greening in universities mainly focuses on aesthetics, functions, and other aspects, while ignoring the impact on the psychological and social aspects of student groups. In addition, there are also shortcomings in the intelligent management and fault diagnosis of social space, which brings many inconveniences and obstacles to social life. This also reflects that traditional landscape design methods cannot meet the needs of modern education. Liu Fei explored the landscape design methods for the new campus of Shandong University of Water Resources and Technology [1]. Cai Yingfang took Southwest Forestry University as an example to analyze the

application of landscape architecture theory in campus landscape design [2]. Liu Yang provided methods for enhancing the cultural heritage and spatial design of university campus landscapes [3]. Zhang Man proposed a method for updating campus landscape design in the post pandemic era [4]. Kang Li studied the landscape design technology of local applied universities under the concept of "environmental education" [5]. Luo Xiaojiao proposed a college campus landscape design scheme based on interactive mode [6]. Mengqi T studied the campus landscape and culture of Henan University of Science and Technology [7]. Khoramaraie M proposed a landscape design solution to achieve the goal of a green university [8]. Cepollaro G provided an experience method for a "landscape school" in Italy [9]. Song P studied the university landscape design method based on ecological protection concept using Jilin Transportation Vocational and Technical College as an example [10]. Their research did not rethink the university campus environment from the perspective of design psychology, which is not conducive to better creating social space.

By configuring the landscape and selecting colors, the natural beauty and cultural atmosphere of the university campus are significantly enhanced. This can not only create a beautiful university campus, but also strengthen the sense of belonging and honor between teachers and students. Landscape design can create various types of recreational spaces, such as green lawns, gardens, and seating areas, making it an ideal place for teachers and students to relax and exchange ideas. This type of space can enhance interaction between people and also enhance the cohesion of the school's social environment.

3. Methods

3.1 Design Psychology in the Implementation of Campus Landscape Strategies

Through a case study on the creation of university campus environment, ten universities are selected as case studies for research. This study explores the characteristics and differences of social space construction through the analysis of individual cases of campus landscape design in various universities. This article mainly explores how to use landscape design to enhance social interaction among students. This article conducts in-depth research on how to build a multifunctional open square and adopts some design schemes.

(1) Field investigation methods

By conducting questionnaire surveys and behavioral observations on individual cases in schools, the aim is to gather data and gain a preliminary understanding of the social behavior patterns of students in various types of campus environments. The survey questionnaire mainly focuses on the usage of college students in different social situations, as well as their preferences and feelings. At the same time, the observation team also records the behavior of students in some special environments, such as Central Park and Student Activity Center.

(2) Application of psychological assessment tools

On this basis, methods such as environmental perception scales and landscape preference assessments in psychology are used to examine the impact of different types of campus landscapes on the social behavior of college students. This measure helps the research group understand how specific landscape elements have an impact on the psychological and social behavior of students. For example, in areas with more green spaces, it can significantly improve the social skills of college students.

(3) Design simulation run

Using 3D software, the impact of different landscape pattern changes on the migration and social interaction of college students is analyzed. Simulation solutions can help predict the flow of people before and after landscape adjustments, and predict in advance which changes affect social behavior. Simulation results can serve as the basis for optimizing design solutions.

(4) Strategy adjustment and implementation

Based on case analysis, field investigation, psychological evaluation, and simulation research, this article adopts and initiates a set of strategies to improve the campus environment, add recreational spaces, optimize pedestrian networks, and establish multifunctional social gathering

places. Every time a change is implemented, experiments are conducted in individual regions to monitor the actual results and make corresponding adjustments.

(5) Establishing a feedback loop mechanism

To ensure that landscape design can continuously meet the user's requirements, this article constructs a complete feedback system, and based on this, conducts a questionnaire survey on user satisfaction to form a complete feedback mechanism. Through this electronic feedback system, students can evaluate the functionality and aesthetics of the campus environment, and report any issues discovered. During this process, designers can promptly obtain relevant information and conduct periodic evaluations and optimizations to ensure the continuity and effectiveness of the design. This feedback mechanism can not only enhance the sustainability of the campus landscape, but also improve the overall satisfaction of students with the campus environment [11].

To measure the change in the frequency of student social activities before and after the improvement of campus landscape, the following formula can be used to calculate the rate of change. For the t-test of independent samples, the formula can be expressed as:

$$t = \frac{\bar{x}_1 - \bar{x}_2}{\sqrt{\frac{s_1^2}{n_1} + \frac{s_2^2}{n_2}}} \tag{1}$$

Among them, $\bar{x}_1$ and $\bar{x}_2$ are the sample mean of the two sets of data; s_1^2 and s_2^2 are the sample variance; n_1 and n_2 are the sample size.

