TEACHING MODEL TO ENHANCE ENVIRONMENTAL AWARENESS FOR INTERIOR DESIGN UNDERGRADUATE STUDENTS IN CHENGDU, CHINA

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BY

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HAS BEEN APPROVED BY THE GRADUATE SCHOOL IN PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR THE DOCTOR OF EDUCATION IN ED.D. (ARTS EDUCATION) AT SRINAKHARINWIROT UNIVERSITY

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The objective of this study is: ： 1) To study stage and need of environmental awareness of interior design courses ； 2) To develop the teaching model of interior design to enhance environmental awareness ； 3) To confirm the model of interior design to enhance environmental awareness. The study aims to use a Mixed Methods Research (MMR) approach. Phase One involves collecting and analyzing data, while Phase Two involves developing a new teaching model. The research sample consists of 17 undergraduate institutions in Chengdu that specialize in interior design, and the respondents are undergraduate students from grades 1 to 4 and graduates who have been involved in interior design for 1 to 5 years. The research instruments include surveys, semi-structured interviews, and focus group discussions. The data were analyzed using frequency distribution, percentage, mean, standard deviation, and priority demand index. The results indicate: 1) Firstly, the most pressing need is to enhance work-integrated learning (WIL) opportunities, as students show significant deficiencies in this area; secondly, there is a substantial lack of knowledge and skills related to Education for Sustainable Development (ESD); the third area is the Project-Based Learning (PBL) teaching method, which received a moderate level of recognition. Lastly, students performed well in terms of attitudes and values, demonstrating a strong recognition of the importance of environmentally friendly design, indicating that the demand in this aspect is the least urgent. 2) The developed teaching model aimed at enhancing environmental awareness among undergraduate students in the field of interior design consists of six important components: knowledge, skills, innovative teaching methods, practice-oriented learning, teacher development and support, and student self-development. Each of these components has its own characteristics and is designed to apply theoretical knowledge of environmental protection to practice, thereby enhancing various dimensions of students' environmental awareness. 3) The model's suitability rating was 4.51–5.00, indicating that it was very suitable; the feasibility rating was 4.51–5.00, indicating a very high likelihood of successful implementation.

Keyword : Teaching Model Environmental Awareness Interior Design Chengdu China

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CHAPTER 1
INTRODUCTION

1.1 Background

In the context of globalization, environmental issues are a common challenge for all nations(Azimi, Rahman, & Nghiem, 2023; Knight & Allan, 2021; Tadena & Salic-Hairulla, 2021; Widyastuti, Probosari, & Saputro, 2020; X.-Y. Zhang, 2015). Rapid economic development has led to resource over-exploitation and irrational energy use, causing climate change, ecological damage, and resource depletion (Cho & Park, 2023; Y. Huang, Wang, & Yang, 2019; Knight & Allan, 2021; Zhao, Gao, Wu, Wang, & Zhu, 2014). These issues have heightened global attention on sustainable development(Gao & Gu, 2021; Nations, 2015; X.-Y. Zhang, 2015). Since 1992, reports like those from the Worldwatch Institute and the UN Environment Program have highlighted global environmental deterioration, calling for urgent action. Despite some progress since the 1992 Earth Summit, global environmental issues remain significant obstacles to human development, underscoring the importance of the UN's 17 Sustainable Development Goals set in 2015, focusing on environmental protection and sustainable communities (Nations, 2015).

In China, ecological protection is central to national strategy and long-term development, with environmental conservation becoming ingrained in public consciousness (Y. Huang et al., 2019). In 2017, Xi Jinping emphasized harmony between nature and humanity as essential for sustainable development. By 2018, ecological civilization was highlighted as crucial for China's sustainability. In 2023, further emphasis was placed on integrating ecological protection into all aspects of development, guided by the principle that "lucid waters and lush mountains are invaluable assets" (Jiefeng & Qianxian, 2020). China's robust ecological protection system reflects its commitment to sustainable development through green development and resource conservation (Qin, 2020).

The global consensus on the importance of environmental protection highlights its critical role in the future of human society and as a major worldwide challenge.

UNESCO and the OECD emphasize Education for Sustainable Development (ESD) as essential (Amran, Perkasa, Satriawan, Jasin, & Irwansyah, 2019). Environmental awareness is vital for tackling global and local environmental issues and fostering individual commitment to conservation (Tadena & Salic-Hairulla, 2021);Meipry & Sudibyo, 2023). Environmentally conscious individuals are more likely to recognize pollution dangers and engage in efforts to address these issues (X. Chen, Huang, & Lin, 2019). Environmental awareness involves recognizing environmental issues and adopting protective measures, driven by knowledge, values, and attitudes (Xi & Wang, 2022).

Higher education enhances environmental knowledge, which in turn fosters eco-friendly behaviors (Lozano, 2006) ;Handoyo, Astina, & Mkumbachi, 2021). Environmental education plays a crucial role in strengthening knowledge, values, and attitudes, leading to responsible behaviors (Zsóka, Szerényi, Széchy, & Kocsis, 2013);Braun, Cottrell, & Dierkes, 2018) and can reflect an individual's willingness to live and act in ways that protect the environment (D. Li, Zhao, Ma, Shao, & Zhang, 2019). Higher education institutions are uniquely positioned to shape future leaders and professionals, influencing major human challenges and contributing to Sustainable Development Goals (SDGs) through research and policy (Alshuwaikhat & Abubakar, 2008); Kestin et al., 2017). Society urgently needs environmental awareness to cultivate socially responsible citizens (Anbalagan & Shanthi, 2015). as it has become a key term in modern discourse (Szeberenyi, Lukacs, & Papp-Váry, 2022).

In 2018, China's Ministry of Housing and Urban-Rural Development mandated that green buildings should constitute 40% of new urban construction by year-end, aiming to enhance energy efficiency and promote sustainable practices (Education, Ren, & Dai, 2018). This initiative calls for a shift from high-pollution, high-energy models to low-carbon, eco-friendly designs. Despite the longstanding proposal for sustainable interior design, its adoption remains limited due to early-stage resource conservation awareness gaps. The construction industry is now gradually embracing sustainable practices, but widespread adoption is crucial (Jiefeng & Qianxian, 2020). To address

these challenges, it's vital to enhance environmental awareness among designers and project managers through education, focusing on environmental theory, attitudes, values, and skills. Practical training should improve technical skills for addressing environmental issues, encouraging the use of green materials and innovation in low-carbon technologies.

China's "National Standards for Teaching Quality" aim to cultivate high-quality environmental specialists (Shuaixia Liu, Chen, & Zhang, 2020). Education should stimulate students' practical abilities and innovative spirit, enabling them to apply theoretical knowledge in fields like interior and environmental design. Sustainable interior design integrates aesthetics, functionality, and environmental responsibility (Goldman, Ayalon, Baum, & Weiss, 2018). Interior designers are crucial in promoting sustainable transformations and eco-friendly practices (Mohsen & Matarneh, 2023). Design education must enhance students' environmental awareness, emphasizing the impact of professional decisions on sustainability (Fytopoulou, Karasmanaki, Tampakis, & Tsantopoulos, 2023). Early interior design often prioritized aesthetics over ecology and environmental protection (Fang, 2020). Designers lacked the educational background to integrate sustainability theories with practice, despite students recognizing environmental urgency (Widyastuti et al., 2020). Environmental awareness is cultivated through practice (J. Huang, Lucash, Simpson, Helgeson, & Klippel, 2019). and modern designers must devise sustainable solutions (Adomßent, 2013). Higher education institutions must educate design professionals with a responsible attitude towards environmental protection, equipping them with knowledge, skills, and values to drive sustainable development (Adomßent, 2013; O$\breve{g}$uz, Çakci, & Kavas, 2010).

Training future interior design decision-makers requires cultivating environmental awareness, including knowledge, attitudes, and problem-solving skills, to promote sustainable design and contribute to Sustainable Development Goals (SDGs). Sustainable development in architecture focuses on minimizing pollution and maximizing material recycling, integrating eco-friendly principles throughout the design process (Jiefeng & Qianxian, 2020). Material selection is crucial, favoring

environmentally friendly, recyclable, or locally sourced materials, and emphasizing energy efficiency through efficient systems and passive design strategies (Mohsen & Matarneh, 2023). Achieving sustainable development involves scientifically assessing material-environment interactions and lifecycle impacts, alongside developing new eco-friendly materials (X.-Y. Zhang, 2015). Sustainable design, guided by ecological principles, aims to minimize environmental impacts and promote energy efficiency, enhancing material recyclability and reducing pollution across various fields (B. Sun, 2021).

Research shows that inadequate environmental knowledge hinders green innovation adoption (X. Chen et al., 2019; Fu et al., 2020). To promote sustainable design in interior design, it's crucial to enhance designers' environmental awareness and skills. This has become a focal issue in design education research (Yunqi, 2022). Despite practical content in foundational courses, there's a disconnect between teaching and real-world needs, with students often struggling to integrate isolated knowledge into projects (Siying Liu, Zhu, & Ma, 2021). The prevalent lecture-based teaching method limits interaction and critical thinking, hindering students' adaptation to real-world environments and career development (Kuang, 2021). Current teaching methods encourage site visits, but without proper guidance, students struggle to gather information effectively, affecting education quality and enthusiasm (Feng, 2019). Traditional education often overlooks the environmental impact of materials and renovations, leading to resource waste and ecological damage (Jia, 2021). This highlights the need to reform teaching models to integrate environmental concepts, enhancing sustainability awareness and practical skills (Jia, 2021).

Challenges in interior design education include a lack of environmental knowledge, attitudes, and practical skills due to the disconnect between education and industry. The Chinese government has promoted industry-education integration to address this, encouraging school-enterprise collaboration. Since 2010, policies like the "National Medium and Long-term Education Reform and Development Plan Outline (2010—2020)" and subsequent documents have emphasized integrating industry and

education to improve talent training and support economic development. The "Opinions on Deepening the Integration of Industry and Education" (2017) and the "National Implementation Plan for Pilot Projects on the Integration of Industry and Education" (2019) further advocate for this approach. In 2023, an "Action Plan for Empowering and Enhancing Vocational Education through Industry-Education Integration (2023-2025)" was introduced to optimize human resource supply and support national development strategies.

In the field of interior design, the integration of industry and education means combining theory with practice to enhance students' awareness of environmental protection. This includes knowledge, attitudes, values, and action capabilities related to environmental conservation. Students not only learn about environmental and sustainable design theories in the classroom but also apply these theories in real business and community projects. This hands-on approach helps to boost their environmental consciousness. Such an educational model prepares students to better meet the demands of the industry after graduation and promotes sustainable development in the field of interior design.

Due to the increasing deterioration of the global environment, the international community's high emphasis on sustainable development, and China's efforts to address the disconnect between education and industry, researchers are hoping to develop new teaching models in interior design to enhance students' environmental awareness. Based on Education for Sustainable Development and integrating Work-Integrated Learning (WIL) and Project-Based Learning (PBL), this new teaching model offers a fresh perspective for interior design education. The new model not only emphasizes the cultivation of students' environmental knowledge, attitudes, and values but also merges theory with practice, and work with learning. Students engage in hands-on projects to apply environmental concepts in real-world scenarios, thereby developing genuine skills to tackle environmental issues. Compared to traditional teaching methods in interior design, this model significantly boosts students' environmental consciousness. Additionally, the research outcomes will provide theoretical support and practical

guidance for the reform of eco-friendly interior design education in Chengdu and across China.

1.2 Objectives of the Study

1. To study stage and need of environmental awareness of interior design courses.

2. To develop the teaching model of interior design to enhance environmental awareness.

3. To confirm the model of interior design to enhance environmental awareness.

1.3 Significance of the Study

Facing increasingly severe global environmental issues such as climate change, resource depletion, and ecological destruction, sustainable development has become a consensus and urgent need in today's society. As a cornerstone of societal progress, education carries the responsibility of addressing these global challenges. This study delves into the current state of environmental awareness training within the undergraduate interior design program in Chengdu, identifying existing deficiencies to inform improvements in teaching models. The goal of developing new teaching methods in Chengdu's undergraduate interior design program is to enhance students' environmental consciousness. This framework not only includes the cultivation of environmental theory, attitudes, and values but also aids in developing students' ability to transform theoretical knowledge into sustainable design solutions capable of addressing environmental issues. The new teaching model emphasizes hands-on project work, encouraging students to participate in real interior design projects to enhance their environmental awareness and master sustainable design skills and core principles. Ultimately, by assessing the feasibility of this new teaching model, the study provides empirical evidence for improving sustainable development education in interior design across Chengdu and nationwide. Training high-quality talent with environmental awareness will become a backbone of the industry, driving the innovation needed for the interior design field to transition towards sustainable development. This contributes

significantly to the Sustainable Development Goals (SDGs) and holds substantial contemporary relevance and historical value in the face of worsening global environmental issues.

1.4 Questions of the Study

1. What is the status quo of environmental awareness in interior design courses?

2. How to develop the teaching model of environmental awareness in interior design?

3. How to evaluate the feasibility of interior design teaching model?

1.5 Hypothesis

1. The existing interior design teaching model for undergraduate students in Chengdu fails to fully integrate and impart the concepts and practices of environmental awareness and sustainable design.

2. Through the development of interior design teaching model, students' environmental awareness and sustainable design ability can be significantly improved.

3. Increased environmental awareness will further influence students' design choices and behaviors, prompting them to adopt more sustainable design strategies in their future careers.

1.5.1 Dewey's Theory of Experiential Learning

According to John Dewey's theory of experiential learning, the importance of experience in the educational process is emphasized. It posits that the generation of knowledge and ideas stems from the interaction between individuals and their environment, highlighting that learning occurs through practical experience and reflection on these experiences. This suggests that learning is not merely the transmission of knowledge but should be constructed through actual experiences and the reflection upon them. In the undergraduate interior design teaching model in Chengdu, applying Dewey's theory aims to enhance students' awareness of environmental conservation and their ability to design sustainably. This necessitates

creating a learning environment where students can actively participate in sustainable design projects. Through such projects, students not only learn the theoretical knowledge of sustainable design but, more importantly, experience and reflect on the application of these concepts in practice. This deepens their understanding of the significance and methods of sustainable design, naturally integrating considerations of environmental conservation and sustainability into the design process, thereby enhancing their environmental awareness.

1.5.2 Theory of Education for Sustainable Development (ESD)

The Education for Sustainable Development (ESD) theory underlines that education should not only impart knowledge and skills but also cultivate an understanding of current global challenges and the values, behaviors, and lifestyles needed to address these challenges. This includes enhancing environmental awareness and encompasses the sustainability of economic and social development. In interior design education, applying the ESD theory means that both the content and methods of education should aim to develop students' awareness of environmental protection and their sustainable design skills. This can be achieved by integrating interdisciplinary knowledge, promoting critical thinking, encouraging social participation, and fostering reflection. Through such education, students learn not only the professional knowledge of interior design but also understand how their design choices impact the environment, economy, and society. This prepares them to adopt more sustainable design strategies in their future careers and explore how design practices can promote sustainable development.

