

Design of Sustainable Campus Spaces Based on Multidimensional Construction Theory

Yuelan Xu, Xiaochun Zhan, Yujing Zhang, Jingyao Ji

Xianda College of Economics and Humanities, Shanghai International Studies University, Shanghai, China

Abstract: This article takes campus spaces as the research object, conducting empirical studies through interviews and questionnaires with teachers and students. The research explores multiple dimensions such as spatial layout and design, supporting facilities, campus space management, space usage intensity, spatial distance factors, and campus spatial environment. The study reveals the utilization efficiency and status of various spaces within the campus and gathers insights from teachers and students on the functionality, environment, facilities, and accessibility of public spaces. The article proposes constructing sustainable spaces from three dimensions: creating vibrant spaces, artistic spaces, and ecological spaces, to enhance interactions with the objective world, increase communication with others, and enhance dialogue with oneself, providing valuable references for the sustainable use of campus spaces.

Keywords: Multidimensional Construction; Campus Public Space; Sustainability; Space Design

1. Introduction

In the 1990s, with the awakening of cultural awareness among Chinese citizens, sustainable development theory became the core guiding thought for urban construction. The goals of "carbon peaking and carbon neutrality" also brought opportunities and challenges to the sustainable space design industry. The sustainable use of campus spaces, as the main body of universities, is a key focus and a critical element for the sustainable development and revitalization of campuses, aiming to achieve the purpose of space education.

This study on multidimensional construction

theory focuses on the multidimensional development of spaces, bringing new ideas for spatial sustainability. Zhang's research in "Research on Multidimensional Construction of Places" explores how campus spaces can meet the needs of different users through multidimensional design and planning, and how space design can enhance the spiritual and cultural value of places [1]. Peng and Yang discusses how to integrate sustainability concepts into the renovation design of public spaces to achieve environmental, social, and economic sustainability in "Research on Public Space Renovation Design under Sustainable Design Concepts" [2]. Qiu and Wu's study "Research on the Activation and Utilization of Campus Spaces under the Mode of Space Education" focuses on how space design in educational environments can promote the holistic development of students [3]. Chen et al. in "Space Observation and Evaluation of Sustainable Development Goals" studies how to observe and evaluate the effects of space design in achieving sustainable development goals [4]. Lin explores the integration of environmental art design in urban public spaces to enhance sustainability in "Research on Environmental Art Design of Urban Public Spaces from a Sustainability Perspective" [5]. Tracey and Vicki's book "Design for Sustainability: A Practical Approach" provides practical design methods to promote sustainability in design practice [6]. Annie et al.'s book "Sustainable Design Transformation" discusses how design and designers drive the process of sustainability, providing some case studies [7]. Tom's book "Sustainability and Design Ethics" possibly discusses the importance of design ethics in promoting sustainability [8]. Wang in "Research on Sustainable Design of Urban Street Signage Systems" addresses the problems in sustainable design of urban street signage systems, proposing principles and

methods for sustainable design and scientific management to promote urban sustainability and improve residents' quality of life [9]. Zhu's literature review "Design Dimensions of Healing Environments in Architecture and Landscape Based on Multidimensional Construction" discusses considerations in environmental design related to the aesthetics, health, and other dimensions of multidimensional construction theory [10]. Thus, it can be concluded that multidimensional spatial construction includes several aspects such as environmental, social, cultural, technical, aesthetic, and health. The environmental dimension refers to considering ecological and environmental factors in design, such as energy efficiency, material selection, waste management, biodiversity, and reducing environmental footprints. The social dimension implies that space design should promote social inclusiveness, equity, and community engagement, emphasizing social responsibility and civic awareness, and cultivating students' understanding and respect for the needs of different social groups. The cultural dimension indicates respecting and integrating local culture and history, creating spaces with cultural significance and identity. The technical dimension refers to utilizing innovative technologies and intelligent systems to enhance the functionality, safety, and comfort of spaces, teaching students to master the latest technologies and tools to promote sustainable design and construction practices. The aesthetic dimension aims to create aesthetically pleasing and inspiring spaces that enhance user experience and well-being, helping students understand the role of aesthetics in improving space quality and promoting sustainability. The health dimension refers to designing spaces that promote healthy lifestyles, such as providing adequate natural light, good ventilation, and comfortable indoor environments, including education on health and well-being, and how design can improve learning quality and efficiency.

2. Methods

2.1 Case Area

This study focuses on the spaces of the Hongkou and Chongming campuses of Xianda College of Economics and Humanities at

Shanghai International Studies University. The Hongkou campus, located in the northeast of the city, covers over 50 acres and consists of a teaching and administrative building in the shape of the character "上" (shang), along with dormitory buildings and various spaces. The Chongming campus, located in Chenjia Town, Chongming District, covers 450 acres. Its campus features a blend of classical and modern styles, integrating Eastern and Western elements with diverse spaces. The study employs literature research, interviews, questionnaires, and observations of daily activities.