The correct diagnosis rate of faults in landscape design Accuracy:

$$Accuracy = \left(\frac{N_{\text{correct}}}{N_{\text{total}}}\right) \times 100\% \tag{2}$$

N_{correct} is the number of correct diagnoses, and N_{total} is the total number of diagnoses.

3.2 Detailed Implementation of Cases

After conducting in-depth analysis of ten universities, the research group uses a comparative research approach to systematically sort out and evaluate the impact of the unique landscape elements of each university on their social interactions. For example, research has shown that the central square is spacious and diverse, and students participate in social activities more frequently, resulting in higher levels of satisfaction. The research results are presented in tables and quantitative analysis, providing empirical basis for the next step of research.

(1) Specific application of on-site investigation methods

During the field investigation phase, the research team conducts a series of behavioral observations and questionnaire surveys. The research team conducts a systematic survey on a specific landscape and studies the frequency, type, and duration of social interaction. In addition, the survey questionnaire distributed in this study covers the usage and preferences of college students in various regions on campus, and statistical software is used to analyze the survey results, providing quantitative data support for the survey results.

(2) Application and expansion of psychological assessment tools

This study uses psychological testing methods to explore the special effects of landscape design on the emotions and behaviors of college students. Through environmental perception scales, researchers can learn about specific campus landscape elements, such as tree coverage, seat comfort, etc. These data help determine which terrain features can stimulate positive emotional responses, thereby driving social interaction.

(3) Designing and simulating the actual operation of the operation

SketchUp and other simulation software are used to create a three-dimensional campus environment model, and can simulate student behavior according to different design changes. On this basis, future changes can be intuitively predicted, such as the emergence of multiple new social nodes in areas with high population density. This step builds a bridge between theory and practice, ensuring the practicality of the design.

(4) Details of strategy adjustment and pilot implementation

Based on simulation and preliminary research, some strategic adjustments have been made, such as adding seats in some areas, increasing green areas, improving pedestrian walkways, lighting, etc., to improve nighttime utilization. Each change involves conducting a small-scale experiment, such as the courtyard that students often visit. After preliminary attempts, it can be promoted throughout the entire school.

Social change rate Change Rate:

$$\text{Change Rate} = \left(\frac{F_h - q}{F_q}\right) \times 100 \tag{3}$$

Among them, F_h is the frequency of social activities after improvement, and F_q is the frequency before improvement.

3.3 Feedback Evaluation

(1) Implementation and optimization of feedback loops

At the same time, the school has also established an electronic and written feedback system to ensure that each student can easily adopt their own opinions. User feedback information is directly entered into the designer's database and regularly analyzed. Based on the opinions of the students, appropriate adjustments are made to the campus environment to meet their needs and preferences and continuously optimize the campus environment.

(2) Feedback optimization case

For example, after the first execution, students reflects a lack of sufficient shading in some newly built rest areas. Designers have responded by adding shading devices in these areas and improving the structure of plants, providing a more comfortable resting environment for people. This rapid response not only effectively solves real-world problems, but also enhances students' confidence and satisfaction with the school.

(3) Implementation of periodic assessments

In this article, the group plans to conduct a comprehensive evaluation of the campus environment at the end of each semester to understand students' satisfaction with the campus environment, their utilization of the campus environment, and their impact on their social life. The research results are applied to campus planning for the next semester to ensure that the overall environment of the school meets the needs of students.

4. Results and Discussion

4.1 Using Psychological Assessment Tools to Evaluate Changes in Students' Perception of Landscape Improvement

The purpose was to understand the impact of improving campus environment on the psychological feelings of college students.

The method was to use an environmental perception scale to evaluate students before and after improvement, and compare them.

The results of using psychological assessment tools to evaluate changes in students' perception of landscape improvement are shown in Table 1. The average score for pleasure improvement before improvement was 3.5 points, and the average score after improvement was 4.7 points. The average score before security improvement was 3.8 points, and the average score after improvement was 4.5 points.

Table 1. Results of using psychological assessment tools to evaluate changes in students' perception of landscape improvement

Evaluation project	Average score before improvement	Improved average score
Pleasure	3.5	4.7
Sense of security	3.8	4.5
Sense of belonging	3.2	4.2
Comfort level	3.6	4.8

4.2 Observing Changes in Behavioral Patterns during Field Investigations

The research objective was to explore the impact of environmental improvement on student behavior patterns.

The method was to conduct continuous behavioral observations on students within the same university campus, record their behavior before and after improvement, and analyze their behavior before and after improvement.