1.6 Scope of the Study

Address range: Chengdu, Sichuan, China

1.6.1 Geographic location and regional characteristics

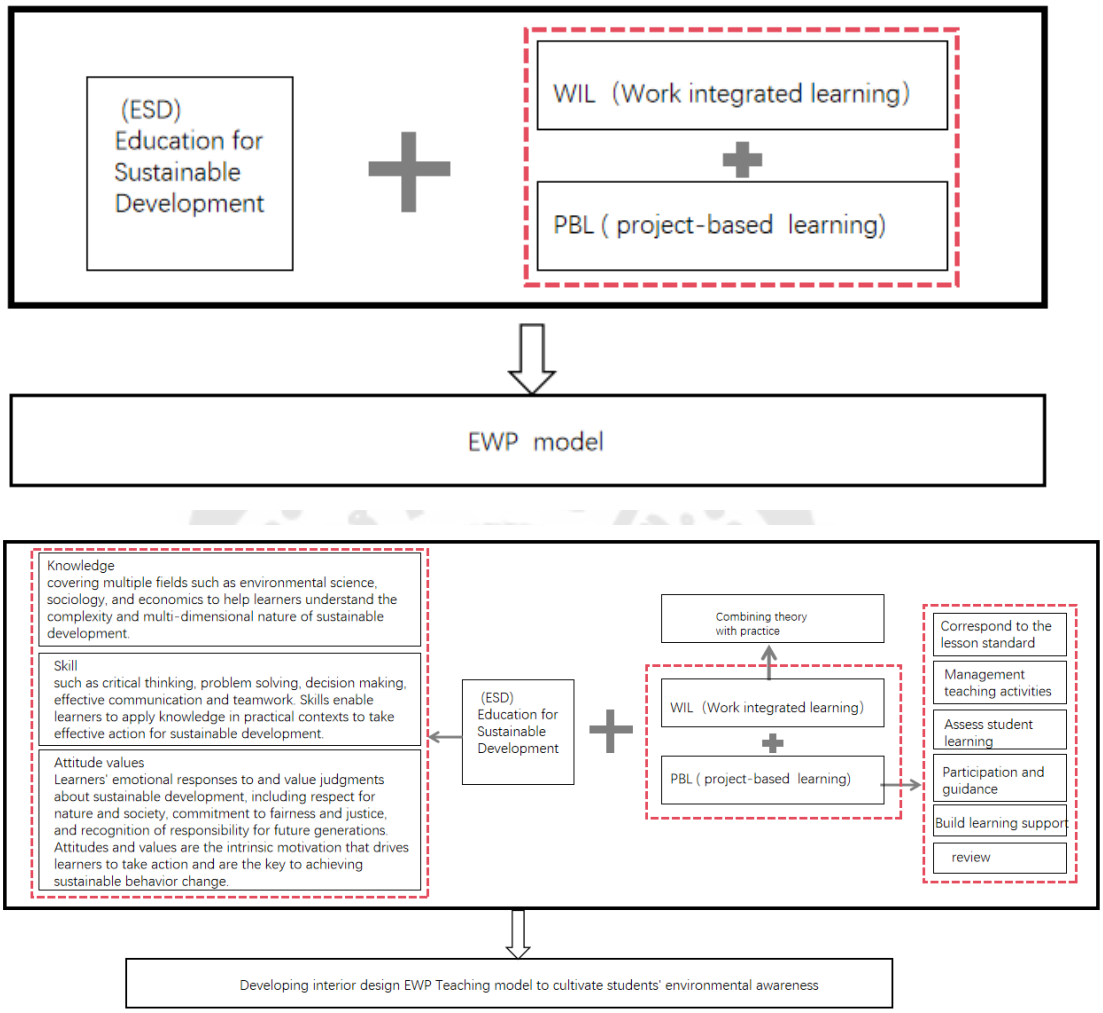
Chengdu, located in the southwestern region of China, boasts abundant cultural history and natural resources, and serves as one of the economic and cultural hubs of Western China. In terms of housing construction, Chengdu is home to a large number of national enterprises and renowned companies, making it a vital support for

urban development. Notable among these are the China Railway Group Limited's subsidiary, China Railway No.2 Bureau Group Company, with an investment scale of 70 billion yuan, and the China Wu Yi Co., Ltd., worth 50 billion yuan, along with other major players like the Hydroelectric Engineering Bureau. Local construction giants such as Sichuan Huaxi Group and Chengdu Construction Engineering Group also have their headquarters here. The interior design industry in Chengdu is quite vibrant, with significant market demand and potential. There is a growing emphasis on educating students in this field about environmental awareness to promote sustainable design practices in the industry.

1.6.2 Educational resources and institutional features:

Chengdu, as the economic and cultural center of western China, exemplifies the regional educational standards and development trends in interior design education. Amid the rapid urban development and booming construction industry, there is a growing demand for interior design professionals who are conscious of environmental sustainability. However, current undergraduate interior design education in Chengdu lacks a systematic teaching model for fostering environmental awareness and sustainable design skills. There is an urgent need for educational innovation to enhance students' awareness of environmental protection.

1.7 Conceptual Framework



1.8 Definition of Terms

1.8.1 Interior design

Interior design is a multidisciplinary field that involves the planning, design, and decoration of spatial environments to enhance their functionality, safety, and aesthetics. Interior designers are typically responsible for creating the overall layout and appearance of indoor spaces, including color schemes, lighting design, furniture selection, the application of materials and finishes, and other decorative elements. Designers must also consider the practicality and comfort of the space while ensuring that the design complies with building codes and health standards.

1.8.2 Environmental awareness

Environmental awareness refers to the comprehensive ability of interior design professionals to understand theoretical knowledge about environmental protection, hold relevant attitudes and values, and apply these theories to sustainable design practices.

1.8.3 Teaching model

The teaching model is a relatively stable teaching activity procedure designed to achieve specific educational goals, based on certain theoretical foundations and integrated with practice. It consists of a series of predetermined teaching strategies and methods aimed at guiding and improving teaching practice. The structure of the teaching model includes teaching philosophy, teaching objectives, curriculum structure, teaching strategies and methods, implementation conditions, and teaching evaluation.

1.8.4 Sustainable design

Sustainable design is a design philosophy and practice aimed at supporting ecological balance and the sustainable use of resources by reducing negative impacts on the environment. It emphasizes resource efficiency, environmental protection, and social responsibility, ensuring that design solutions are economically viable and can be realized and promoted in the market. Sustainable design adopts a lifecycle approach, considering the entire lifecycle of a product or building from raw material acquisition, production, and use to final disposal, while minimizing environmental impact. Additionally, it encourages adaptation to changing environmental and social needs through innovative design and technology. Sustainable design involves not only the selection of technologies and materials but also reflects the values and sense of responsibility of designers, with the goal of creating a healthier, fairer, and more sustainable future, and making significant contributions to the achievement of the Sustainable Development Goals (SDGs).

CHAPTER 2
REVIEW OF THE LITERATURE

2.1 Sustainable Design

Concept of Sustainable Design Sustainable design was first proposed by Hans Carl von Carlowitz in 1713. In 1987, according to the Brundtland Report, the definition of sustainable design is "the economic development that meets the needs of the present without compromising the ability of future generations to meet their own needs." With the advocacy of the United Nations, countries around the world have deepened their understanding of sustainable development (Keitsch, 2012). The essence of sustainable design is to balance considerations of usage needs, environmental benefits, social benefits, economic benefits, and business development, and to rethink design to meet consumption needs, explore sustainable development solutions that conserve energy and protect ecological health while making full use of resources (Margolin, 1998).

Scholars in the academic community have different focal points when it comes to sustainable design, leading to a lack of consensus on its definition. Sustainable design is a strategic activity that aims to meet consumer needs while reducing resource consumption and waste, minimizing environmental pollution, and enhancing the quality of life. It is a method of achieving sustainable development through design practices, education, and research (Bhamra & Lofthouse, 2016). Furthermore, sustainable design involves the process of designing products and services based on the consideration of multiple dimensions of sustainable development (Leerberg, Riisberg, & Boutrup, 2010).

Sustainable design can be understood as the concrete application of sustainable development in design practices. It involves design activities aimed at finding solutions to sustainability issues and serves as a strategy and model for addressing human survival and development concerns. It is a systematic design strategy that seeks the harmonious development of people with the environment, economy, and society. Furthermore, it is a crucial approach for achieving efficient use of resources and energy in manufacturing and reducing environmental pollution.

2.1.2 Development of sustainable design

The development of sustainable design has primarily unfolded through four stages:

The first stage is green design, which prioritizes environmental factors as the primary purpose of design. Under this premise, it ensures that the product meets the necessary functionality, lifespan, quality, and other requirements. The goal is to optimize every step in the manufacturing process and comply with eco-friendly standards (J. Yan & Feng, 2014). This stage focuses on reducing resource and material consumption throughout the product's lifecycle, facilitating product reuse, and minimizing environmental impact. Although this phase incorporates environmental considerations and reflects deeply on the role and social responsibilities of design, enhancing its value, early green design concepts were more about intervention and remedy after recognizing problems and risks. They merely delayed the emergence of hazards rather than implementing truly sustainable strategies. Furthermore, excessive material consumption behaviors have diminished the intended environmental effectiveness (Conglin, 2023).

The second phase is ecological design, which builds upon the principles of green design by incorporating comprehensive considerations of a product's lifecycle stages. This includes strategies to reduce resource consumption and properly manage waste during production. Ecological design is an advanced form of green design, supplementing its shortcomings by developing from its foundation (Ruijia, 2023). It differs from green design, which typically addresses a single issue, by focusing on the entire spectrum of a product's journey—from design and manufacturing to consumer use. Designers are tasked not only with reducing pollution during production but also with considering the potential environmental impacts during consumption. Ecological design considerations encompass pollution and resource depletion during manufacturing, as well as modern technological pollutants like noise, reflection, radiation, and the generation and disposal of waste (Shan & Shixiu, 2022). A key feature of ecological design is its emphasis on "Life Cycle Assessment," characterized by a

systematic approach and quantifiable indicators that standardize and regulate the design process. By overseeing the entire lifecycle of a product—including material selection, production, manufacturing, use, and recycling—designers become aware of environmental issues that arise during the design process and link these issues to the design outcomes. This awareness drives designers to minimize the overall negative environmental impact as much as possible. Additionally, designers must consider the potential environmental impacts throughout the product's lifecycle.

The third stage is the design of product system services. At this stage, the entire process of product design is considered, incorporating a variety of factors from the business environment to propose comprehensive solutions for new business models, shifting from designing products to designing solutions (Renhua, 2014). Product system design moves from the traditional concept of "materialized products" to "system design," engaging with the "product and service" level. Professor Manzini from Politecnico di Milano explains this as a shift from designing concrete objects to designing solutions. In his book "Product Design," Wu Xiang suggests that the design of a product system should consider the whole, viewing each part as a subsystem or component and integrating these subsystems with the external environment organically. This system design is not about specific products but rather an integration of existing products and services. Its innovation lies in shifting the primary focus of designers from the explicit aspects of the product, such as function and appearance, to the implicit aspects, such as the manner of use and the experiential feel of the product, while also considering environmental benefits (X. Liu, 2010). Successful product service system design involves innovative thinking about product usage patterns rather than merely redesigning the product itself. Product system design must take into account a harmonious balance among people, environment, and society, satisfying human physiological and psychological needs on the basis of respecting the environment, and constructing a modern society that is sustainable in all aspects. Scholars have categorized product system design into urbanized, industrialized, and emotionalized product system design (Zhencheng, 2020).

The fourth phase is designed for social equity and harmony. Social design focuses on achieving equitable and harmonious development, further refining and deepening the concept of "sustainable design." It shifts from tangible material products to addressing the spiritual and emotional aspects of the public (Chen Xiangyi, 2003). Professor Manzini of the Politecnico di Milano describes this innovative form of social design as having a "green, social, and networked" development direction(Manzini, 2007). However, social innovation is not the ultimate goal of sustainable design but rather a means to an end. Its emphasis is on a higher dimension of care for the future of people, the planet, and all living beings on Earth, with the core goal of achieving sustainable development. Research and development in sustainable design keep pace with the times, combining the spirit of the age, technological advancement, economic growth, and public demand to develop corresponding forms that address issues and meet the needs of sustainable development. Sustainable design is not necessarily about new technology but must enhance ecological benefits and social welfare while meeting the demands of economic growth. In essence, sustainable design seeks to balance the social, economic, and environmental aspects, meeting the consumers' basic and psychological needs while minimizing the environmental impact, ultimately achieving harmonious development between humans and nature.

In summary, scholars have studied the concept and development of sustainable design, as well as the principles of its application in products. Nowadays, an increasing number of people recognize the importance of sustainable design and are taking part in actions to promote its development. However, there are still some inevitable issues that need to be addressed. For instance, economically, addressing environmental problems requires substantial funding, and it is a challenge to solve these issues with limited resources. In terms of education, governmental departments need to intensify their efforts to raise awareness of sustainable design. Currently, only a minority actively supports green initiatives, while those with lower living standards have the will but lack the means to support environmental causes. Policy-wise, effective measures must be taken to remediate actions that harm the environment. Following these

principles in design can help reduce manufacturing costs and energy consumption, maximize the value of resource use, prolong product lifespans, extend the functional value of products, and promote harmonious development among people, nature, and society. These research findings support this paper's investigation into interior design teaching models and how they can cultivate students' awareness of environmental protection.

2.1.3 Research on the status quo of sustainable design

The United States has introduced the concept of green products, awarding an eco-friendly label to products that meet environmental standards. Nordic countries, rich in forest resources, use wood as a significant material in industrial design. With the advancement of sustainable design principles and heightened awareness for forest conservation, these nations are exploring sustainable design starting from the product lifecycle stages (Bunz, Henze, & Tiller, 2006). Germany, as an industrial powerhouse and major car producer, is examining sustainable design in the context of vehicle dismantling, advocating for a systemic approach as the only effective method for sustainability (Yudelson & Meyer, 2013). Japan adheres to the philosophy that "design triggers design thinking, which then guides design actions," focusing its sustainable design research on material treatment, processing, and recycling (Sunikka - Blank & Iwafune, 2011). In China, sustainable design involves incorporating environmental impact into material and technology choices, thoroughly analyzing and refining traditional material selection methods (Yu, 2021).

Integrating environmental demands, design methodologies, operational tools, and corporate strategies in product development provides a comprehensive theoretical framework for sustainable design, along with a general directive for environmental sustainability concepts. The introduction of life cycle design methods offers specific approaches and tools to assess the environmental impact of products, using case studies of environmental product design to summarize the principles and strategies of sustainable design (Jingjin & Jianjun, 2022). Scholars have analyzed the issues with unsustainable design solutions from a systemic perspective, examining

sustainability strategies and practices in terms of reducing impact, reusing, recycling, restoring, and processes (Li, 2019). Additionally, researchers have applied the concept of green modularity to product design, assessing new modular methods from the perspective of a green life cycle. They have utilized a contact graph scoring system enhanced with engineering attributes to evaluate the degree of connection between materials and product components, proposing a green material cost analysis method that can be used to evaluate the environmental performance index of materials (Pujie & Fenghua, 2022).In summary, extensive research has been conducted on sustainable design in industrial design, leading to the proposal of numerous practical methods and strategies. A review of the relevant literature reveals that the main focus areas are sustainable design strategies, material selection and evaluation in sustainable design, and aspects of sustainable consumption.

2.1.4 Research on sustainable design of interior design

2.1.4.1 Connotation of sustainable interior design

Sustainable development is the process of evolving in a way that fully considers the needs of future generations. In interior design, designers can guide and constrain their creative actions through sustainable design thinking. Only then can the interior design industry develop in a healthy and sustainable manner, and design works can truly fulfill the original intention of continuously improving the quality of people's lives (Li,2019). Sustainable interior design is a scientific design philosophy and method that reflects people's reconsideration of the environmental costs brought by societal development and showcases the moral and social responsibility of designers (Lubo, 2023). From the perspective of design science, sustainable design is an extension of the concept of sustainable development. This concept emphasizes that design considerations, including the results, environmental impact, and simulated implementation process, should be taken into account from the outset. It promotes constant consideration of the natural world and resource interests, avoiding their destruction and waste, thereby achieving harmonious development among population, resources, and the environment.

