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Research on the Construction, Application and Reflections of Low-Carbon Green Schools

-- A Case Study of Zhejiang DongFang Polytechnic

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Abstract

Taking Zhejiang DongFang Polytechnic as a case study, this research combines the mainstream concepts, common models, specific implementation paths, existing problems and corresponding reflections of current low-carbon green school construction. By adopting multiple methods such as literature review, questionnaire survey, exchange interviews and data analysis, it comprehensively analyzes the practices, existing issues and potential improvement measures of the college in constructing a low-carbon green campus. The results show that through a series of initiatives including optimizing the energy structure, promoting green buildings, strengthening waste recycling and utilization, and carrying out environmental education, Zhejiang DongFang Polytechnic has achieved remarkable results in reducing carbon emissions and resource consumption. Meanwhile, it has established a valuable evaluation system for low-carbon green school construction. The research findings not only enrich the relevant theories of low-carbon green school construction but also provide practical references for similar institutions to carry out related construction.

Keywords

Low-Carbon Green School; Campus Construction; Practical Path; Evaluation System; Zhejiang DongFang polytechnic.

1. Introduction

Against the backdrop of intensifying global warming and increasingly prominent ecological and environmental issues, "carbon peaking and carbon neutrality" have become important national strategies in China, and green and low-carbon development has evolved into a universal consensus and collective action across society. As the core carrier of talent cultivation, scientific and technological innovation, and social services, institutions of higher education are not only major contributors to energy consumption and carbon emissions but also bear the crucial mission of spreading green concepts, fostering ecological literacy, and leading the sustainable development of society. The construction of low-carbon green schools is not only an inevitable choice for universities to respond to national strategies and fulfill social responsibilities but also an inherent requirement for optimizing the campus ecological environment, enhancing the quality of education, and cultivating high-quality talents with environmental awareness and innovative capabilities[1].

In recent years, competent educational authorities in China have successively issued a series of policy documents, such as the "Action Plan for Building Green Schools," to promote the construction of green campuses in schools at all levels and of all types. [2]A number of universities have actively explored and practiced, forming distinctive construction models. However, on the whole, there are still problems including inconsistent construction standards, unclear implementation paths, and imperfect evaluation systems. In particular, targeted

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research and replicable experiences regarding the construction of low-carbon green campuses in higher vocational colleges are relatively scarce. As a key higher vocational college in Wenzhou, Zhejiang Province, Zhejiang DongFang polytechnic is rooted in the needs of regional industrial development and takes the initiative to practice the concept of green development.[3] Since launching the special construction of a low-carbon green campus in December 2022, the college has carried out extensive explorations in energy conservation, environmental optimization, and the integration of green education into teaching. Taking this college as a specific case, this research conducts an in-depth analysis of its construction background, core initiatives, practical effects, and existing problems. The purpose is to sort out the inherent laws and key paths for the construction of low-carbon green campuses in higher vocational colleges, construct a scientific and reasonable evaluation system, provide theoretical support and practical reference for similar institutions in China to promote green and low-carbon transformation, and contribute to the green development of the education sector and the realization of the national "double carbon" goal.[4]

2. Research Framework

This research follows the logical path of "theoretical foundation → empirical investigation → analysis and induction → model construction → reflection and optimization" to systematically explore the application practice of low-carbon green school construction. The specific research ideas are shown in Figure 1:

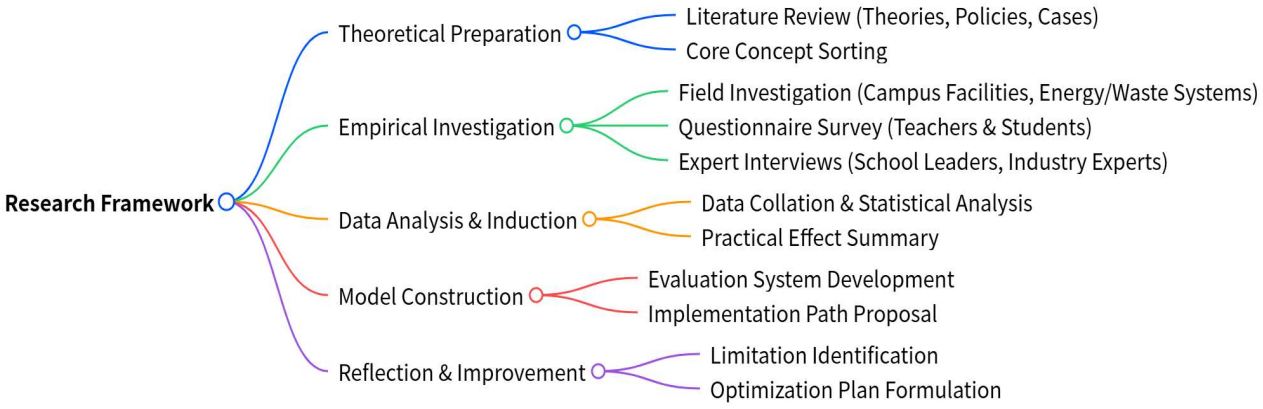


Figure 1. Mind Map of Project Implementation and Research

(1) Theoretical Preparation Stage

Conduct systematic literature review on domestic and foreign theories, policies, and practical cases related to low-carbon green schools.