2.2 Qualitative Data Collection

Following the principle of voluntariness, 10 students were selected as typical cases for in-depth investigation and interviews (see Table 1). It was clearly stated that the interview content would adhere to confidentiality principles, be used solely as research material, and not disclose any personal information. The interview outline included three main aspects: (1) Which public space do you spend the longest time in on your campus? (2) What do you usually do in that public space? (3) How long do you generally stay there?



Figure 1. A—F Spaces on Campus

Spaces on campus through observations of students' daily activities and on-site visits, it was found that the Chongming campus features numerous learning and social spaces. Despite careful design, these spaces have low

utilization rates. The following spaces were observed (Figure 1): A. The study space on the second floor of the Business Management Teaching Building is a two-story open space with dual lighting, often vacant, indicating low utilization. B. The rest area on the second floor of the Business Management Teaching Building is near faculty offices and rarely used by students. C. The public lobby on the first floor of the Business Management Teaching Building is spacious and a passage to the second floor. Occasionally, students wait or

small activities are held here, but it generally remains underutilized. D. The shared space on the 5th floor of the Comprehensive Building is crowded with students after classes. E. The shared space in the International Exchange Building features large floor-to-ceiling windows, attracting teachers and students for communication or studying, reflecting the space's appeal and vitality. F. The public lobby on the second floor of the Business Management Building is open and spacious, popular among students.

Table 1. Interview Content

Number	Gender	Age	Campus	Most Frequented Public Space on Campus	Space Characteristics	Behavior	Duration
1	Male	21	Hongkou Campus	Public space on the first floor of the administrative building	Dining options, spacious, seating available	Drinking coffee, communicating with classmates	0.5—1 hour
2	Female	21	Hongkou Campus	Public platform on the 7th floor of the teaching building	Semi-outdoor space, garden view, seating, regular exhibitions	Studying	2—3 hours
3	Female	20	Chongming Campus	Lobby on the first floor of the International Exchange Building	Highly accessible, spacious, comfortable sofas	Reading	1—2 hours
4	Female	20	Chongming Campus	Study room on the first floor of the International Exchange Building	Enclosed glass room, privacy ensured, equipped with tables, chairs, and whiteboards	Discussions	2—3 hours
5	Female	19	Chongming Campus	Coffee shop in the dormitory area	Dining options, close to dorms, sunken courtyard view	Discussions	0.5—1 hour
6	Male	21	Chongming Campus	Lobby on the first floor of the International Exchange Building	Highly accessible, spacious, comfortable sofas	Discussions	0.5—1 hour
7	Male	20	Chongming Campus	Lobby on the first floor of the International Exchange Building	Highly accessible, spacious, comfortable sofas	Discussions	0.5—1 hour
8	Female	20	Chongming Campus	Lobby on the first floor of the Business Management Building	Spacious, equipped with tables and chairs	Discussions	1—2 hours
9	Female	20	Chongming Campus	Commercial street	Dining options, seating available, near the gym	Leisure and socializing	1—2 hours
10	Male	19	Chongming Campus	Lobby on the first floor of the Comprehensive Building	Tables, chairs, computers, high traffic area after classes	Discussions	0.5—1 hour

2.3 Quantitative Data Collection

Through the distribution of questionnaires (Table 2), the study investigates students' satisfaction with and expectations for campus spaces, as well as the current utilization of

public spaces. The investigation focuses on aspects such as spatial layout and design, the quality of supporting facilities, campus space management, space usage intensity, spatial distance factors, campus spatial environment, and socio-cultural factors.

Table 2. Questionnaire Survey Items

	Question/Statement
Space Layout and Design	The layout and design of the current school public spaces are very spacious.
	Various activities held in public spaces are very interesting.
	The ceiling height in public spaces is very comfortable.
	The design of public spaces is very attractive.

Quality of Facilities	The facilities in the space are very complete.
	The furniture in public spaces is very comfortable.
	There are smart facilities like computers.
Campus Space Management	The management of campus spaces is good.
Space Usage Intensity	How much time do you spend studying in public spaces each day?
	How much time do you spend relaxing and socializing in public spaces each day?
	There are too many people using the public spaces, it's uncomfortable.
Space Distance Factors	It is very convenient to study in public spaces.
	It is convenient to wait in the campus.
Campus Space Environment	The natural ecological environment of the campus is good.
Socio-Cultural Factors	The campus reflects cultural and regional characteristics.