2.1.4.1 Interior design of sustainable design works

Sustainable design in interior design has produced numerous works with diverse techniques. One recent example is a contemporary residential design in Sagaponack, New York, by Bates Masi Architects. They took into consideration the unique location between the Atlantic Ocean and a lake, using home decor materials that withstand harsh and humid conditions. They maximized the use of space and light to create a comfortable indoor environment (Yishao, 2023). The pursuit of sustainability imposes higher demands on interiors, requiring designers to make more comprehensive decisions regarding the use of space.

Some buildings have incorporated no less than 95 sustainable green technologies, truly qualifying as eco-friendly luxury homes. Designers have attempted to merge landscape and ecological architecture by adhering to three key principles: integrating sustainable energy with green technologies; meeting ecological and environmental standards; and considering emotional comfort, ensuring residents feel at home (W. Li, 2023). These luxury homes blend structural systems, materials, spaces, and landscapes with technology, achieving reduced energy consumption and energy generation through the combined use of green tech and energy-saving systems (Yunqi, 2022). The residences feature high-density triple-glazed windows and vertical cylinders, maintaining a constant indoor temperature by maximizing the use of natural resources like solar energy, rainwater harvesting, natural ventilation, and lighting, resulting in exceptional indoor comfort. Moreover, the interiors are decorated with recycled materials and eco-friendly wallpaper to minimize carbon emissions. Plants are grown on the exterior walls and roofs, making the buildings not only energy-efficient and environmentally friendly but also aesthetically pleasing.

In China, there has been considerable reflection on the sustainability of interior design, especially within public spaces such as office environments. Advocates of green office design adhere to specific principles. They prioritize the selection of renovation materials that meet pollution control standards and encourage measures to reduce material pollution in future use, such as ensuring proper ventilation and placing a

bowl of vinegar to diminish decorative odors. Additionally, they strive to minimize renovation costs while meeting functional and aesthetic requirements. Lastly, to create a comfortable and pleasant office atmosphere, they aim to reduce the demolition and construction of walls and properly manage construction waste (N. Li, 2022).

In summary, scholars have proposed new design concepts in the field of sustainable interior design, studying the essence and works of sustainability in interior design. The research emphasizes preserving natural advantages in renovation projects, such as creating a comfortable indoor microclimate that's warm in winter and cool in summer, and excellent insulation and soundproofing. Adhering to eco-friendly principles and integrating sustainable development strategies, the studies aim to improve the living quality of cave dwellings. Sustainable design practices vary by country, but designers globally are contemplating interior sustainability, reflecting a new wave of design thinking that meets the objective requirements of ecological protection and sustainable growth. These scholarly contributions lay the groundwork for this paper's exploration of teaching models in interior design education.

2.2 Interior Design

2.2.1 Concept of interior design

The definition of interior design is constantly evolving with the development of media and technology. Traditionally, interior design involves creating a functional, comfortable, and aesthetically pleasing living environment that satisfies both the material and spiritual needs of people. This is achieved by applying architectural design methods and material technology according to the purpose of the building, its environment, and specific requirements(Sully, 2015). Interior design must meet people's functional requirements for space while also possessing certain spatial use value(Zwanch, Carter, & Davenport, 2023). Aimed at fulfilling the indoor environmental needs of individuals, from spiritual to material aspects, modern interior design is developing towards a comprehensive approach. It not only reflects in engineering technology but also caters to visual enjoyment, encompassing the integration of multiple elements such as heat, light, sound, environment, artistic conception, and atmosphere.

2.2.2 Research on interior design teaching model

The hallmark of design education is the development of a comprehensive design education system centered around architectural design. Architectural design exemplifies the fusion of art and science, and design education has always emphasized the integration of aesthetics and engineering. In addition to architectural design, furniture design education serves as a prime example. Often, an exceptional architect is also a skilled furniture designer, a phenomenon that is not unrelated to Europe's emphasis on combining art with technology in design education (Zhen, 2016). Initially emerging as vocational education, interior design teaching models have placed a strong emphasis on practical instruction from the outset. Design institutions commonly establish various studios or school-operated factories, adopting an "industry-education integration" approach to education(Asojo, 2012). Products designed and produced by students in these studios or factories are frequently sold commercially, becoming an important revenue source for the schools and a practice widely adopted by early design institutions(Abdallah, 2022).

The Boulle School in Paris, France, is a vocational institution specializing in furniture making. Since its inception in 1886, the school has adopted an educational philosophy that integrates cultural education, professional theory, and technical practice. In its practical teaching approach, it combines materials, craftsmanship, technology, and aesthetics to provide an integrated education. The students it nurtures are first and foremost furniture craftsmen, and only then do they become furniture designers (Sparke, 2019). This text outlines the fundamental model adopted by early European design institutions, particularly vocational education schools, for cultivating talent. It describes an interior design teaching model that emphasizes technical skills over artistic abilities, known as the "skill-art combination" approach. In this model, the teaching staff predominantly consisted of craftsmen, especially those skilled in furniture making. This educational approach remained unchanged until the emergence of the Bauhaus movement, which brought about significant modifications(Sormunen, Juuti, & Lavonen, 2020).

As the inception of modern design education, the educational philosophy, system, and dual-instructor teaching model of the Bauhaus have exerted a profound influence on the development of design education worldwide. The model, constructed on the concept of a "new unity of art and technology" and embodied in the "interior design studio," has become a template for contemporary interior design education. To this day, it remains the fundamental teaching model in the majority of design institutions across Europe and North America(Bilan, Vasilyeva, Kryklii, & Shilimbetova, 2019). Scholars have elevated the artistic component in interior design education and have attempted to forge an alliance of "art and technology" by combining artists with craftspeople, aiming to cultivate designers proficient in both areas(Petermans & Cain, 2019). However, the Bauhaus's architecture-centered training model still struggles to escape the dominance of science and technology over art and has not fully resolved the integration of art and technology. The dual-instructor model also gradually declined due to various contradictions between the instructors, such as issues of authority (Mitton & Nystuen, 2021).

Many international studies on Bauhaus include discussions on this topic, such as those by Friedhelm·Kröll and Academic works by Frank·Whitford et al , have discussed its legacy. The Ulm School of Design, as an inheritor of the Bauhaus educational system, propelled rationalist design to new heights after the war. It pioneered an integrated model of interior design education that combined academia and professional design with research and development, shaping the modern design team's work model(Forgács, 1995). However, Ulm's approach excessively emphasized the role of science and technology, veering towards an extreme rationalism that resulted in designs that were often monotonous and impersonal, lacking warmth and human touch. The Ulm teaching model, which sought to unify science and art, still favored a "suppress art, emphasize work" approach(Yong Li & Zong, 2021). In 2003, on the 50th anniversary of the Ulm School of Design, the Ulm Archives organized a major exhibition titled "Ulm: Method and Design" to review more than a decade of the institution's achievements. The exhibition featured extensive photographs and text covering Ulm's

history, buildings, biographies of founders, theoretical contributions, interviews with departments, teachers, and students, and focused on discussing the "Ulm model" and its impact(Kirsch, 2020). In Japan, the exploration of the "art and engineering combined" educational model has been profound, with several institutions named after "art and engineering." These design institutions share a common characteristic in their academic construction and student training: they are predicated on the study of art engineering, interpreting the disciplinary attribute of art design as art engineering, integrating science and technology with the art design discipline, and advocating for a blend of art and engineering with a permeation of humanities and sciences. Students who complete their studies are awarded Bachelor's, Master's, and Doctoral degrees in Art Engineering, centered around education in artistic design that emphasizes sensory refinement (S. Wang, 2016). Shinji Koike interpreted the concept of "art engineering" as the "humanization of technology," which means positioning technology in its rightful place (Ravimohan, 2021). Art engineering thus emerges as an interdisciplinary field blending art and engineering—primarily engineering technology—to meet the design needs of modelrn society(Mitcham, 2022). Its educational philosophy is to fuse multiple disciplines such as science, technology, and art, positioning the interdisciplinary field of education and research as "Design equals art engineering." This concept reflects the "art and engineering combined" approach in design studies(Wilson, 2003).

German design institutions largely follow the teaching models of two pioneering schools, and the German Academy of Fine Arts stands out for its development and innovation. It has effectively combined the "dual-master" teaching approach of the Bauhaus with an "inquiry-based" teaching model, establishing a student-centered pedagogy. Here, the instructor leads during lectures, while learners take the lead during their studies, creating a "learning community(Meyer & Norman, 2020)." Inquiry-based teaching uses projects as a medium, emphasizing context and problem design for "problem-based" instruction. It focuses on teamwork and teacher guidance instead of teacher control, leading to a distinctive inquiry-based interior design teaching model built on project-driven learning(Orthel, 2015).Cranbrook

Academy of Art, building on the Bauhaus design education model, has established an "open" graduate teaching model centered on studios. It is characterized by its strict control over enrollment numbers, promoting elite education with only 150 students across nine departments, where applicants must have strong practical experience and creative abilities (McCarthy,2019). A key feature of this open model is the absence of fixed design courses, offering only a selection of theoretical research courses. Students are expected to establish their own client networks (with departmental support) and take on real design projects, with mentors primarily tasked with addressing issues encountered during these projects(Vieira-Sbruzzi, Ferreira, Barbosa, & Borges, 2021). Although Cranbrook Academy of Art focuses on graduate education, its innovative approach to undergraduate interior design education, especially in course design, is worth learning from. Meanwhile, a "cooperative education" model that combines academia and industry, pioneered by Herman Schneider at the University of Cincinnati in 1906, has had a profound impact on higher education in the United States and worldwide(Sue & Okazaki, 2022). This model integrates design, engineering, and business based on a unified project management platform, differing from typical internships and is a partnership model between schools and businesses. It is widely popular in higher education across North America, Western Europe, Southeast Asia, and Oceania.

The Royal College of Art in the UK, like the Cranbrook Academy of Art in the US, which only offers postgraduate education, places special emphasis on collaboration between institutions and academic bodies. It operates in partnership with institutions such as the Royal College of Music and the Royal Academy of Sciences, while also sharing resources with the Victoria and Albert Museum and the British Empire Museum (Urban, Wagoner Jr, & Gaither, 2019). The college annually recruits outstanding undergraduates from around the world with exceptional artistic talent and a background in engineering technology, aiming to cultivate innovative designers or design managers in the field of interior design. Its teaching model is based on "Design Platforms," with six platforms in the interior design department, each featuring experts from various fields

including artists, theorists, designers, architects, and business strategists(Wenjia, 2017). This "think tank" style of Design Platform not only broadens students' avenues for knowledge but also builds confidence as they delve into design projects(She, 2021).

In the Scandinavian Peninsula, located in northern Europe with parts extending into the Arctic Circle, the long and cold winters, along with abundant forest resources, have fostered a Nordic design education that values architectural and interior design more than continental Europe. It integrates more technological elements into the traditional functionalist education of household items like furniture, glass, and ceramics, resulting in a holistic educational model centered on architecture, with interior and furniture design as integral components(Gibson, 2015). From the perspective of academic development, Nordic countries place great importance on interdisciplinary integration and collaboration within design disciplines, emphasizing the combination of traditional craftsmanship with modern science and technology. They focus on ergonomics research, leading to a "human-centered" approach to green design education and the importance of introducing "dual-skilled" teaching staff, as exemplified by institutions such as Aalto University School of Arts, Design and Architecture in Finland and the Royal Danish Academy of Fine Arts in Copenhagen(Salman, Fobler-Cressy, Habib, Elkady, & Mohammed, 2021).

In summary, a review of the current state of research reveals that there are still numerous issues to be addressed in the field of interior design education at this stage. There is significant room for improvement in several aspects related to teaching methods, including educational philosophies, the design of teaching activities, curriculum development, and the evaluation of teaching outcomes. Most of the existing research on the "integration of art and craftsmanship" in teaching has been based on practical perspectives, with a general lack of theoretical research. This paper aims to contribute to the theoretical framework of teaching models in this field, based on practical research, and to lay some groundwork for future studies. It is important to stress that conducting research from a theoretical perspective does not negate the value and importance of practical research. Rather, it addresses the fact that findings

from practical research are often derived from intuitive thinking and lack theoretical consideration. This study seeks to explore the necessity of implementing "knowledge innovation" and "progressive project-driven learning" in the field of interior design from a more rational and scientific standpoint. However, the ultimate goal is to return to practice to test the authenticity and reliability of the theory.

2.2.3 Application of environmental awareness in interior design

In the 1960s, American design theorist Victor Papanek emphasized the social and ethical values that designers should embody. He advocated for the mindful use of Earth's limited resources, a concept that was not fully embraced at the time and faced some skepticism(N. Wang, Yu, & Wu, 2015). It wasn't until the 1970s, with the emergence of the term "finite resources," that people began to reassess Papanek's design philosophy, gradually accepting his definition of a designer. This led to the concept of "eco-design," which slowly gained attention and recognition(B. Zhang & Song, 2020). By the 1980s, global attention had shifted towards environmental protection, and "eco-consciousness" started to spread worldwide(Rashdan & Ashour, 2017). Designers of this era revisited their previous work, realizing that excellence in design equated to a path of sustainable development. Consequently, many designers began to consider more deeply the relationship between people, society, and the environment in their design processes, striving to minimize waste of natural resources and reduce pollution from interior design(Rashdan, 2016).

Most scholars studying interior design have traditionally focused on the subject from a purely design-oriented perspective, rarely expanding and connecting it with broader considerations. During this period, green interior design has achieved some progress but has encountered numerous obstacles, learning valuable lessons along the way. As it moves forward, green interior design is developing along a path that aligns with cultural nuances and national conditions. However, this development has been slow, and the accomplishments modelst, indicating that green interior design still has a considerable journey ahead, requiring further promotion and in-depth study(Mitton & Nystuen, 2021). With the advancement of society and the economy, people's material

lives have improved significantly, but many still lag in cultural sophistication, clinging to wasteful practices and equating the most expensive with the best, often lacking environmental awareness. This mindset prevails in home renovations that aim for luxury at the expense of sustainability, using materials believed to be harmless but which contain harmful chemicals, leading to resource waste and potential health threats(Celadyn, 2019b). In light of this, society needs to emphasize the importance of green design and environmental consciousness, and there is a call for the refinement and revision of related laws and regulations. Green and sustainable design should adhere to a human-centric approach, harmonizing the relationship between people and nature, planning living spaces thoughtfully, and providing personalized services and living environments(Vallet & Tyl, 2020). As the interior design industry rapidly grows, the ranks of designers are swelling. However, with low barriers to entry, there is a variance in the quality of professionals. Some designers disregard professional ethics and social responsibility, creating products that violate green design principles and harm the environment. Therefore, it is imperative to enhance the professional integrity of designers, advocating for green ecological design to achieve harmony between humans and nature.

Research on green interior design started relatively late and has been limited in scope, but as socio-economic development continues, it is expected that more scholars will delve into this field, providing a solid theoretical foundation for the advancement of environmental conservation efforts. Scholars have elaborated on the role of environmental awareness in interior design from the perspectives of importance and necessity. They have discussed specific measures for applying environmental consciousness in interior design, offering a theoretical basis and practical guidance for eco-friendly home design(Jones, 2008). Incorporating environmental awareness into interior design is a forward-thinking concept that offers a new creative direction and injects fresh vitality into the field, broadening designers' horizons(Kim & Kang, 2022).