Sort out core concepts (e.g., low-carbon campus, green education) and mainstream construction models, laying a theoretical foundation for the research.

(2) Empirical Investigation Stage

Field Investigation: Conduct in-depth inspections ofZhejiang DongFang polytechnic's campus environment, architectural facilities, energy utilization systems, and waste disposal sites to collect first-hand data on current construction status.

Questionnaire Survey: Distribute questionnaires to teachers and students to investigate their cognitive level, participation willingness, and suggestions regarding low-carbon green campus construction.

ISSN: 2688-9323

Expert Interviews: Conduct in-depth interviews with school department heads (e.g., Logistics Management Office, Student Affairs Office) and industry experts to obtain professional insights and practical experience.

(3) Data Analysis & Induction Stage

Organize and analyze data collected from surveys, interviews, and field investigations using statistical tools.

Summarize the practical effects, key measures, and characteristics of the college's low-carbon green construction.

(4) Model Construction Stage

Based on empirical results and theoretical research, construct an evaluation system for low-carbon green school construction, covering dimensions such as energy utilization, environmental construction, educational practice, and management mechanisms.

Propose targeted implementation paths and optimization strategies for vocational colleges.

(5) Reflection & Improvement Stage

Identify limitations in the research process (e.g., data collection difficulties, methodological deficiencies).

Put forward feasible improvement plans to enhance the scientificity and applicability of the research results.

3. Practice of Low-Carbon Green Campus Construction inZhejiang DongFang polytechnic

3.1. Current Construction Situation

Zhejiang Dongfang Vocational and Technical College launched the special construction of a low-carbon green campus in December 2022. Centering on the four goals of "low-carbon energy, green buildings, resource utilization of waste, and normalized education", it has implemented a series of key initiatives and achieved phased results.

3.2. Core Construction Initiatives and Effects

3.2.1. Optimization of Energy Structure

The college has gradually replaced traditional high-energy-consuming energy sources and promoted clean energy such as solar energy and air energy. It has installed 320 solar street lamps in teaching buildings and dormitories, with the coverage rate of solar water heaters reaching 85%; renovated the gas equipment in the canteen and adopted high-efficiency and energy-saving cooking utensils to reduce gas consumption. Through the adjustment of the energy structure, the energy consumption per unit area of the campus has decreased significantly.

Table 1. Comparison Table of School Energy Consumption (Unit: kWh/㎡·year)

Energy Type	2022 (Before Construction)	2023 (After Construction)	Reduction Range
Electricity Consumption	85.6	72.3	15.5%
Gas Consumption	18.9	14.2	24.9%
Comprehensive Energy Consumption	104.5	86.5	17.2%

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3.2.2. Promotion of Green Buildings

The newly-built training building of the college is designed and constructed in strict accordance with green building standards, adopting new thermal insulation wall materials, Low-E insulating glass, and other energy-saving building materials, with a building energy-saving rate of 65%; carried out energy-saving renovations on existing teaching buildings and dormitories, replaced more than 2,300 square meters of energy-saving doors and windows, and added 12,000 square meters of external wall insulation layers. After the renovation, the heating energy consumption of the buildings in winter has decreased by more than 30%.

3.2.3. Waste Recycling and Utilization

Established a campus waste classification and recycling system, set up 650 classified trash cans, and assigned 20 full-time waste classification supervisors; cooperated with professional environmental protection companies to realize the fixed-point recycling and resource utilization of recyclables such as waste paper, plastic, and metal. Kitchen waste is converted into organic fertilizer through biological treatment equipment for campus greening maintenance.

Table 2. Statistics of Campus Waste Disposal (Unit: Ton/Year)

Waste Type	2022	2023	Recycling Rate (2023)
Recyclables	128	156	92.3%
Kitchen Waste	320	358	85.7%
Hazardous Waste	5.2	6.8	100%
Other Waste	486	392	--
Total Waste Generation	939.2	912.8	--
Waste Reduction Rate	--	--	2.8%

3.2.4. Environmental Education and Practice

The college has integrated the concept of low-carbon environmental protection into the whole process of talent training, offering 12 related courses such as "Introduction to Environmental Protection" and "Fundamentals of Green Design"; relying on the professional advantages of the School of Art and Design, it has carried out 18 activities such as the "Green Campus Design Competition" and "Low-Carbon Life Creative Works Exhibition", with more than 3,000 student participants; established a campus environmental protection volunteer team with 860 registered volunteers, carrying out more than 40 voluntary activities such as community environmental protection publicity and campus environmental improvement every year.

