Architectural and Environmental Design of the Comprehensive Building of Meizhou Vocational and Technical College

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Abstract. At present, the design and planning of teaching and living areas on university campuses are relatively simple, but there are problems such as poor ventilation, low indoor air quality and poor sound insulation. This study takes the building and environment of the campus complex of Meizhou Vocational and Technical College as the research object. Through software simulation and on-site data collection, the neutral temperature (Tc) equation method is used to provide a reference for the planning and design of the building and environment, and to analyze the indoor and outdoor air comfort, thermal comfort and acoustic comfort. Field tests verify the validity of the post-design simulation results.

Keywords: Campus planning; spatial integration; open space; environmental design

1 Introduction

For a long time, vocational education in China has remained at the professional level, which has become an important bottleneck restricting the development of vocational education. The existence of the concepts of last resort and inferiority makes vocational education unattractive. In recent years, China has introduced a series of policies and measures to promote the reform and innovation of vocational education, providing strong support for the high-quality development of vocational education. With the continuous expansion of vocational education in China, people have put forward higher requirements for vocational college buildings. However, there are many problems in the buildings of vocational colleges and universities in China.

Existing campuses have single-function buildings in various functional areas, especially within the school teaching area. Many schools have built single-function buildings such as teaching buildings, libraries, and administration buildings, which have problems of heat dissipation in summer, poor wind protection in winter, and poor

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acoustic insulation [1]. Pedestrian wind comfort is an important indicator of livability [2] and affects indoor and outdoor thermal comfort [3]. Weak connections between functional areas and increasing campus problems make rational planning of campus space an important influence on student behavior [4]. In addition, background noise, glare, and room temperature in learning environments can affect the concentration and productivity of students and teachers [5]. However, it is increasingly recognized that both the outdoor environment [6] and indoor environmental quality (IEQ) [7] have an impact on the health of the users; at the same time, more research has been conducted on the relationship between indoor air quality (IAQ) and user comfort [8]. Reasonable overall planning and design can meet the needs of different types of teachers and students for learning and living, and enhance students' sense of security and belonging.

The design of teaching buildings in most institutions will determine the building scale in a large range, resulting in closed internal space and unclear functional zoning. In addition, overly subdivided functional zoning can also lead to problems such as spatial confusion and poor lighting. Currently, the design and planning of teaching and living areas in university campuses are relatively simple, but there are problems such as poor ventilation, low indoor air quality, and poor sound insulation. The aim of this study is to design building units using the neutral temperature (Tc) equation method through software simulation and field data collection.

2 Case Studies and Analysis and Methodology

The base selected for this design is located in the north part of the main campus of the Vocational and Technical College in Meijiang District, Meizhou City, Guangdong Province, China. Meizhou, the ancient name of Jiaying Prefecture, is a provincial municipality in Guangdong Province, a famous hometown of overseas Chinese and known as the Hakka Capital of the World. Located in the northeastern part of the province and the middle reaches of the Meijiang River, Meizhou is the junction of Guangdong, Jiangxi and Fujian Provinces, and also the intermediate zone connecting the inland hinterland of western Fujian and Gannan with Shantou, Shenzhen and Guangzhou. China's national top-level design has given Meizhou the strategic positioning of one area and two cities, supporting Meizhou's whole area to build a pioneer area for the revitalization and development of the former Central Soviet Region of Gan, Fujian and Guangdong in docking and integrating into the Guangdong-Hong Kong-Macao Greater Bay Area, and to build a gateway city of the former Central Soviet Region of Gan, Fujian and Guangdong in docking and integrating into the Guangdong-Hong Kong-Macao Greater Bay Area, and a regional central city in northern Guangdong, so as to promote the high-quality development of Meizhou. (Figure 1)

Fig. 1. Geographic Location.

2.1 Site Selection Analysis

Meizhou Vocational and Technical College (Meizhou Agricultural School), the total land area of 640.88 acres, including the main campus of the East, West, North, Guangmei Industrial Park Campus, with a total planned floor area of 299,300 square meters, the size of 12,000 students. Selected site of Meizhou Vocational and Technical College North District 0.48 kilometers away from the East District, 0.47 kilometers away from the West District, 4.3 kilometers away from the City East Campus. There is Zhouxi River on the east side, the main campus road on the north side, off-campus residential buildings on the south side, and open space on the west side.