By reviewing extensive literature, authors have explored the application of environmental consciousness in design in terms of materials, space, aesthetics, and greening. They have also studied practical cases to address challenges encountered when integrating environmental awareness into the interior design process, and have forecasted the prospects for environmental consciousness in the industry's future (McGee, Park, Portillo, Bosch, & Swisher, 2019). Researchers argue that the existence of designs that waste resources, damage the environment, and affect human health is due to some designers' lack of professional ethics and their disregard for the pollution hazards of interior decorations. To change this disorder in the renovation industry, systems should be established, such as holding designers accountable for their work throughout their careers. If their designs cause environmental damage or impact human health, designers should face significant consequences (Yildiz & Budur, 2019). Contemporary designers should embed eco-friendly and ecological design principles throughout their careers, striving to create a better living environment for their clients. The article provides a detailed analysis of the crucial role of green design in interior design, articulating its principles and how to integrate environmental awareness into contemporary design fields. The author hopes that the article will raise awareness of environmental conservation and provide theoretical references for designers in the industry(Jain et al., 2020). The article also reveals the environmental pollution caused by traditional design practices, pointing out that profit-centered designs not only waste resources but also pose serious threats to human health(Danza et al., 2020). By examining unsuccessful cases, it concludes that contemporary designers should shift from outdated design philosophies and keep pace with the times, focusing on the harmony between humans and nature and emphasizing green design principles as a basis for practitioners in the field.

In contemporary society, the pace of development continues to advance, and the level of scientific and technological innovation is constantly being refreshed. This evolution has spurred a shift in interior design from a traditional, singular approach to a more diverse one (Pastore & Andersen, 2019). The conventional design methods no

longer satisfy the modern demand for quality of life and contradict the advocacy for sustainable development; they fail to meet the spiritual and psychological needs of individuals. Therefore, interior designers should revamp their design philosophies to keep pace with the times, integrating eco-friendly design concepts with current trends. Environmental consciousness is not only a response to protecting ecological civilization but also an inevitable trend in societal development(Celadyn, 2018). As people's living standards improve, there's a move away from previous lifestyles toward higher spiritual aspirations and a higher quality of life. Moreover, after facing repercussions from nature, people's awareness of environmental protection has significantly increased, especially in terms of demands for a better indoor living environment(Sorrento, 2012). Incorporating this environmental awareness into interior design is a requirement of the times and aligns with contemporary desires for a high-quality life. It is believed that in the near future, environmental consciousness will pervade the entire design industry, becoming the foundation for every designer's creative process. Additionally, more scholars are expected to conduct in-depth research in this area within the academic community.

Environmental degradation, imbalance, pollution, and resource waste have swiftly brought about nature's retribution on humanity, with global warming, rising sea levels, smog, and acid rain serving as punishments for excessive resource exploitation. This has led to a reconsideration of human actions and their impacts(Kotzias & Pilidis, 2017). The concept of "ecology" was first introduced by the German scholar Hegel in 1869, focusing on the relationship between organisms and their environment. By the 1960s, it had evolved into an interdisciplinary science, integrating with other fields(Z. Yan, 2022).

The application of environmental awareness in interior design is a synthesis of ecological principles with design disciplines. Although not yet a complete system, developed countries have begun to incorporate principles of ecological protection, resource conservation, and pollution control into design foundations(Moya, van den Dobbelsteen, Ottele, & Bluyssen, 2019). The global energy crisis of 1973 sparked a

revolution in thought across various disciplines, recognizing the importance of the natural environment and limited resources for human development and survival. Designers started to explore the relationship between design, humans, and nature, aiming to find a sustainable balance through design activities (N. Chen, Tsay, & Chiu, 2017). At the same time, ecology has gradually matured during this phase, leading to the emergence of environmental awareness in the application of interior design.

In 1969, Ian McHarg's integration of ecology and design in his book "Design with Nature" influenced the emergence and development of green architecture(Mao, 2014). By the early 1980s, ecological design is now being integrated into interior design. The University of Northside in the United States led the design and construction of an ecological house with excellent insulation properties. It effectively isolates the heat generated by sunlight exposure and heating equipment within the indoor environment. The household electricity mainly relies on wind turbines and solar panels installed on the pergola(Yeler, 2015). The source of electricity is very natural and does not cause pollution during use. Rainwater collected from the roof can be stored in the basement and filtered through a sand bed for household water use(Oh & Kim, 2009). British architect Norman Foster designed the Frankfurt Commerzbank Headquarters, famously dubbed the "Eco-Tower" and praised as an "energy blender with sky gardens." Following its lead, Germany's first eco-friendly office building in Berlin and Japan's inaugural high-rise eco-friendly residential building emerged, marking significant milestones in ecological architecture.

Since the 1990s, the study and exploration of green ecological indoor environments have gained increased attention, with many scholars in Western developed countries dedicating their efforts to this field. Significant progress has been made in developing new eco-friendly building materials, energy-saving constructions, and smart buildings. Research on eco-friendly indoor environments has evolved from focusing on eco-friendly buildings to the interiors and then expanded to include the external spatial environment, encompassing streets, cities, and even broader areas(Assali, 2017). Although the research on the ecological indoor environment initially

focused on individual buildings, its impact can directly affect a wider scope, gradually shifting from a micro to a macro perspective(Kuppusamy & Mari, 2017). In 1991, the Wilfs published "Green Architecture: Design for a Sustainable Future," divided into four sections: purpose, action, practice, and recommendations. They argued that the concept of a "green footprint" isn't a novel approach for buildings(Abdullah, Khalil, Haron, Hamid, & Yan, 2023), as it has existed since people recognized the benefits of south-facing windows for comfortable temperatures. What's considered innovative is integrating the "green approach" holistically into design, contemplating how to construct a building that embodies sustainability. They believed that green buildings should adhere to six principles: energy conservation, climate-responsive design, recycling of energy materials, respect for users, respect for the site's environment, and an integrated design philosophy (Celadyn, 2019a). The "Sustainability Design Principles" book published in 1993 outlined the sustainable meanings associated with natural resources, cultural resources, site design, architectural design, energy use, water supply, and waste management(Ahn, Pearce, Wang, & Wang, 2013). Sustainable design is defined as a philosophy where human development should embody the principle of conservation and apply this principle in isolation in daily life. It emphasizes that all life is based on a common foundation, and different regions need interdependent, self-sustaining life support systems (Aktas, 2013). Scholars have discussed how interior design, with humans as its foundation, can employ ecological principles to find methods and pathways for symbiotic integration. They proposed five ecological design methods and principles, including: design outcomes should originate from the environment itself, evaluating design standards through ecological expenditure; integrating design with nature, public participation in design; and enhancing nature(Jiang & Wang, 2022). Le Corbusier, one of the most important modern architects of the 20th century, was inspired by nature, appreciating its beauty, fresh air, and bright sunlight. This led him to the realization that planning and construction should be reevaluated based on natural resources and land conditions, taking into account sunlight, space, and green

vegetation, and fully integrating light and shadow effects in the early stages of design(Werner & Long, 2002).

In summary, sustainable design in interior design, due to its long application history, possesses a comprehensive theoretical framework and mature design methodologies. These not only serve as a reference for academic theories but also play a crucial role in guiding industry practices. However, in the process of learning from global advancements, several challenges arise, such as significant cultural differences, variations in building materials and decorative techniques, and regional discrepancies. These differences can make the direct application of Western technologies problematic in terms of material sourcing and construction. Therefore, it's essential to maintain unique characteristics in interior design and decoration. Despite the rapid development of science and technology and the accelerating pace of information renewal, the delay in forming a cohesive information system for new Western design trends significantly impacts designers.

2.3 Create teaching model

2.3.1 Concept of teaching model

The concept of teaching models was first introduced by scholars such as Joyce and Weil, who defined it as a paradigm or plan that guides the selection of materials, the composition of coursework, and reveals the activities of the teacher(Morrison, Ross, Morrison, & Kalman, 2019). Teaching models reflect specific educational theories and maintain a relatively stable structure for certain teaching tasks (Krismadinata et al., 2020). They concretize the teaching system and process, representing an integrated form of teaching styles and methods(Brown & Pressley, 2023). Guided by certain educational philosophies and theories, teaching models are designed and organized to achieve specific educational objectives, presenting different teaching structures in a simplified and stable form (Ariyanto, Hidayatullah, & Nurtanto, 2020). From an inductive perspective, teaching models are generalized and abstracted standard patterns with universal significance derived from various disciplines and

teaching methods. From a deductive perspective, they represent the application of these patterns in educational teaching activities(Larson & Lockee, 2019).

The concept of teaching models is defined as relatively stable teaching activity procedures that are designed to achieve specific educational objectives, based on certain theoretical foundations and integrated with practice.

2.3.2 Theoretical and practical exploration of teaching model

Before the establishment of schools, the primary model of teaching was individualized instruction. This eventually gave way to the classroom teaching system. In the early 19th century, Johann Friedrich Herbart from Germany developed a four-stage teaching model consisting of clarity, association, system, and method(Pikkarainen, 2012). Another model by Rhein included five stages: preparation, presentation, comparison, generalization, and application(Rhein, 2018). American scholar John Dewey also influenced the field of education. However, the most impactful teaching model was that of Kilpatrick, which centered around the teacher, the classroom, and knowledge, introducing a five-step teaching method: organizing instruction, reviewing previous lessons, presenting new material, consolidating new knowledge, and organizing homework(Schmidt, 2010). Subsequently, the theoretical framework of teaching models expanded, introducing various approaches such as Joyce and Weil's models, the Soviet developmental teaching model, the outline signal learning model, and Western European and Japanese exemplar teaching models, subject teaching models, and suggestive teaching models(Joyce, Weil, & Wald, 1973). Additionally, the 1980s educational reform led to four typical teaching models: self-directed learning, objective-driven instruction, inquiry-based learning, and emotional-cognitive mutual enhancement(Cheng, 2023). Scholars have summarized the characteristics and functions of teaching models, highlighting their simplicity, directiveness, exploratory nature, coherence, replicability, and developmental potential. They bridge the gap between theory and practice with dual functionality (Ambarini, Faridi, Sukarno, & Yuliasri, 2023). This research suggests that in the context of the new era, teaching models also exhibit characteristics of informatization.

In the classification, selection, and application of teaching models, a notable approach is that of American scholars Joyce and Weil, who divided them into information processing models, individualized teaching models, social interaction teaching models, and behavior control teaching models(Usher, Hershkovitz, & Forkosh - Baruch, 2021). A typical classification of teaching models includes three types: systematic transmission and learning of textbook knowledge between teachers and students, teacher-guided student learning through activities, and a teaching model that is a compromise between the two (Ayçiçek & Yanpar Yelken, 2018). When selecting a teaching model, factors such as educational goals, the nature of the teaching content, students' age characteristics and cognitive levels, teachers' personal attributes, and the material conditions of teaching should be considered (Toma & Greca, 2018). During application, it is important to establish correct teaching philosophies, seek diverse and flexible approaches, pay attention to students' psychological patterns, and fully utilize modern teaching media (DiPaola & Wagner, 2018). Joyce and Weil view teaching models as a paradigm or plan that informs the selection of curriculum materials and guides teacher activities, essentially serving as a learning pattern to ultimately enhance students' learning abilities(Makransky & Petersen, 2021). Scholars see teaching models as a structural analogy of teaching activities, created for specific cognitive purposes, or as a system of strategies and styles related to teaching procedures. Others believe that teaching models belong to the category of teaching methods and represent an integration of various methods(Zhukov et al., 2019).

In the context of "Internet+ Education," the learning environment, goals, methods, content, and evaluation of online courses, as well as the relationships between these learning elements, have changed. These changes have further driven the transformation of the relationships between teaching subjects, leading to innovations in teaching models(Saputra, Joyoatmojo, Wardani, & Sangka, 2019). The essence of "Internet+" is to deconstruct and reconfigure the intelligent and technical elements of the internet, resulting in the fission and rebirth of their relational structures(Supena, Darmuki, & Hariyadi, 2021).

In summary, the academic community generally believes that the flipped classroom model greatly enhances students' knowledge absorption, learning interest, and skill development. However, empirical studies on the practical effects of flipped classrooms are relatively scarce and have not yet formed a systematic body of research. While most regions and schools have initiated teaching practices within the classroom, the lack of in-depth theoretical guidance and sufficient experience has led to numerous challenges and issues, preventing the widespread establishment of this model. In particular, discussions on dynamically adapting the teaching media and its use in terms of temporal, value, and psychological structures to suit different individual students have not been fully explored. Existing research often summarizes successful experiences and highlights deficiencies, with more focus on theoretical rather than empirical studies of teaching models. There is also a lack of systematic research findings. Overall, scholars have not delved deeply enough into the theoretical research and practical exploration of teaching models, resulting in a general lack of personalized and systematic approaches.

2.3.3 Category research of teaching model

The teaching model is mainly divided into PBL teaching model and TBL teaching model. The research status of PBL teaching model and TBL teaching model is as follows

2.3.3.1 Research on PBL teaching model

The concept of Problem-Based Learning (PBL) was originally developed by Howard Barrows in the United States as a teaching method for the medical field and has since spread to other countries(Zhiyu, 2012). PBL is predominantly used in medicine, with less application in other fields. Literature indicates that researchers have different understandings of PBL, distinguishing between problem-based learning and project-based learning. Both interpretations share similarities in their student-centered, problem-oriented teaching processes and steps (Shen & An, 2022).

Key characteristics of the PBL teaching model include: 1) the use of problems to initiate learning, 2) the use of realistic learning materials and scenarios, 3)

the cultivation of students' problem-solving and critical thinking skills, 4) the sharing of conclusions and solutions during and after the learning process, and 5) a combination of formative and summative assessment methods. However, the PBL model has limitations: 1) the classroom environment and resources are limited to the classroom setting, 2) the feedback mechanism of this teaching model is not very effective, and 3) it demands high basic qualifications from teachers(Akl, 2014).

Over the past century, traditional medical education methods have been effective, but as society and lifestyles have evolved, so too have perspectives on health and disease, leading to changing expectations for medical students. Nowadays, they are required not only to have professional medical knowledge but also to possess interpersonal and communication skills, empathy, and a sense of responsibility. With these changes, the reform and development of medical education have become urgent. American scholar Howard Barrows first introduced the Problem-Based Learning (PBL) teaching model in the 1970s, which was piloted at Canada's McMaster University Medical School (Tang et al., 2008). The PBL model was successful at McMaster University, and similar initiatives began in other institutions in Australia and the Netherlands. Many scholars have conducted in-depth studies on the PBL model, including Jannah, who applied PBL to mathematical problem-solving, showing that it enhanced students' abilities in this area (R. Li & Antiohos, 2021). Momo Rosbiono Kartamiharja implemented PBL in the context of tofu wastewater treatment in chemistry education, and the study indicated that PBL could improve the learning process and outcomes in chemistry education (Kartamiharja, Sopandi, & Anggraeni, 2020). PBL has been widely applied not only in medicine but also in other disciplines such as architecture, political science, and information technology(Ao-tian, 2017).

As the PBL model has evolved, researchers have identified certain limitations and recognized that it may not be suitable for all courses. Consequently, some scholars have combined PBL with Lecture-Based Learning (LBL), integrating it with conventional teaching methods (Hu, Hu, Shan, & Wang, 2020). In "The Application and Evaluation of PBL+LBL Dual-Track model in Operations Research Course

Teaching," the combination of these two methods is discussed, suggesting that it can effectively enhance students' abilities to think independently and solve problems (Zheng & Wen, 2023). Scholars have also combined PBL with Team-Based Learning (TBL) for teaching mathematics, finding that the PBL+TBL approach can effectively foster students' enthusiasm for learning and teamwork(Liang, Huang, Huang, Yuan, & Liu, 2022).