Table 3. Survey Results of Teachers' and Students' Cognition and Participation in Low-Carbon Environmental Protection (n=756)

Survey Dimension	Specific Indicators	Proportion
Cognitive Level	Understand the concept of low-carbon green campus construction	82.4%
	Do not understand	17.6%
Willingness to Participate	Willing to participate in campus environmental protection activities	90.1%
	Unwilling	2.3%
	Uncertain	7.6%
Behavioral Habits	Practice waste classification in daily life	78.5%
	Save water and electricity resources	89.3%
	Prioritize green travel methods	65.7%

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4. Construction of Evaluation System for Low-Carbon Green School Construction

4.1. Framework of the Evaluation System

Based on the construction practice ofZhejiang DongFang polytechnic and combined with relevant theoretical research, this research constructs an evaluation system for low-carbon green school construction consisting of 4 first-level indicators, 12 second-level indicators, and 30 third-level indicators, covering four dimensions: energy utilization, environmental construction, educational practice, and management mechanism. The analytic hierarchy process is adopted to determine the weight of each indicator to ensure the scientificity and rationality of the evaluation.

Table 4. Evaluation System for Low-Carbon Green School Construction (Excerpt)

First-Level Indicators	Weight	Second-Level Indicators	Weight	Third-Level Indicators
Energy Utilization	0.35	Proportion of Clean Energy	0.15	Proportion of solar energy, wind energy, etc.
		Energy Utilization Efficiency	0.12	Energy consumption per unit area
		Effect of Energy-Saving Renovation	0.08	Building energy-saving rate, equipment energy-saving effect, etc.
Environmental Construction	0.28	Proportion of Green Buildings	0.09	Proportion of buildings meeting green building standards
		Campus Green Coverage Rate	0.07	Proportion of green area to the total campus area
		Waste Treatment Level	0.12	Waste classification accuracy rate, recycling rate, etc.
Educational Practice	0.22	Degree of Curriculum Integration	0.08	Number of related courses offered, proportion of class hours
		Frequency of Activity Organization	0.07	Annual number of environmental protection themed activities
		Degree of Teachers' and Students' Participation	0.07	Proportion of teachers and students participating in environmental protection activities
Management Mechanism	0.15	Organizational Guarantee	0.05	Special leading group for work, management systems, etc.
		Fund Investment	0.05	Proportion of special funds for low-carbon green construction

4.2. Application of Evaluation Methods

Using this evaluation system to comprehensively score the construction of the low-carbon green campus ofZhejiang DongFang polytechnic in 2023, with a full score of 100 points, the final score is 82.6 points, which is at a good level. Among them, the environmental construction dimension has the highest score (89.3 points), and the management mechanism dimension has a relatively low score (76.5 points), reflecting that the college still has room for improvement in system improvement and long-term supervision.

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5. Research Conclusion and Discussions

5.1. Research Conclusion

Through initiatives such as optimizing the energy structure, promoting green buildings, strengthening waste recycling and utilization, and carrying out environmental education practices,Zhejiang DongFang polytechnic has achieved remarkable results in the construction of a low-carbon green campus. The comprehensive energy consumption per unit area has decreased by 17.2%, the waste reduction rate has reached 2.8%, and teachers and students have a high level of environmental protection cognition and participation.

The evaluation system for low-carbon green school construction constructed in this research covers four dimensions: energy utilization, environmental construction, educational practice, and management mechanism, which has strong pertinence and operability and can provide a reference for similar colleges and universities to carry out construction evaluation.

The research finds that the difficulty in data collection and the need to optimize research methods are common problems in the current research on low-carbon green school construction, which need to be further improved in subsequent research.

5.2. Application Value

Academic Value: This research enriches the theoretical system of low-carbon green school construction. The proposed evaluation system and practical paths provide new perspectives and methods for research in related fields and expand the research boundary of low-carbon campus construction in higher vocational colleges.

Practical Value: The construction experience ofZhejiang DongFang polytechnic summarized in the research can provide specific reference for other colleges and universities to carry out the construction of low-carbon green campuses; the constructed evaluation system can help colleges and universities accurately identify construction shortcomings and clarify optimization directions.

Social Value: The promotion and application of the research results are conducive to improving the low-carbon environmental protection awareness of colleges and universities and the public, promoting the green transformation of the education field, and contributing to the realization of the "double carbon" goal and the promotion of sustainable social development.

5.3. Improvement Suggestions

Strengthen Data Support: Establish a regular monitoring mechanism for data such as campus energy consumption and waste disposal, introduce intelligent data collection equipment, and improve the comprehensiveness and accuracy of data collection.

Improve Management Mechanism: Further improve the management system and assessment and evaluation mechanism for the construction of low-carbon green campuses, incorporate construction results into the performance assessment of departments, and form a long-term working mechanism.

Deepen School-Enterprise Cooperation: Strengthen cooperation with environmental protection enterprises and scientific research institutions, introduce advanced technologies and management experiences, and promote the innovative application of low-carbon green technologies on campus.

Expand Research Scope: In the follow-up, the research sample can be expanded to compare the construction practices of colleges and universities of different types and regions, so as to further improve the theoretical and practical system of low-carbon green school construction.

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