2.2 Neutral Temperature (Tc) Equation

According to ASHRAE Standard 55-1992 [9], in which the correction is based on the effect of airflow velocity, the calculation formula for the neutral temperature Tc in the human thermal comfort zone is given when the indoor temperature is above 28 °C and the outdoor relative humidity is greater than 70 [10].

$$T_c = 19.7 + 0.40\theta_0 - 4(\theta_0 - 70\%) + \frac{0.55v}{0.15} \quad (1)$$

where ϕ_0 is the indoor relative humidity, v_0 is the body surface wind speed, and θ_0 is the outdoor temperature. When the indoor temperature is below 28 °C, the effect of relative humidity on human thermal comfort is minimal, and Guo's Equation (1) can be simplified as [10]

$$T_c = 19.7 + 0.30\theta_0 + \frac{0.55v}{0.15} \quad (2)$$

3 Design Strategy

3.1 Form Logic - Unit Link Layout

Unit corridor layout is a unit block as a unit of the building layout form. Generally by the combination of building monoliths, it has two basic features: the monoliths have a certain degree of relative independence, neither fully subordinate to a monolith, nor fully subordinate to other monoliths, but a certain degree of independence from each other. At the same time, the relative independence between the monoliths, so that the diversity of group layout forms, as well as the flexibility of the design can be realized. Unit layout to a certain extent can be adapted to the architectural function and environmental requirements of the building space. Unit layout in many ways shows the flexible adaptability to the new qualities of institutions in the new era conditions.(Figure 2)

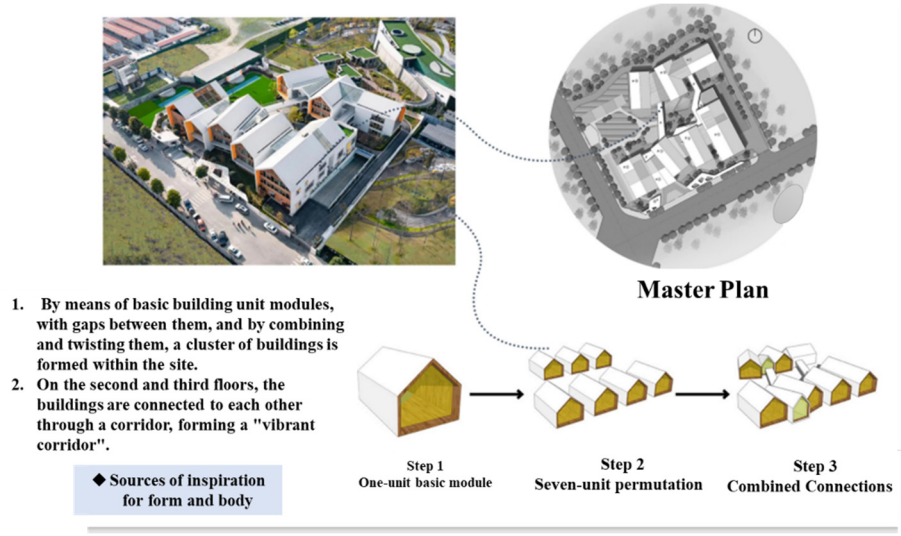

Fig. 2. Sources of inspiration for form and body.

3.2 Landscape Logic - Personal Space Needs

The combination of open space and semi-open space is adopted. The open space includes the entrance plaza, which has a large area and is an area where students can engage in a variety of club activities to meet their different activity needs. There are many types of semi-open spaces, such as small courtyards, or curved pathways with shade. These types of spaces are mostly adjacent to arterials, easily accessible, possess openness, and are screened by vegetation to give a sense of dependence and privacy. They are much quieter and easier to create a sense of intimacy than entrance plazas. They are recognized and loved by teachers and students because they are at one with nature and can communicate at will.

4 Design Results

4.1 Functional Layout

The four main functional areas of the comprehensive building are:

1. Teaching Area: According to the teaching demand, 1 to 3 floors of Building A and 1 to 3 floors of Building B are set up as teaching areas, which are mainly classroom-based teaching rooms. The teaching area includes ordinary classrooms, multimedia classrooms, computer classrooms, voice classrooms and other supporting rooms.
2. Administrative office area: 1 to 3 floors of Building C are set up for the administrative office area, which is mainly used for offices. It includes offices, multi-functional meeting rooms and other supporting rooms.
3. Study Area: A small study area is set up on the 2nd to 3rd floors of Building C, which is mainly an open study room. It includes a reading room and a semi-open bookstore.
4. Student Activity Area: At the same time, the center area from the 1st to the 3rd floor of Building B is set up as a student activity area. It makes it easy for students to reach the activity area in the classroom, avoiding the need to pass through other classrooms to reach the activity area in the classroom. The two sides were designed with patios, lounge seating, and hexagonal floor paving to add interest, mainly to provide a space for students to relax and interact. (Figure 3).