The rapid development of the Project-Based Learning (PBL) model in the educational field has led scholars to keep pace with the trend, with its introduction into education during the 1990s (Bo, Ding, & Wang, 2022). Initially applied in the medical field, PBL showed significant teaching effectiveness, prompting medical schools to adopt it for both clinical and basic courses from 1990 onwards(Song, 2022). The successful application of PBL in medicine has spurred in-depth research by educators. Over the past decade, research on PBL has increased annually and has expanded from the medical field to other disciplines(G. Sun & Zhuang, 2022). Scholars have applied PBL to online course design, providing valuable guidance for the practical work of developing online courses(Kolmos, Holgaard, & Clausen, 2021). It has also been implemented in interior design education, where studies have shown that PBL significantly enhances student engagement, problem-solving skills, and academic performance (Xiong, 2021). Some researchers have combined PBL with other models, such as integrating it with Team-Based Learning (TBL) for teaching experimental design in junior high school physics, which has proven to enhance student abilities and offer innovative teaching strategies for frontline teachers and other subjects(Yunikawati & Tuanani, 2022).

In summary, PBL has been widely endorsed by scholars both domestically and internationally for its unique approach and positive teaching outcomes. Its application has extended from the medical field to various other areas of study. Throughout its evolution, researchers have identified some limitations to the PBL model and have attempted to combine and optimize it with other teaching models, resulting in

blended approaches that have shown significant improvements in student engagement and overall skill development.

2.3.3.2 Research on TBL teaching model

The concept of the Team-Based Learning (TBL) model was established in 2002 by Professor Michaelsen and other scholars at Oklahoma State University, USA. It is a teaching model that ensures educational quality despite increasing student numbers by focusing on teamwork. The Team-Based Learning (TBL) teaching model has gained popularity internationally in recent years (Gopalan & Klann, 2017) . From the perspective of academic learning, undergraduate students in the TBL model can acquire subject knowledge and skills through exploration, collaboration, and reflection. They can also participate in team activities specifically designed by teachers(Parrish, Williams, & Estis, 2021). Guided by their instructors, students engage in group learning and discussions. Such group activities foster students' ability to learn independently (Carless, 2007). Team-Based Learning (TBL) under teacher guidance, organized in small groups, facilitates systematic knowledge and skill impartation by the teacher, addresses common issues encountered in teaching, and promotes equitable sharing of team resources(Anwar et al., 2017).

The TBL model is characterized by its team-driven approach, ample opportunity for student ideas to be showcased and discussed, multi-level interaction during the teaching process, and emphasis on developing students' teamwork and communication skills. It includes frequent testing with a combination of formative and comprehensive evaluations. However, the model requires extensive preparation before classes and can increase the workload for teachers due to the frequency of assessments.

Originating in the 1970s in the United States, TBL was initially applied in business and law education before spreading to the medical field(Freeman, 2012). Over the following two decades, the model evolved and was adopted by many developed countries in Europe and America. In the US alone, over 100 medical schools have implemented TBL with mostly positive educational outcomes(Nursimloo, Ramdhony, &

Mooneeapen, 2020). The rapid development of TBL has attracted scholarly attention, leading to the establishment of TBL institutions in countries like the United States and Singapore, offering platforms for practitioners and scholars to share resources and further optimize and develop TBL(Roessingh, 2014). Additionally, websites dedicated to TBL have been created, aiming to leverage the growth of the internet to enhance understanding and promote the integration of this innovative teaching model in education.

As the Team-Based Learning (TBL) teaching model continues to evolve and improve, scholars have applied it across various fields. They regard TBL as a highly structured instructional strategy that is well-received by most participants. Online TBL courses have proven effective in fostering student learning abilities, enabling students to use their skills confidently when needed (Sannathimmappa, Nambiar, Aravindakshan, & Kumar, 2022). Research on the effectiveness of TBL in management courses suggests it is an efficient tool for developing interpersonal skills, particularly in students with less than five years of work experience (Choi, Slaubaugh, & Tian, 2021). In today's increasingly digital educational landscape, TBL offers a valuable option for promoting active learning and interpersonal skills (Elmore, Skelley, & Woolley, 2014). Scholars have advocated for Team-Based Learning as a strategy to support autonomous learning within inquiry communities (Xiaoyu, 2016).

Research on TBL can be categorized into three main areas: the integration of various instructional models, the application of TBL across different academic disciplines, and its use in higher education, with a focus on medical or health-related fields. Jin Chengping combined TBL with flipped classroom techniques for university physical education courses, finding that this joint approach significantly affects student engagement, skill acquisition, and the quality and transformation of physical education teaching in higher education (Long, 2023). A meta-analysis comparing PBL, CBL, and TBL methods in medical genetics education revealed that all three methods outperform traditional teaching in improving student performance and interest. However, the quality of the literature included in the study needs improvement

(Mengyao & Bin, 2023). TBL has also been applied to university courses on innovation and entrepreneurship, identifying challenges in blended learning environments and proposing solutions for the future of the teaching model (Yinle, 2023).

In summary, employing PBL or TBL models exclusively in teaching has its challenges. Solely using PBL's problem-driven approach can lead to laziness or plagiarism among some students, undermining the effectiveness of subsequent discussions and failing to meet educational goals. TBL relies on teamwork to complete tasks, enhancing knowledge mastery but at a high cost. Therefore, combining PBL with TBL to form a PBL+TBL teaching model can compensate for each method's shortcomings and maximize their benefits, achieving the desired educational outcomes. Research on the PBL+TBL model includes its application to interior design courses, constructing a PT teaching model for undergraduate education. This paper will focus on the application of the PBL+TBL model to high school physical education volleyball classes, analyzing its effects on teaching basic volleyball techniques and the overall impact on high school volleyball education.

2.3.4 Research on the impact of teaching model on the cultivation of environmental awareness

Educational models across various countries were initially implemented through specialized curricula and classroom-based instruction. However, the approach has evolved from the traditional lecture format to integrating environmental education into all subjects and everyday life. British environmental education scholar M.A. Lucas noted that environmental education's content is about the environment, its purpose is to protect the environment, and it should be taught within the environment itself (Chand & Shukla, 2003). Some nations have shifted from a school-centric model to a collaborative approach involving government, families, communities, schools, and businesses. For instance, in the United States, the focus is on partnerships between businesses, communities, and schools to engage students in real-world experiences, such as visiting wastewater treatment plants and recycling centers during holidays to understand the importance of environmental protection, thus enhancing the public's

environmental consciousness(Hoffman, 2011). Similarly, children's gardens in kindergartens are designed to maintain their natural ecology with grass, ponds, sand, plants, and trees. Outdoor excursions, environmental camps, and park and forest surveys are used to expose children to nature, fostering an appreciation for a beautiful environment and building their environmental awareness from an early age(Sonu & Snaza, 2015).

Despite the growing awareness of environmental issues and the deepening research and practice in environmental education, due to its unique nature and differences in educational systems among countries, environmental education research remains an ongoing journey. There is yet to be a systematic, nationally distinctive environmental education system. The reasons for this are multifaceted: economic and scientific disparities across the world lead some countries to prioritize economic growth, often at the expense of environmental concerns, resulting in a general lack of environmental awareness and engagement (Liu Lanfang 2017). Additionally, environmental education often relies on a singular channel—school education, particularly at the undergraduate level—where many institutions lack specialized environmental education faculty. Teachers are often part-time and from other disciplines, lacking in-depth theoretical knowledge and pedagogical skills in environmental science (Ying, 2020). As environmental knowledge is self-taught, its accuracy and rigor are questionable. The lack of specialized faculty in environmental education also results in a homogeneity of teaching methods, a lack of innovation in instructional approaches, and content that is overly simplistic and generalized. The focus on textbook knowledge neglects the development of students' ability to apply what they have learned (Ganatsios, Filippou, Mpekiri, & Danahy, 2021).

Consequently, students show a low enthusiasm for learning, leading to less noticeable teaching outcomes. This situation is further exacerbated by the long-standing influence of traditional educational systems. Under the sway of crucial exams like the middle and high school entrance exams, parents often prioritize academic achievements over nurturing an awareness for environmental protection in their

children's daily life and studies. In fact, some families have never paid attention to environmental education(Yadav, 2023). While some schools focus on improving the students' learning and living environments, they overlook the importance of fostering a mindset geared towards the sustainable development of the natural environment(Schild, 2016). Moreover, environmental education hasn't been given a prominent role in higher education either. Many universities only offer specialized elective courses for students majoring in environmental education, without making them available or mandatory for all university students(Chuanhui & Hanwei, 2011). Therefore, the teaching model significantly impacts students' environmental consciousness, as students receive varied environmental knowledge based on different teaching methods.

Based on the aforementioned research and analysis, and starting from a practical survey, this study examines the current state of environmental awareness among undergraduate interior design students in Chengdu. It identifies the reasons behind the weak environmental consciousness among these students and proposes strategies for interior design teaching models to enhance students' awareness of environmental protection.

2.4 Environmental awareness

2.4.1 Concept of consciousness

The 17th-century English philosopher Thomas Hobbes began to advance the concept of consciousness, positing that all phenomena in nature, including humans and animals, are composed of material molecules, and that even human consciousness is generated by molecular motion within the brain (Burt, 1962). Consciousness is a comprehensive manifestation of the human brain's functional activities, involving our perception of the environment, awareness of our own existence, and the knowledge and understanding of things ((Rosenthal, 1998). Normally, people can accurately identify time, place, and characters, and respond to them promptly and precisely. The focus of this paper is the cultivation of students' environmental awareness within the context of interior design course models.

2.4.2 Concept of environmental awareness

Environmental awareness, also known as environmental consciousness, is a philosophical concept reflecting the level of understanding and awareness that people have about the environment and its protection. It also represents the conscious practice of individuals adjusting their economic activities and social behaviors to protect the environment and harmonize the relationship between humans and nature. Simply put, environmental awareness includes both an internal aspect—people's level of understanding of the environment, which involves psychological, sensory, and emotional factors—and an external aspect, which is the degree of consciousness in their environmental protection behaviors. These two aspects are interdependent and both are essential(Ham, Mrčela, & Horvat, 2016).

The term "environmental awareness" is relatively new and lacks a universally accepted definition. In 1968, American scholar Roth introduced the concept of "environmental literacy," which is widely recognized as synonymous with "environmental awareness." Researchers suggest that environmental awareness refers to the participation of individuals in environmental protection behaviors based on their personal circumstances. As there are differences in values and proactivity among individuals, the level of these behaviors varies, which can be compared through quantitative research(Mei, Wai, & Ahamad, 2016). Environmental awareness is part of environmental behavior, demonstrated by the proactive adoption of environmental protection consciousness and subsequent behavior changes, especially as a spontaneous awareness(Hadzigeorgiou & Skoumios, 2013). Environmental awareness is an understanding of environmental protection that reflects people's grasp of environmental knowledge and their ability to adjust their behaviors according to their cognitive level, fostering harmony between humans and nature(Chawla, 2008). It is a comprehensive concept that encompasses various cognitions about environmental protection, not only the relationship between humans and nature but also encompassing both rational and emotional understanding. Rational understanding refers to the

theoretical and viewpoint aspects of the environment, while emotional understanding refers to attitudes and psychological aspects(Abdellatif, 2022).

Environmental awareness is a behavioral tendency formed by a series of mental activities that cognitively experience the environment. It is also a potential consciousness about environmental protection(Maria, Irham, Hartono, & Rahayu Waluyati, 2022). Through systematic learning of environmental protection knowledge, the brain consciously generates a protective awareness of the environment. Scholars have explained environmental awareness from five perspectives: having affection for the environment, valuing environmental protection, perceiving environmental issues and behaviors, possessing basic environmental knowledge, and having the skills and experience to deal with related issues. Essentially, environmental awareness refers to the feelings, knowledge, attitudes, and behaviors regarding the environment and its protection that people develop in their daily lives and production activities(Choudhury, 2021).

In summary, this article defines environmental awareness within the context of interior design teaching models as the cultivation of students' environmental protection awareness. It includes understanding the goals, content, and methods of environmental protection to enhance the sensitivity of interior design students toward environmental protection. This is beneficial for students to meet environmental standards when creating interior design products.

2.4.3 Research on the development of environmental awareness

In 1962, Rachel Carson's book "Silent Spring" was published, drawing significant attention and prompting people to reconsider the relationship between human behavior and environmental issues(Hadzigeorgiou & Skoumios, 2013). The term "environmental awareness" reflects humanity's profound contemplation of the relationship between humans and the environment, marking an awakening. The concept was first introduced by American scholar Raus in 1968, who suggested that environmental ignorance leads to pollution. Raus differentiated between the environmentally unaware and the literate citizens through the concept of "environmental

literacy," and also surveyed citizens' environmental literacy levels(Kopnina, 2018). Subsequent research equated "environmental literacy" with "environmental awareness." In 1978, American scholar Dunlap introduced the concept of the "New Environmental Paradigm," which views humans as part of the natural ecosystem, interacting and impacting each other, with a firm belief in the existence of limits and advocating the recognition of the importance of ecological balance(Dunlap, 2008). On this basis, the two researchers also designed the "New Environmental Paradigm" survey.

Japan has not only focused on researching the public's environmental awareness domestically but also on that of its neighboring countries. Japanese research institutions conducted surveys on environmental awareness in developing countries around them in the last century, finding that differences in social systems lead to significant variations in the public's level of environmental awareness(Wirth, 2010). To incorporate the enhancement of public environmental awareness into environmental protection measures, researchers from different academic backgrounds have varying interpretations of its connotations. Some believe that environmental awareness consists of five aspects: environmental cognition, environmental values, environmental ethics, environmental participation, and environmental legal views (Mei, Wai, & Ahamad, 2017). Others argue that environmental awareness should include environmental knowledge, fundamental environmental values, attitudes towards participation in environmental protection, and environmental protection behaviors(Makhtar, Amirah, Ab Wahab, Hassan, & Hamid, 2021). In the 2007 national survey on public environmental awareness, the public's environmental knowledge, awareness, and behaviors were assessed to measure environmental awareness comprehensively(Garcia & Luansing, 2016).

The level of public environmental awareness directly influences the degree of public participation in environmental governance, which is why many scholars focus on fostering this awareness. Research on environmental awareness cultivation is divided into two aspects: exploring the factors that influence environmental awareness and finding effective ways to nurture it. Scholars often investigate factors such as economic

level, socio-cultural environment, age, and education level (Jun & Meimei, 2013). With a deeper understanding of these factors, scholars then explore how to cultivate environmental awareness. Despite the continuous improvement of citizens' environmental consciousness, there are still three main issues: the need for a general increase in public environmental awareness, significant regional differences in public environmental consciousness, and a lack of enthusiasm among the public for active participation in ecological governance (Y. Huang et al., 2019). Since children and teenagers are highly impressionable, education at the foundational level plays a crucial role in cultivating environmental awareness. Environmental education needs to be adapted to local conditions in each country. In the United States, education is managed locally, allowing each area to decide its environmental education model. In the US, undergraduate environmental education is primarily conducted as "supplementary courses" or through an "integrative approach." In the 1980s, environmental education was incorporated into the UK's national curriculum as a compulsory subject (Theodorou, Kydonakis, Botzori, & Skanavis, 2018). UK undergraduate environmental education focuses on outdoor teaching and environmental practice as the main entry point. At the beginning of this century, the UK suggested introducing environmental education into other subjects during the revision of the national curriculum (Mawsally & Sudarmilah, 2019). In 1977, France published the "Haby Government Bulletin," proposing the integration of environmental education into compulsory education to guide students in understanding nature and developing skills to solve environmental issues, marking the formal start of France's undergraduate environmental education (Taulien et al., 2019). Japan's environmental education has developed in coordination with environmental law. Although Germany started its environmental consciousness education later, it does not affect its contribution to environmental laws and regulations. Germany has some of the most detailed and comprehensive environmental laws in the world. In Germany, environmental education is a responsibility and obligation of undergraduate education, and teachers must integrate it into subjects including natural and social sciences (Bolscho & Hauenschild, 2006). Scholars suggest that environmental education should

be integrated into subjects such as ecology, environment, and energy, encouraging schools that are able to offer dedicated environmental awareness classes and lectures to enhance educational outcomes (Yang Li, 2018). In 1988, the requirements and specific content of environmental education were further clarified in the "Outline of the Curriculum for Nine-Year Compulsory Education" (draft for initial review) and related subjects(Fu, Zhang, & Bai, 2017). There are two main methods of environmental education: dedicated environmental courses and integration through other relevant subjects. The latter is the most commonly used and aligns more closely with reality. An analysis of the literature on environmental education reveals that most researchers focus on identifying environmental education content and selecting teaching methods when studying integrative environmental education.