The behavioral pattern was when learning alone, the frequency before improvement was 5 times/hour; the frequency after improvement was 8 times/hour; the duration before improvement was 30 minutes/time; the duration after improvement was 35 minutes/time. The behavior pattern was during group discussions, with a frequency of 3 times/hour before improvement, 6 times/hour after improvement, a duration of 45 minutes/time before improvement, and 50 minutes/time after improvement. The frequency and duration of different behavior patterns before and after improvement are shown in Figure 1.
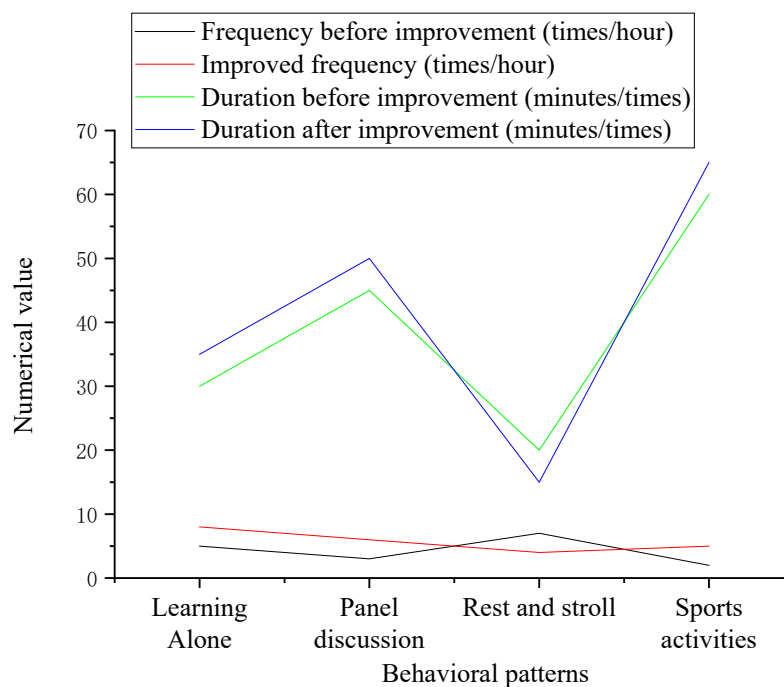

Figure 1. Frequency and duration of different behavior patterns before and after improvement

4.3 Comparison between Behavior Changes Predicted by Software Simulation and Actual Situations

The purpose was to test the predictive ability of simulation design on real behavioral changes.

The method was to use urban planning software to simulate the behavior flow of different types of landscape changes, and verify the accuracy of the model through on-site observation data.

The comparison results between the behavior changes predicted by software simulation and the actual situation are shown in Table 2. The simulated prediction value for independent learning frequency design was 8 times/hour, and the observed value in the field was 7.5 times/hour; the frequency of group discussion was designed with a simulated prediction value of 6 times per hour and a field observation value of 6.3 times per hour.

Table 2. Comparison results between behavior changes predicted by software simulation and actual situations

Behavioral indicators	Design simulation predicted values (times/hour)	Field observation values (times/hour)	Difference value
Independent learning frequency	8	7.5	0.5
Panel discussion frequency	6	6.3	-0.3
Rest and stroll frequency	4	4.2	-0.2
Sports activity frequency	5	4.8	0.2

4.4 Comparison of Fault Diagnosis Accuracy Before and After Strategy Adjustment

The research objective was to evaluate the effect of terrain changes on the performance of fault diagnosis systems.

The method was to set different failure scenarios, compare the diagnostic accuracy before and after adjustment, and evaluate the improvement results by chi square test and other statistical methods.

The diagnostic accuracy before and after adjusting the strategy for different fault scenarios is shown in Figure 2. The diagnostic accuracy before adjusting the lighting fault strategy was 80%, and after adjusting the strategy, the diagnostic accuracy was 92%; the diagnostic accuracy before unclear identification adjustment was 75%, and after strategy adjustment, the diagnostic accuracy was 88%; the diagnostic accuracy before traffic obstruction adjustment was 70%, and after strategy adjustment, the diagnostic accuracy was 85%.
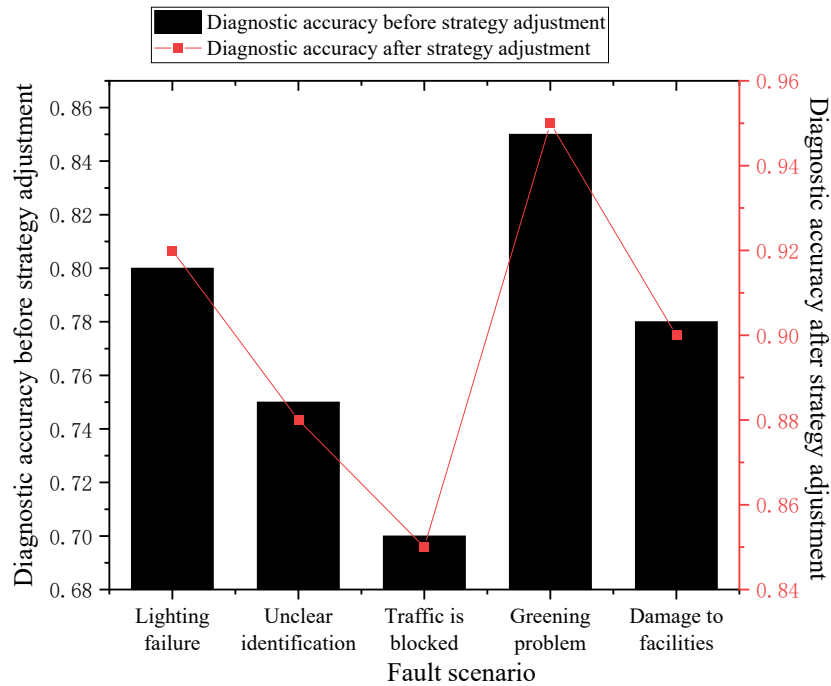