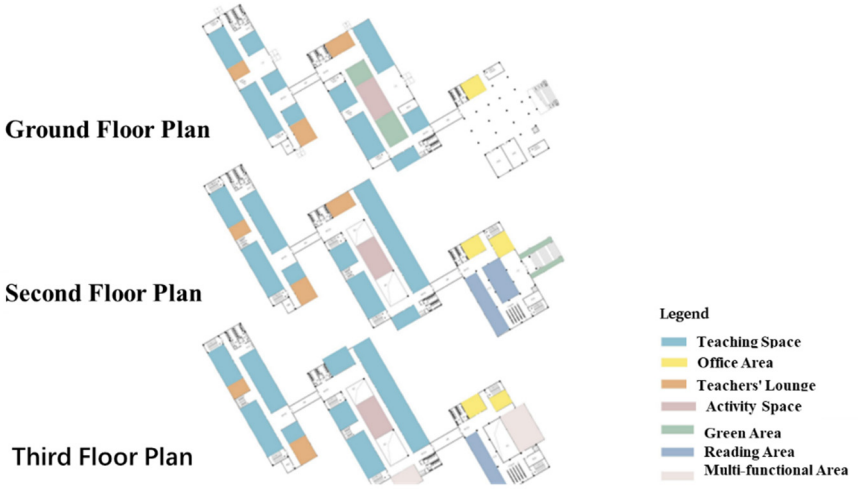

Fig. 3. Functional Area Chart.

4.2 Traffic Flow

The comprehensive building mainly includes teaching area, administrative office area, study area and student activity area. Teaching area and administrative office area, teaching area and study area are connected through the corridor, which is convenient for

teachers and students to communicate and study at different times, and also convenient for students to study and read after class, and at the same time, students can directly enter the reading room on the second floor through the big steps of Building C. The three independent units are connected through the corridor, which is independent and closely connected with each other, forming a complete organic whole. The three independent units are connected through the corridor, which are independent of each other and closely connected to each other, forming a complete organic whole, which is an "open and shared" modern learning center. It creates a relaxing and pleasant learning atmosphere for students and an efficient working environment for teachers.

4.3 Outdoor Landscaping

Planning "plants" as the main line and soul of landscape design, "plants landscape" as the basic elements of campus landscape design, the formation of "an axis, three pieces, multiple nodes" space The spatial pattern of "one axis, three pieces and multiple nodes" is formed. One axis refers to the main road of Building B as the base landscape planning center, and three pieces refer to the main road of ABC three buildings as the landscape design division area, and landscape design is carried out in each area. The landscape design of the three areas is relatively independent and connected with each other, forming an organic whole with a sense of order. (Figure 4)

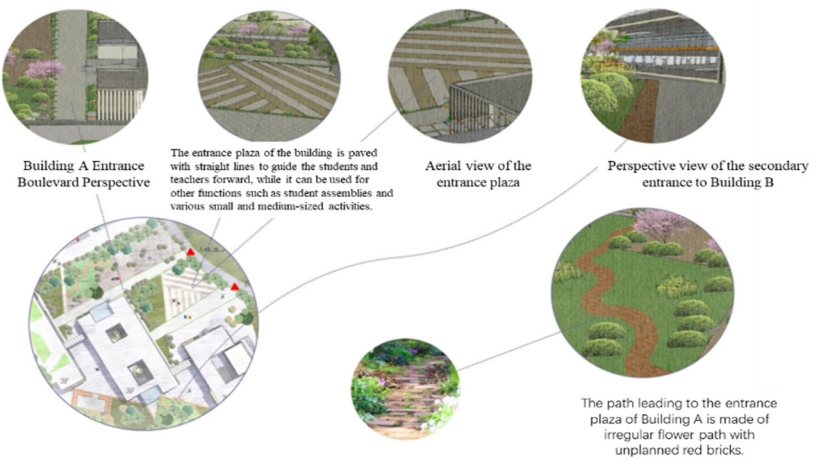

Fig. 4. Landscape Schematic Design.

5 Conclusions

Comprehensive building in vocational education plays an important role, is an important guarantee for the normal operation of the institution, is an important place for teaching, scientific research, management and services, a collection of a variety of functions, to meet the needs of all aspects of the students to create a good learning and living

environment, so the program in the design of the teachers and students in the design of full consideration of personalized needs, to meet the needs of the function of the multi-level and multi-angle. The building design adopts the unit corridor layout, the unit block distinction makes each functional area relatively independent, without interference with each other, and the design of the corridor connects the three unit blocks, which is convenient for teachers and students to communicate with each other in their daily study, and creates a relaxing and happy learning atmosphere for the students, and also provides teachers with a highly efficient working environment. The landscape design is overall unified and sparse, with a number of leisure nodes designed, using landscape plants as design elements, supplemented by characteristic paving to meet the needs of different outdoor scenes. The architectural and environmental design of the comprehensive building in this program helps to form a good learning and working atmosphere and promotes the healthy development of students.

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