The approach to integrating environmental education and the feasibility of conducting environmental education in undergraduate interior design teaching were presented (Cotton, 2019); this included the development of interior design course resources and the study of local environmental education curricula (Valderrama-Hernández, Alcántara, & Limón, 2017). A comparison was made between the new and old versions of the undergraduate interior design curriculum standards and the environmental education components in textbooks (Dada, Eames, & Calder, 2017). Most existing research focuses on exploring the content of teaching materials and discussing avenues for environmental education, with less analysis on strategies from the teacher's perspective. The ultimate goal of environmental education is to cultivate students' environmental awareness and foster habits of caring for the environment. At the current middle school level, influenced by exam-oriented education, many teachers use lecturing methods for environmental education, neglecting to cultivate students' abilities to actively participate and independently explore (Saari & Mullen, 2020).

In summary, after reviewing the development of teaching models, this article finds that the characteristics of case teaching methods align with the instructional approaches needed to cultivate environmental awareness in interior design students. In particular, the case teaching model can compensate for the lack of extracurricular

practical activities for interior design students, maximizing the promotion of environmental knowledge learning, establishing the right environmental attitudes, and forming environmentally friendly behaviors in the existing classroom setting. This article explores viable educational methods through practical research on cultivating students' environmental awareness through interior design teaching models, hoping to enrich the system of case teaching methods in interior design.

2.4.4 Research on the composition of environmental awareness

Scholars have differing views on the components of environmental awareness. They believe that environmental awareness is the recognition, experience, and behavioral inclination towards environmental protection formed through a series of psychological activities. It consists of three elements: environmental awareness, environmental experience, and environmental behavior (Ebreo & Vining, 2001). Scholars examine citizens' environmental literacy from four dimensions: citizens' willingness to protect the environment, their actual pro-environmental behaviors, their attitudes or emotions towards environmental issues, and their knowledge about the environment. This approach aims to understand citizens' awareness, thoughts, and feelings about ecology and pollution (Maloney & Ward, 1973). Environmental awareness is composed of individual-level factors (such as gender, age, cultural level) and structural-level factors (such as socio-economic development, environmental issues, the level of environmental scientific development, prevailing values, government management systems, the penetration of mass media, the extent of environmental education, and the intensity of environmental protection work) (Volk, Hungerford, & Tomera, 1984). To assess environmental education programs, surveys are distributed to measure the impact on fourth, fifth, and seventh-grade students across three dimensions: environmental knowledge, attitudes, and behavioral intentions (Bergman, 2016).

Scholars have different criteria for dividing the components of environmental awareness. Some define it as a multi-dimensional category that includes environmental concern and the rights to protect the environment. Concern refers to the priority given to environmental protection, the degree of acceptance of environmental protection, and

the level of participation in it. Upholding environmental rights involves remedial actions taken when faced with environmental harm, including complaints to the government, the media, and self-protection (Fisman, 2005). The components of environmental awareness include sensitivity to environmental issues, the level of environmental knowledge, environmental attitudes, self-awareness in environmental protection, and the handling of environmental issues (Novotný, Huttmanová, Valentiny, & Kalistová, 2021). Other scholars suggest that environmental awareness reflects people's views on the relationship between humans and nature, summarizing it into four aspects: environmental knowledge, environmental values, attitudes towards environmental protection, and pro-environmental behavior (Kikuchi-Uehara, Nakatani, & Hirao, 2016). Environmental awareness refers to the sum of various recognitions about the environment itself, the relationship between humans and the environment, and knowledge about environmental protection. It mainly includes two levels: the rational level of thoughts, viewpoints, theories, and the emotional level of psychology and attitudes towards the environment (Hayyolalam & Kazem, 2018).

In summary, extensive research by scholars both domestically and internationally on the concept and components of environmental awareness has been conducted from various perspectives, defining its concept and composition. However, due to the broad connotation of environmental awareness and the fact that its conceptualization is a recent development, there are still many deficiencies in related research. The most prominent issue is the lack of a unified definition of environmental awareness and significant differences in the recognition and application of its components. Upon reviewing relevant materials, this paper notes that there is limited research on how to enhance environmental awareness among interior design students, with most studies focusing on environmental education.

2.4.5 Research on the cultivation of students' environmental awareness

The national emblem of environmental education marks the beginning of the legalization and standardization of environmental education in the United States. The 1975 Belgrade Charter set the direction for defining environmental education goals in

the country, providing theoretical guidance (Ma, Liu, Wu, & Guo, 2019). For middle school students, it emphasizes understanding the relationship between living and non-living matter and flows within the human environment, which includes both animals and plants (Sengupta, Das, & Maji, 2010). It also highlights the universal environmental issues brought about by scientific and technological development from an environmental and social perspective, advocating for the use of various resources to investigate local environmental problems, identify their consequences, and develop action strategies (Lestari & Siskandar, 2021). Interdisciplinary and multidisciplinary curricula in environmental education start from students' real-life experiences, involving various practical activities set by teachers (Bosio & Waghid, 2023). Through these activities, students learn about environmental protection. In the U.S., under the combined influence of education and law, students deeply integrate environmental awareness into their thinking, and teachers continuously explore teaching methods to foster this awareness.

In Asia, Japan was among the first to enact legal documents related to environmental education, such as the Environmental Education Act, which includes a registration system for environmental professionals and provides guidelines and necessary advice for individuals and groups engaged in environmental protection, reflecting Japan's commitment to training talent in this field (Solomon, 2010). Japanese school environmental education pays special attention to the relationship between the environment and individual behavior (Yingchao, Masahiko, & Peng, 2011), adopting different curricular approaches for students at various developmental stages, including multidisciplinary integration and independent environmental education courses. The characteristic of Japanese Green Schools is the combination of on-campus and off-campus life models to educate students about environmental protection (Inui & Kato, 2002). Other countries are also exploring teaching methods for environmental education within basic education. Australia is integrating environmental issues into basic education in various ways (Sethusha & Lumadi, 2013), while the United Kingdom has established

various environmental issues at different stages to help citizens better understand environmental concerns.

The cultivation of environmental awareness started later in developing countries but has progressed rapidly, as seen in nations like India and Thailand. With its vast population and lower levels of productivity, India prioritizes environmental education by integrating it into the curriculum and reinforcing it with practical activities. At the undergraduate level, environmental awareness is taught as a separate course with its own textbooks (PF, 2017). In Thailand, the rise of environmental consciousness followed curriculum reforms in the 1970s. The planning and development of its environmental education program are a collaborative effort between the Ministry of Education, the Ministry of Education Technology, and other informal education sectors, leading to commendable results (Zhou, 2013). Thailand focuses on the ability to address environmental issues, particularly valuing practical environmental knowledge in primary education.

Scholars worldwide are exploring interdisciplinary approaches to environmental education. Interior design is one such discipline where environmental topics are integrated into the curriculum, effectively merging subject teaching with environmental education goals—a practice already being experimented with in many countries (Redman & Redman, 2014). Germany has successfully combined environmental education with subjects like geography, while Australia includes environmental education goals in its eight core curricular subjects (Eulefeld & Shaw, 1991). Japan incorporates environmental education as a special topic in its teaching syllabi at different stages, with sections like "Nature Inquiry" and "Humans and Nature" designed to deepen students' understanding of the relationship between humans and the environment, and the importance of protecting it (Kaur & Sharma, 2019).

In summary, schools emphasize a comprehensive teaching model that integrates cross-disciplinary and multidisciplinary elements to foster environmental awareness among students. This model prioritizes practicality, enabling students to understand environmental issues from various perspectives and learn to solve them

effectively. Interior design, as a natural science discipline, plays an irreplaceable role in this educational process. The development of quality education and the urgency of environmental education underscore the significance of interior design education in cultivating students' environmental consciousness. Scholars have highlighted the necessity and feasibility of promoting quality education in interior design teaching to foster environmental awareness by referring to the basic concepts proposed in interior design course standards and the related environmental themes. Developed countries' characteristics and positive outcomes in environmental education have been analyzed, demonstrating the need for robust environmental education and the proactive role of interior design as a discipline, supported by advancements in science and technology and societal demands (Sivamoorthy, Nalini, & Kumar, 2013).

Furthermore, scholars have examined the rich environmental education resources in current undergraduate interior design textbooks, emphasizing the importance of the discipline in raising students' environmental consciousness. Discussions on the section "Interior Design and Environment" in textbooks and changes in its arrangement and content over time illustrate that improved environmental knowledge contributes to heightened environmental awareness. The exercises in textbooks contain a wealth of materials for cultivating environmental consciousness, which teachers should skillfully utilize during instruction (Shelest, Ionov, & Tikhomirov, 2017).

Additionally, strategies for nurturing environmental awareness among undergraduate interior design students have been researched, with new approaches proposed to address existing issues in the teaching process. Teachers are encouraged to diversify their teaching methods to integrate environmental knowledge, organize extracurricular activities, and develop school-based curricula (Tedjokoesoemo, Nilasari, & Sari, 2022). Deepening environmental education and more effectively fostering environmental consciousness can be achieved by organizing environmental research projects within interior design teaching and leveraging data and information technology.

Research on fostering environmental awareness in interior design teaching has proposed strategies relevant to undergraduate education, emphasizing the importance of integrating environmental education. However, there is a scarcity of research specifically targeting interior design teaching, with most studies relating to high school education (Sunlin & LAN, 2008). Scholars have analyzed existing research and found that theories on environmental education are quite rich, offering references and guidance for enhancing environmental protection in interior design education. However, differences in national conditions, school resources, and educational backgrounds are evident (Kaletová et al., 2022). Therefore, transformation and innovation must be performed in the course of certain applications.

In summary, many scholars have focused on issues related to interior design education, finding that environmental education within this field is not comprehensive enough. There is a lack of empirical studies in specific case-based education, as well as a practical understanding of the integration between interior design education and environmental education. As a result, much of the existing work is theoretical, offering limited practical guidance. This paper aims to analyze the actual situation of specific teaching models and propose targeted strategies to foster environmental awareness within interior design education.

CHAPTER 3
METHODOLOGY

The research on "Teaching model to enhance environmental awareness for interior design undergraduate students in Chengdu, China" employs a Mixed Methods Research (MMR) approach, combining the advantages of quantitative and qualitative research to achieve a more comprehensive data collection and analysis. The researcher first collects and analyzes quantitative data, followed by the collection and analysis of qualitative data.

In terms of data collection, the researchers selected various tools, including a review of relevant literature and studies, questionnaires, semi-structured interviews, and focus group discussions. The researchers made their observations, recorded data, and conducted analyses to obtain deeper, more reality-congruent data for creating new models.

This study is divided into three phases:

1. Phase One: Analyze the current state and needs of environmental awareness among students in the interior design program.

2. Phase Two: Develop a new teaching model to enhance environmental awareness among interior design students.

3. Phase Three: Invite stakeholders to evaluate the effectiveness of the new model in enhancing students' environmental awareness.

3.1 Research Variables

The variables of the study are divided into two parts:

Independent Variable: The existing traditional teaching model and the newly developed teaching model aimed at enhancing environmental awareness.

Dependent Variable: The level of students' environmental awareness.

3.2 Research Subjects and Samples

3.2.1 Phase One: Analyzing the Current State of Environmental Awareness and Needs Among Interior Design Students

3.2.1.1 Quantitative Research

Target Group: The target group for this study consists of undergraduate students majoring in interior design from institutions in the Chengdu area. Participating students will be selected through voluntary enrollment to ensure they maintain an open attitude towards the new teaching model and are willing to engage actively.

Sampling Method: Stratified random sampling will be employed to ensure both breadth and depth in the research. Students from different academic years, including recent graduates, those who graduated one year ago, and those who graduated three to five years ago and are currently working in interior design, as well as students from diverse backgrounds, will be selected to obtain representative data. This group has directly received education in interior design and plays a decisive role in future sustainable development, making the enhancement of their environmental awareness significantly important.

Number of Participants: Approximately 400 questionnaires are expected to be distributed to students.

The sample of schools comprises 17 undergraduate institutions specializing in environmental design in Chengdu, including 9 public and 8 private institutions.

Undergraduate (Public)		Undergraduate (Private)	
1	Sichuan University	1	Geely University of China
2	Southwest Jiaotong University	2	Chengdu Vocational University of Art
3	Southwest Minzu University	3	Sichuan Technology and Business University
4	Xihua University	4	Sichuan University Jinjiang College
5	Sichuan Agricultural University	5	Chengdu Jincheng College
6	Sichuan Normal University	6	Sichuan University of Media and Communications
7	Sichuan Conservatory of Music	7	Gingko College of Hospitality Management
8	Chengdu University	8	Chengdu College of Arts and Sciences
9	Sichuan Tourism University		

Figure 1 displays the distribution of the sample population in Phase One of the study.

The information providers for this study are undergraduate students majoring in Environmental Design from Chengdu. Through the data collected from a questionnaire survey, the researchers can summarize the current state of environmental awareness among undergraduate interior design students in Chengdu. Subsequently, additional information will be gathered through semi-structured interviews to analyze the environmental awareness needs of these students, in order to explore ideal conditions and develop new teaching models.

3.2.1.2 Qualitative Research

Semi-Structured Interviews

Target Population: The target population for this study consists of educational experts in interior design courses, industry experts, and interior designers who have graduated for over three years in the Chengdu area.

Number of Participants: It is anticipated that six participants will be invited to engage in the semi-structured interviews for this research, including two

educational experts, two industry experts, and two interior designers who have graduated over three years ago.

Sampling Method: Purposive sampling will be employed.

1. Educational experts should represent a broad range of teaching and practical experience and possess in-depth knowledge of sustainable design education. These educational experts must have at least five years of teaching experience in interior design and have taught courses related to environmental awareness or sustainable design. Additionally, educators who have participated in curriculum design or educational reform projects related to interior design education, particularly those involving environmental protection and sustainable design, are also part of the target group. By analyzing the feedback and suggestions from these educational experts, effective teaching strategies can be identified to better cultivate students' environmental awareness and sustainable design capabilities.

2. The selected industry experts should be from the company's decision-making or mid-to-senior management levels, possessing profound industry insights and extensive practical experience. These experts should be directly involved in corporate strategy formulation, have a deep understanding of training methods and human resources development, and hold at least ten years of practical experience in fields related to interior design. Notably, industry experts who have promoted or implemented sustainable design practices within their companies can provide a comprehensive perspective from industry demand to educational supply, helping to identify specific market needs and expectations regarding environmental awareness, thus driving teaching models to better align with actual industry requirements.