The questionnaires were distributed online and on-campus. The design of the questionnaire is divided into two parts: the first part consists of items reflecting demographic characteristics, including the respondent's gender, age, educational level, and physical health status. The second part comprises items on the respondents' perceptions of campus spaces, divided into 7 categories and 15 items. The third part uses a Likert 5-point scale for measurement, with options ranging from "Very Dissatisfied" to "Very Satisfied," assigned values of 1, 2, 3, 4, and 5 respectively. Higher scores indicate a higher level of approval from the respondents.

The author invited 10 faculty members to test the questionnaire. Based on the test results, the questionnaire was revised and refined, eventually forming the evaluation questionnaire.

3. Results

Through research and interviews, it was found that students generally pay considerable attention to the functionality, environment, facilities, and accessibility of public spaces. The analysis was conducted on four dimensions of traditional campus space layout: learning space, social space, residential space, and sports space. Learning spaces should reflect cultural connotations and campus regional characteristics, provide a certain degree of privacy, and be equipped with intelligent search systems and convenient communication facilities. These factors guide students' willingness to stay in learning spaces, increasing their study time. Social spaces should have a good environment (aesthetic spatial layout, natural environment, sound environment) and equipment furniture. The presence of intelligent facilities can influence the duration of students' stay. Residential spaces in student dormitories generally meet the need for private spaces for sleeping and

resting, semi-private spaces for solitude and intimate interactions, semi-public spaces for conversations with friends and classmates, and public spaces for socializing and entertainment. These spaces have a significant influence on students. The teaching, living, and sports areas should be separated yet interconnected, influencing and permeating each other. By extending the extensibility and inclusiveness of campus activity spaces, activating the limited campus space, and forming flexible, comfortable, convenient, and sensory-stimulating activity venues, students will be encouraged to love sports. These four functions are grouped together, complementing each other with corresponding matching functions, collectively creating spaces where students enjoy learning, living, and exercising, thus subconsciously forming a multidimensional sustainable space atmosphere.

4. Conclusions

The article analyzes the most concerned aspects such as spatial layout and design, spatial distance factors, and campus spatial environment, and proposes methods for constructing sustainable spaces.

On the basis of the traditional four dimensions, the article strengthens the sustainable and variable diversity of space design, constructing from three dimensions: 1. Cognitive Practice through Interaction and Dialogue with the Objective World: Students expand their knowledge and experience by contacting, observing, and operating, enhancing their cognitive level and constructing the meaning of the objective world. 2. Social Practice through Interaction and Dialogue with Others: Students weave relationships with others through communication, sharing, and interaction, achieving personal growth and progress. 3. Reflective Practice through Interaction and Dialogue with Themselves:

Students objectively recognize their strengths and weaknesses, understand that growth is a process of change and development, and strive for healthy growth.

Through various surveys and interviews, it was found that the focus points are the vitality, artistic nature, and green ecological environment of the space. Therefore, the following suggestions are proposed to improve utilization and educational effects.

4.1 Constructing Vitality Spaces to Enhance Educational Effects

Transform campus spaces into creative places, breaking spatial barriers with open campus building designs to promote more interaction between teachers and students. Each floor should have activity function spaces for students to rest, making every space a place for life exploration. Emphasizing the mutual relationship between teachers, students, buildings, and activities, and strengthening the openness and functionality of spaces so that teachers and students enjoy thinking, resting, entertaining, and interacting, is the best embodiment of "space education."

4.2 Constructing Artistic Spaces to Enhance Educational Effects

Provide students with an open and free learning platform through artistic space forms and educational activities. Using space to introduce thematic exhibitions and build aesthetic education platforms connected with courses fosters students' creativity, imagination, and aesthetic taste through artistic creation and performance, while also promoting their emotional expression, teamwork spirit, and social responsibility. This combination not only enriches students' learning experiences and enhances their comprehensive qualities but also makes a positive contribution to urban cultural construction and educational development.

4.3 Constructing Ecological Spaces to Enhance Educational Effects

Integrate ecological civilization education into the entire educational process. Achieve green, low-carbon, and sustainable development through spatial design and cultural atmosphere, which can also enhance student cohesion. Through joint participation in space renovation and operation, students can increase their

communication and cooperation, forming a closer community relationship, enriching learning life, and improving quality, thus achieving a higher level of educational effect.

The method of multidimensional construction and sustainable space design and education can jointly promote a more sustainable and resilient future while providing students with a comprehensive and integrated educational experience. In the construction of university spaces, multidimensional construction promotes the spatial extension of "Five Educations" (moral, intellectual, physical, aesthetic, and labor education), realizing multi-subject spatial linkage, and promoting students' all-round development.

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