Figure 2. Diagnostic accuracy before and after adjusting strategies for different fault scenarios

4.5 Comparison between Calculation of Management Efficiency Improvement Ratio and Traditional Methods

The purpose was to quantitatively evaluate the effectiveness of improving campus management efficiency by comparing it with traditional management methods.

The method was to statistically analyze the time efficiency before and after improvement, and use the efficiency improvement rate as the evaluation indicator. The research method of this article was to use two methods: comparative analysis of benefits and cost-benefit analysis. The time required before improvement was based on experience; the time required after improvement was based on the proposed method in this article; the time required for traditional methods was based on the time obtained without using any methods.

The comparison of time required for different management tasks is shown in Figure 3. The time required for cleaning work improvement was 10 hours before improvement, 8 hours after improvement, and 12 hours for traditional methods; the time required for maintenance inspection and improvement was 5 hours, 4 hours after improvement, and 6 hours for traditional methods.
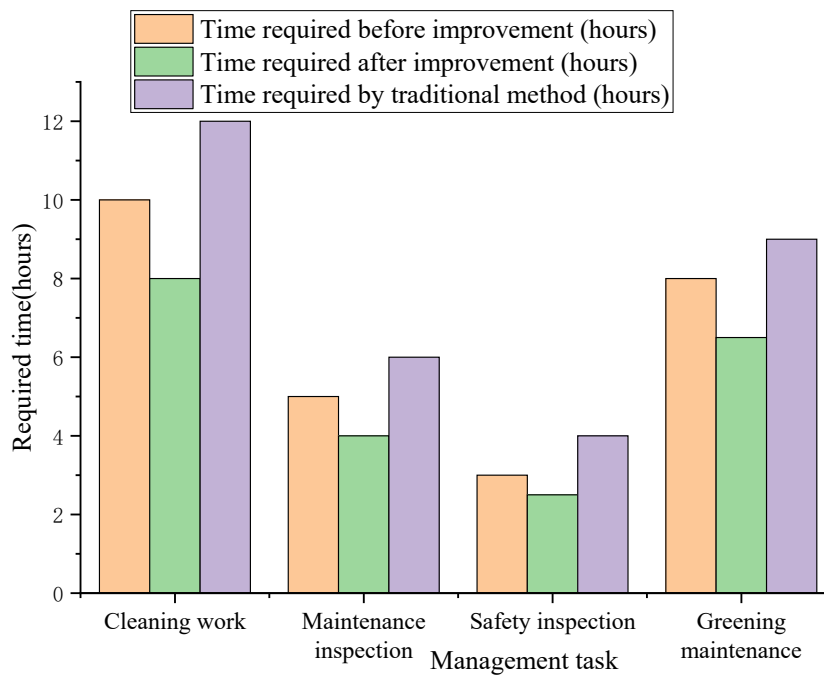
Figure 3. Comparison of time required for different management tasks

5. Conclusions

This article explored the creation of a university campus environment guided by the theory of design psychology. Through case analysis, on-site investigation, psychological evaluation, and design simulation, the goal is to achieve a profound understanding and enhancement of the university's social space. This not only enhances the beauty and functionality of the landscape, but also enhances its effectiveness in social interaction with students. The application of this integration method ensures that the creation of campus environment can be closer to the real needs and psychological feelings of students, providing strong support and promotion for social interaction in schools. After continuous testing, feedback, and optimization, the current university campus landscape has gained more humanistic care, which can better meet the learning and social life needs of students. The "user oriented" design concept that can be adopted in the future not only benefits the participants directly, but also has great reference significance for future campus environmental planning.

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