3. Designers who have graduated for over three years are professionals who have accumulated rich design experience throughout their careers, having participated in multiple design and construction projects. Moreover, they have implemented or advocated for environmentally friendly design in their careers, possessing practical experience and shareable successful cases or lessons that can offer continuous feedback from education to professional practice for the research.

Such feedback aids in a comprehensive understanding of the impact of education on career development and the actual demands for environmental awareness within the profession, thereby making the teaching model more practical and forward-looking.

The following is the list of participants:

Education Expert 1: Professor Luo Xue, former head of the Environmental Design Department at the School of Art, Sichuan University of Science and Engineering, currently serving as the Assistant Dean of the School of Art. With 20 years of experience in the interior design industry and 16 years in interior design education, she has studied at the Academy of Fine Arts, Tsinghua University. She is a member of the China Higher Education Association, the China Architectural Society, and a senior engineering member of the China Engineering Union, as well as a senior interior architect and high-level designer in interior decoration and display. She is also an expert in the Chengdu Architectural Decoration Industry Expert Database and a member of the Chengdu Mulan Society. She has presided over more than 50 domestic spatial design projects, providing her with substantial project design and practical experience as well as a solid background in interior design education. She has published multiple papers and participated in the publication of one textbook.

Education Expert 2: Huang Junsen has been engaged in the interior design industry for 18 years and in interior design education for 15 years. He is a teacher of environmental design at University of Electronic Science and Technology of China, Chengdu University of Information Technology, and Sichuan University of Science and Engineering. He is a nationally recognized dual-teacher and has provided many high-level designers to national party and government agencies, as well as the military and society each year. He is a specially approved expert in rural revitalization by the State Council and one of the first Tibetan-Han designers in the construction of the new city of Kangding, focusing on sustainable design for rural revitalization.

Enterprise Expert 1: Zhao Shiguang holds a combined bachelor's and master's degree in architecture from Hochschule Anhalt in Germany. He has worked in architectural and interior design for 25 years and has been involved in

architectural design and education for 17 years. He has served as an architect and interior designer at the Southwestern Architectural Design Institute and is the founder of Chengdu Yize Architectural Design Co., Ltd. He concurrently holds the position of head of architectural projects at Sichuan Jindu Planning and Design Co., Ltd. He has obtained global Autodesk Revit certification as an instructor. He is the author of the book "Fundamentals of Architectural Revit Modeling," totaling 530,000 words, published by the China Architectural Industry Press. He has contributed to the "Implementation Standards for Decoration and Renovation Projects of Rail Transit Stations" and is currently presiding over multiple projects involving BIM management. Over the years, he has focused on sustainable design, possessing a comprehensive understanding and research into sustainable development and environmental protection, with experience in promoting and teaching environmental protection concepts and practices at various educational levels. He has led over 100 architectural and interior design projects, boasting extensive practical experience.

Enterprise Expert 2: Yang Qin has been engaged in the interior design industry for 21 years and currently serves as the Director of Architectural Decoration Design at China Railway Eryuan Group. She was awarded the title of Chief Employee of the Design Institute in 2023 and received the "Model Worker Around Me" award from China Railway Second Bureau in 2024.

China Railway Eryuan Group Co., Ltd. (referred to as China Railway Eryuan) is a state-owned enterprise under the China Railway Group Limited, which ranks among the Fortune Global 500 and the World's 500 Most Valuable Brands. The headquarters is located in Chengdu, Sichuan, and it currently has 13 subsidiaries. Branch offices are established in all 31 provinces, cities, and autonomous regions in China. The company has won 186 national quality engineering awards, including 42 Luban Awards, 59 National Quality Engineering Awards, and 29 Zhan Tianyou Awards. It has also received 740 provincial and ministerial quality engineering awards, 93 national and provincial technological progress awards, and holds 1,168 national patents and 34 overseas patents. The company has compiled and contributed to 108 national,

industry, local, and group standards, and established 13 technology research and development platforms, including national and provincial enterprise technology centers and postdoctoral innovation practice bases. China Railway Eryuan has been recognized as a "National Earthquake Relief Hero Collective," "National May Day Labor Certificate," "National Outstanding Construction Enterprise," and "Credible Enterprise in China's Engineering Construction," among others. It has received accolades such as "Outstanding Enterprise in Sichuan Province," "Advanced Enterprise in Sichuan's Construction Industry," and "Advanced Enterprise for Opening Up in Chengdu's Construction Industry."

Designer Participant 1: Wang Xue, graduated with a bachelor's degree in interior design in 2016 and has been working in interior design ever since.

Designer Participant 2: Zhang Luxuan, graduated with a bachelor's degree in interior design in 2015 and has also been working in interior design since graduation.

3.2.2 Phase Two: Developing New Teaching Models to Enhance Environmental Awareness Among Interior Design Students.

In the development of a teaching model aimed at increasing environmental awareness among interior design students, sample selection is based on a thorough analysis of the current state and needs regarding environmental awareness as demonstrated in the first phase. Once the teaching model has been completed, mentors will be invited to review and provide feedback to ensure the model's effectiveness and applicability.

3.2.3 Phase Three: Inviting Stakeholders to Assess the Effectiveness of the New Model in Enhancing Students' Environmental Awareness.

To obtain comprehensive and diverse feedback, the most suitable approach is to select individuals representing various stakeholders. They should possess relevant backgrounds and experiences to evaluate the effectiveness and applicability of the new teaching model for undergraduates from different perspectives. In this focus group interview, the researchers will invite six experts who have extensive

experience in interior design and related fields, providing professional insights from educational theory, industry needs, and career development.

These experts include two education specialists, two business experts, and two industry specialists. Among the education specialists, one focuses on curriculum reform and best practices in environmental design, capable of evaluating teaching models from the perspective of both theory and practice; the other is an interior design teacher with practical teaching experience who also serves as the design director of an eco-friendly materials company, providing valuable insights into practical teaching. The business experts consist of an executive or project manager in the field of sustainable design, responsible for the actual operation of environmental projects, assessing the alignment of students' practical abilities with market demands; and a designer or engineer from a green building or environmental design company, who is also a lecturer at Sichuan University of Architecture, evaluating students' hands-on skills and eco-friendly design thinking from both technical and practical perspectives. Among the industry specialists, one is a designer engaged in interior design with a focus on environmental concepts, possessing over five years of experience and having successfully applied environmental knowledge in the early stages of their career; the other is a senior designer who has participated in or led multiple eco-friendly design projects, providing feedback on long-term career development and suggesting improvements to teaching models.

3.3 Research Tools

3.3.1 Research tools for investigating the current state and needs of environmental awareness among students in the interior design program.

3.3.1.1 Quantitative Research

The tools used for data collection include a five-point Likert scale questionnaire, designed by the researcher based on the framework of variables and indicators, resulting in a questionnaire with 34 questions. The questionnaire is divided into three sections:

The first section defines the terminology involved in the research to facilitate questionnaire responses.

The second section collects basic information about the respondents using a checklist format, covering aspects such as identity, gender, age, grade level, and the institution attended.

The third section consists of a questionnaire that includes a five-point rating scale, addressing the current state of students' environmental awareness. The response standards for the questionnaire are as follows:

1 indicates strong disagreement

2 indicates disagreement

3 indicates uncertainty

4 indicates agreement

5 indicates strong agreement

The researcher constructs the questionnaire according to the following steps:

1. Conducting a review of relevant literature and studies to determine the questionnaire structure.

2. Performing an effective content validity test by providing the constructed questionnaire to five experts for evaluation, including two educational experts from Thailand and three experts from China. The Chinese experts consist of one specialist in educational management, one industry expert, and one professor with experience in sustainable design. The evaluation focuses on the questionnaire's content validity, coverage of topics, clarity of language, and layout format, selecting items with an IOC (Item Objective Congruence) value between 0.5 and 1.0 (according to the research by Sirichai Kanjanavasi, 2002). The evaluation results show that the content validity of questions related to the respondents' basic information is 0.950, while that of the current state of environmental awareness is 0.912.

The following is the list of relevant experts:

1 Dr. Atiyot Sankuranurak, Department of Art Education, Faculty of Fine Arts, Srinakharinwirot University (SWU).

2 Dr. Suebsai Sangwachirapiban, Department of Visual Design, Faculty of Fine Arts, SWU.

3 Shen Hongzhao, Male, Professor, Position: Chief Architect of the Architecture Survey and Design Institute, Southwest Jiaotong University, China.

4 Rao Jianhua, Male, Professor, Position: Director of the Graduate School, Sichuan Conservatory of Music, China.

5 Wei Daping, Male, Professor, Position: Deputy Dean of the School of Architecture, Sichuan Architecture Institute, China.

Quantitative research data analysis: The researcher has established the following plan for data analysis:

1. Data Cleaning: First, the collected questionnaire data will be cleaned to exclude invalid or incomplete responses. This includes checking the completion status of each questionnaire and performing a preliminary inspection of the data to eliminate obvious errors or outliers.

2. General data analysis of the respondents, including gender, age, grade, and school, will be conducted using frequency and percentage analysis.

3. Descriptive Statistical Analysis: Statistical software (SPSS) will be used to calculate the mean (x), standard deviation (SD), minimum (Min), and maximum (Max) for each question. This will aid in portraying the overall response trends of participants to various questions.

4. Inferential Statistical Analysis: To examine whether there are significant differences in environmental awareness among students of different grades, t-tests or ANOVA (Analysis of Variance) will be performed. Additionally, regression analysis may be employed to explore the relationship between students' attitudes toward environmental awareness education and other variables such as grade and gender.

3.3.1.2 Qualitative Research

The tool used for qualitative data collection is semi-structured interviews. The researcher designed an interview consisting of 35 questions based on a framework of variables and indicators. The interview content is divided into three parts:

The first part focuses on interviews with education experts and includes three basic details about the respondents, their schools, the interview time, and the interview sample. It comprises 15 interview questions related to the current state of students' environmental awareness, including the challenges and practical issues educators encounter during the teaching process, specific suggestions for improvement, teaching methods and strategies, assessment design criteria, the cultivation of students' sense of social responsibility, resource and support mechanisms, and the sharing of successful teaching models and case studies.

The second part centers on interviews with industry experts and includes the same three basic details about the respondents, their companies, the interview time, and the interview sample. This section includes 10 interview questions addressing the practical application of environmental design in businesses, the industry’s demand for environmental design skills, expectations and challenges faced by companies regarding newly hired designers, the cultivation of environmental awareness, project management experience, and collaboration between companies and educational institutions.

The third part pertains to interviews with designers who have graduated for more than three years. It includes the same three basic details about the respondents, their companies, the interview time, and the interview sample. This section consists of 10 interview questions that explore the designers’ experiences and challenges related to environmental design in their actual work, the practical application and enhancement of skills, feedback on environmental design training in education, the evolution of environmental awareness in their professional development, the sharing of successful project cases, innovations and practices in environmental design,

perceptions of industry trends, and suggestions for future environmental design education.

The researcher constructed the interviews following these steps:

Review relevant literature and research to determine the interview content.

Conduct effectiveness testing of the content by providing the constructed questionnaire to five experts for review, including two Thai education experts and three Chinese experts. The Chinese experts comprise one from the field of education management, one industry expert, and one professor with experience in sustainable design. Assessments were made regarding the effectiveness of the interview content, coverage of topics, clarity of language, and formatting quality, selecting items with an IOC (Item Objective Congruence) value between 0.5 and 1.0 (according to research by Sirichai Kanjanavasi, 2002). The evaluation results indicate that the effectiveness of the content related to the respondents' basic information questions is 0.999, while the effectiveness of the content concerning current environmental awareness needs is 0.944.

The following is the list of relevant experts:

1 Dr. Atiyot Sankuranurak, Department of Art Education, Faculty of Fine Arts, SWU.

2 Dr. Suebsai Sangwachirapiban, Department of Visual Design, Faculty of Fine Arts, SWU.

3 Shen Hongzhao, Male, Professor, Position: Chief Architect, Architectural Survey and Design Institute, Southwest Jiaotong University, China.

4 Rao Jianhua, Male, Professor, Position: Director, Graduate School, Sichuan Conservatory of Music, China.

5 Wei Dapeng, Male, Professor, Position: Deputy Dean, Department of Architecture, Sichuan Architecture Academy, China.

Qualitative Data Analysis: The researcher has developed the following plan for data analysis:

Qualitative data is derived from semi-structured interviews. The purpose of qualitative data analysis is to extract deep insights and perspectives from participants regarding the research questions. The analysis steps include:

Transcription: First, all interview recordings are transcribed into text for detailed analysis. It is essential to ensure accuracy during the transcription process, and recordings should be replayed as necessary to verify the text.

Coding: The transcribed text is read, and initial coding begins. This process involves identifying key concepts, themes, and patterns within the text. The coding process may be iterative; as the analysis progresses, new codes may be added, and existing codes may be merged or reclassified.

Thematic Analysis: Based on the coding, major themes are identified and defined. This step requires the researcher to have a deep understanding of the data in order to group related codes into meaningful themes that reflect the participants' views, experiences, and attitudes.

Validation: To ensure the reliability and validity of the analysis, a triangulation method will be employed to compare the consistency and differences between various data sources (such as designer interviews and teacher interviews). Additionally, research participants may be invited to provide feedback on the preliminary analysis results to further validate the accuracy of the analysis.

3.3.2 Development Steps for Enhancing Environmental Awareness Teaching Models for Interior Design Students.

3.3.2.1 In this phase of constructing or developing the model, the researcher will build or develop the model based on the Hypothesis Model. The steps are as follows:

1. Analyze relevant literature and research findings to extract information for analysis and synthesis, forming the framework of the research concept.

2. Assess the current state and needs of environmental awareness among undergraduate students in the Interior Design program at Chengdu.

3. Create the first draft of the model.

4. Invite mentors to review and provide feedback on the draft, and refine and modify it based on the mentors' guidance to complete the development of the teaching model.

3.3.3 Evaluation of the Effectiveness of the New Model in Enhancing Students' Environmental Awareness.

At this stage, the researchers will invite six industry-related experts and stakeholders to evaluate the newly developed teaching model aimed at enhancing environmental awareness among students in the interior design program. This evaluation will collect their feedback and suggestions on the new teaching model and further optimize it based on their input, ensuring that it possesses a high degree of adaptability and feasibility. The six experts involved in the evaluation will be selected based on the following criteria: two scholars engaged in model development and arts education, two exemplary teachers, and two practitioners in the field of interior design. The evaluation tool will be a suitability and feasibility assessment form, which will utilize a five-point Likert scale and open-ended questions, allowing experts to assess the appropriateness and practicality of the model for enhancing environmental awareness among undergraduate students in interior design. The evaluation criteria are as follows:

Suitability Rating:

An average score of 4.51 – 5.00 indicates it is very suitable.

An average score of 3.51 – 4.50 indicates it is relatively suitable.

An average score of 2.51 – 3.50 indicates it is suitable.

An average score of 1.51 – 2.50 indicates it is unsuitable.

An average score of 1.00 – 1.50 indicates it is very unsuitable.

Regarding the feasibility of implementing the model:

An average score of 4.51 – 5.00 indicates the likelihood of implementation is extremely high.

An average score of 3.51 – 4.50 indicates the likelihood of implementation is high.

An average score of 2.51 – 3.50 indicates the likelihood of implementation is moderate.

An average score of 1.51 – 2.50 indicates the likelihood of implementation is low.

An average score of 1.00 – 1.50 indicates the likelihood of implementation is extremely low.

The following is the list of experts participating in the focus group discussion:

1. Dai Bo, Male, President of the Architectural Design Institute of China Railway 2nd Bureau

2. Zhao Shiguang, Male, Founder and Chief Designer of Chengdu Yize Architectural Design Co., Ltd.

3. Luo Xue, Female, Professor at Sichuan University of Commerce and Partner at Sichuan Qingjingtang Decoration Design Co., Ltd.

4. Peng Huaji, Male, Associate Professor at Sichuan University of Commerce and Design Director of Sichuan Jiangan Environmental New Materials Co., Ltd.

5. Huang Yalang, Female, Partner and Chief Designer at Chengdu Fanmu Decoration Design Co., Ltd.

6. Chen Fangfang, Female, Artistic Director at Chengdu Nengyan Art Design Co., Ltd.

3.4 Data Collection

The researcher conducted data collection in the following ways:

1. Literature review, by studying documents and research related to enhancing environmental awareness in indoor design educational models.

2. Collecting information on the current state of environmental awareness among undergraduate interior design students in Chengdu through questionnaires.

3. Interviewing industry experts, educational specialists, and alumni to inquire about the demand for environmental awareness.

4. Designing a draft framework for a new teaching model.

5. Submitting the draft framework of the teaching model to the supervising teacher for review.

6. Modifying the draft based on the supervisor's suggestions and completing the development of the teaching model.

7. Presenting the new teaching model to relevant stakeholders for focus group discussions to seek consensus on the draft, with six participants. The researcher took the following measures:

(1) Identifying the characteristics of environmental knowledge skills, attitudes, values, and sustainable design action capabilities the undergraduate interior design teaching model targets, and reaching consensus on the teaching model. The stakeholders involved in the evaluation included two scholars in the fields of interior design and environmental education, two experts related to sustainable development, and two exemplary design teachers representing teaching practice, totaling six individuals.

(2) The researcher selected a moderator who could create a discussion atmosphere and effectively control the discussion, allowing them to facilitate without expressing personal opinions, enabling participants to speak freely. The researcher appointed a recorder responsible solely for note-taking and independently transcribing the recordings to ensure the recorded content matched the audio. Additionally, an assistant was selected to handle recording, photography, and videography to facilitate the moderator and recorder's roles, ensuring everyone could contribute effectively.

(3) A week in advance, the researcher provided the members of the focus group discussions with 1) an abstract of the research outline and 2) the model proposal for their review, so they could provide feedback and suggestions.

(4) During the focus group discussion, the researcher briefly summarized the research findings on the current issues and needs collected through the survey and clarified the purpose of the discussion.

(5) The researcher requested that the academic seminar be recorded, photographed, and videotaped for subsequent transcription and publication.

(6) The results of the focus group discussion were compiled into a consensus on the proposal, and the summary was feedback to the members for re-confirmation of its accuracy.

(7) The content was analyzed to determine consistency.

The researcher revised the proposal based on the summarizing suggestions of the experts.

3.5. Statistical Methods Used in the Research

The statistical methods used in analyzing the current status of environmental awareness among undergraduate students in the enhanced interior design program are as follows:

3.5.1 Statistical Methods for Calculating the Index of Consistency (IOC)

$$\mathbf{IOC} = \frac{\sum \mathbf{R}}{\mathbf{N}}$$

IOC = consistency of objectives and test methods.

$\sum$R= Total number of expert review scores.

N= Total number of experts.

3.5.2. Statistical methods for calculating test reliability: Cronbach's α coefficient (Alpha coefficient)

$$\alpha = \frac{k}{k-1}\left\{1 - \frac{\sum S_i^2}{S_t^2}\right\}$$

α = Instrument Reliability

k = Number of Items

S_i^2 = = Total Variance of Items

S_t^2 = Variance of Total Scores

3.5.3 Statistical Calculation for Mean.

$$\bar{x} = \frac{\sum x}{N}$$

$\bar{x}$ = Average value of the score

$\sum x$ = Total sum of the scores

N = Quantity

3.5.4. Statistics for calculating the Standard Deviation.

$$S.D. = \sqrt{\frac{N\sum x^2 - (\sum x)^2}{N(N-1)}}$$

$S.D.$ = Standard Deviation

$\sum($ x $\bar{x}$) = Total Score minus Average Score

N = Quantity

3.5.5 Statistical Methods for Testing Differences in Means of Related Samples (t-test for Related Samples)

$$t = \frac{\Sigma D}{\sqrt{\frac{n\Sigma D^2 - (\Sigma D)^2}{n-1}}}$$

D represents the score difference between each pair.

n represents the number of pairs.

3.5.6. Calculation of frequency

3.5.7. Calculation of percentage

3.5.8. Content analysis

3.6. Research Implementation Steps

3.6.1 Phase One: Investigating the Current Situation and Needs of Environmental Awareness among Undergraduate Students in Chengdu's Interior Design Program. The specific implementation methods are as follows:

3.6.1.1 Literature Review

(1) Review existing literature on interior design education, with particular emphasis on environmental awareness.

(2) Study the theories and methodologies of environmental education.

(3) Analyze the advantages and limitations of current teaching models.

(4) Conduct an in-depth study of relevant literature to establish a theoretical foundation.

3.6.1.2 Use of Surveys

A questionnaire will be employed utilizing a five-point rating scale. The content will address the current state of students' environmental awareness, and statistical analysis will be applied to rank the necessity of their needs, utilizing a modified Priority Needs Index (PNI Modified) for calculation.

3.6.1.3 Interviews

Conduct structured interviews with six participants, including two educational experts, two industry experts, and two interior designers who have graduated for over three years. The educational experts will be selected from one private undergraduate institution and one public undergraduate institution in Chengdu, representing a broad range of teaching and practical experience, with a deep understanding of sustainable design education. The industry experts will be chosen from a state-owned design institute and a private design company in Chengdu, both of which have received numerous honors. Decisions will be made at the leadership or mid-level management, ensuring they possess profound industry insights and rich practical experience. Designers selected must have over three years of work experience in the field, having accumulated substantial design experience through active participation in various design and construction projects.

3.6.1.4 Analysis Summary

The researcher will summarize the gaps between the current situation and the desired state regarding needs, as well as propose plans to enhance environmental awareness among undergraduate students in Chengdu's Interior Design program, and will draft a teaching model aimed at improving this awareness.

3.6.2 Phase Two: Developing a Teaching Model to Enhance Environmental Awareness among Undergraduate Students in Chengdu's Interior Design Program. The specific execution methods are as follows:

3.6.2.1 Design Draft or Development Steps

In this phase, the researcher will first create or develop a model based on the hypothesized model, with steps including analyzing relevant literature and research findings, assessing the current state of environmental awareness and needs among undergraduate students in interior design, analyzing the interview results, extracting information, and conducting analyses and syntheses to form a draft research framework conducive to model drafting.

3.6.2.2 Adviser Review Model

Submit the draft framework of the teaching model to the supervising instructor for review, and revise it according to the instructor's suggestions to complete the development of the teaching model.

3.6.2.3 Focus Group Assessment Model

Invite six stakeholders to evaluate the adaptability and feasibility of the new teaching model, collect feedback, and optimize the teaching model based on their recommendations.

CHAPTER 4
RESEARCH FINDINGS

Research Topic: Teaching model to enhance environmental awareness for interior design undergraduate students in Chengdu, China.

The researchers will present the analysis results in the following sections:

4.1 To study stage and need of environmental awareness of interior design courses

4.1.1 Basic Information of Respondents

4.1.2 Current Environmental Awareness of Undergraduate Students in Interior Design in Chengdu

4.1.3 Collection of Environmental Awareness Needs of Undergraduate Students in Interior Design in Chengdu through Interviews

4.2 Teaching Model (Draft) to Enhance Environmental Awareness of Undergraduate Students in Interior Design in Chengdu

4.3 Applicability and Feasibility of the Teaching Model for Environmental Awareness in Interior Design

4.1 To study stage and need of environmental awareness of interior design courses

4.1 .1 Basic Information of Respondents

In a study on the environmental awareness status of undergraduate students majoring in interior design in Chengdu, 400 samples were randomly selected. Ultimately, 382 complete questionnaires were received within the designated timeframe, accounting for 95.5% of the initially selected samples. According to the sample size analysis by Krejcie and Morgan (1970), at least 331 samples are needed if the population size is 2,400. The sample size for this study meets this requirement. The survey collected data on gender, age, grade level, and institutional distribution to analyze the demographic characteristics of the samples.

Table 1 The results

		Frequency	Percentage
Gender			
	Male	180	47.1
	Woman	202	52.9
Age			
	18-20	102	26.7
	21-23	109	28.5
	24-26	91	23.8
	27 or above	80	20.9
Grade			
	Freshman Year	13	3.4
	Sophomore Year	52	13.6
	Junior Year	108	28.3
	Senior Year	136	35.6
	Graduated 1-2 years ago	57	14.9
	Graduated 3-5 years ago	16	4.2
University			
	Sichuan Technology and Business University	28	7.3
	Chengdu Jincheng College	19	5.0
	Chengdu College of Arts and Sciences	25	6.5
	Chengdu Vocational University of Art	25	6.5
	Gingko College of Hospitality Management	25	6.5
	Geely University of China	25	6.5
	Sichuan University of Media and Communications	21	5.5
	Sichuan University Jinjiang College	26	6.8
	Sichuan University	18	4.7
	Chengdu University	21	5.5
	Sichuan Tourism University	23	6
	Sichuan Agricultural University	21	5.5
	Sichuan Normal University	18	4.7
	Sichuan Conservatory of Music Chengdu Academy of Fine Arts	30	7.9
	Xihua University	14	3.7
	Southwest Jiaotong University	26	6.8
	Southwest Minzu University	17	4.5

The results in Table 1 show that there were a total of 382 respondents, of which 202 were female, accounting for 52.9%, and 180 were male, accounting for 47.1%. In terms of age distribution, the sample was primarily concentrated in the 21-23 age range, with 109 individuals representing 28.5%. The second largest group was those aged 18-20, comprising 102 individuals or 26.7%. The third group included respondents aged 24-26, totaling 91 individuals, which accounts for 23.8%. Lastly, there were 80 respondents aged 27 and above, making up 20.9%. Regarding educational stages, the largest proportion was among senior students, with 136 individuals, representing 35.6%. This was followed by junior students, with 108 respondents, accounting for 28.3%. The third group consisted of graduates with 1-2 years of experience, totaling 57 individuals, or 14.9%. The fourth group comprised sophomore students, with 52 individuals, making up 13.6%. Next were graduates with 3-5 years of experience, totaling 16 individuals, which accounts for 4.2%. Finally, there were only 13 freshmen, representing 3.4%. The distribution of institutions shows that the sample covered multiple higher education institutions, with Sichuan Conservatory of Music and Chengdu University of Fine Arts leading with 30 respondents, accounting for 7.9%. This was followed by Sichuan University of Commerce, with 28 respondents, or 7.3%. Some institutions had a smaller sample size, such as Xihua University, which had only 14 individuals, accounting for just 3.7%.

4.1.2 Current Status of Environmental Awareness among Undergraduate Students in Interior Design in Chengdu

4.1.2.1 Descriptive Analysis

Table 2

	Items	Mean	SD	Level
Knowledge	1. In the course, I have learned systematic and comprehensive knowledge of environmental protection theories.	2.88	1.24	Moderate
	2. My course includes content on sustainable design principles and methods.	2.85	1.322	Moderate

	3. I have studied and understood the 3F and 5R principles in sustainable interior design.	2.83	1.273	Moderate
	4.I have learned how to save energy, water, and materials in design.	2.86	1.239	Moderate
	5.I understand the physical qualities of indoor environments (indoor air quality, indoor thermal comfort, indoor lighting, indoor sound environment).	2.96	1.257	Moderate
Skills	6.I am able to effectively implement energy saving, water conservation, and material efficiency in interior design projects.	2.91	1.292	Moderate
	7.I can apply the 3F principles (environmental harmony, human-centered design, and dynamic development) and the 5R principles (reassess, renew, reuse, recycle, and reduce) in project planning for sustainable interior design.	2.73	1.304	Moderate
	8.I have acquired sufficient training in environmental protection skills during the course, and I am capable of communicating and addressing issues related to environmental protection.	3.01	1.335	Moderate
	9.I can establish specific environmental goals for interior design projects and effectively operate and manage green initiatives.	2.96	1.307	Moderate
	10.I am capable of evaluating and optimizing indoor design schemes for sustainability during the design process, taking into account various sustainable development strategies.	3.05	1.311	Moderate
Attitude and Values	11.I believe environmental awareness is crucial in interior design.	3.95	1.024	High
	12. I belienvironmental protection and sustainable development.	3.81	1.104	High
	13.I willing to explore and incorporate the concept of sustainable development into my designs.	3.91	1.095	High
	14.I hope that future designs can better balance environmental	3.8	1.105	High

	and economic benefits.			
	15.I am willing to continuously learn more environmental design knowledge and skills.	3.87	1.09	High
	16.I believe that environmentally-friendly design can enhance the overall quality of design. It not only improves the environment but also boosts customer satisfaction and market competitiveness.	3.82	1.12	High
	17.I consciously consider environmental factors in the design process.	3.87	1.051	High
	18.I am willing to participate in environmental design research and development projects.	3.8	1.111	High
	19. I believe that sustainable design is one of the core values of interior design.	3.82	1.047	High
	20.I am willing to promote the importance of environmental protection through my own design works.	3.73	1.071	High
PBL Project-Based Learning	21.The content of the environmental design course is highly consistent with national and local teaching standards, helping me clarify learning objectives.	3.15	1.532	Moderate
	22.The connection between course content and teaching standards enables me to systematically grasp important concepts and skills in environmental design.	3.09	1.459	Moderate
	23.The school's arrangement of teaching activities for the environmental design course is reasonable and effectively stimulates my interest in learning.	3.31	1.425	Moderate
	24.The teaching management activities provided by the school help me to learn and master environmental design skills more systematically.	3.13	1.435	Moderate
	25.The evaluation of design outcomes assesses my theoretical knowledge of environmental design and my ability to practice sustainable design. Teacher evaluations of our design projects are fair, detailed, and constructive.	3.26	1.451	Moderate

	26.The evaluation method of students' environmental design projects effectively motivates my learning and willingness to improve design proposals.	3.24	1.365	Moderate
	27.Throughout the learning and practice process, I receive timely, comprehensive, and personalized guidance and feedback from teachers.	3.23	1.384	Moderate
	28.The specific guidance and feedback provided by teachers in projects have a positive impact on my learning.	3.14	1.43	Moderate
	29.The learning resources and tools provided by teachers in the course are very helpful for my understanding and application of environmental design concepts, helping me to better complete environmental design projects.	3.21	1.436	Moderate
	30.After each project, I reflect, summarize, and analyze the gains and losses in environmental design.	3.19	1.367	Moderate
	31.I use the results of reflection to improve subsequent designs, which helps enhance my environmental awareness.	3.19	1.408	Moderate
The theory of Work-Integrated Learning (WIL)	32.I have the opportunity to participate in real work projects or internships in the course.	2.47	1.428	low
	33.Environmental design projects collaborated on by the school with companies or institutions allow me to apply theoretical knowledge to practice, gaining more operational experience and guidance.	2.51	1.393	low
	34.Participating in actual projects with companies or institutions significantly improves my environmental design capabilities and professional qualities.	2.73	1.332	Moderate

Table 2 indicates the current state of environmental awareness among undergraduate students majoring in interior design in Chengdu, ranked from high to low based on average values as follows:

Knowledge Dimension:

In terms of the knowledge dimension, students generally have a moderate grasp of environmental theoretical knowledge, with average scores ranging from 2.83 to 2.96 and standard deviations between 1.22 and 1.32. This suggests that students possess a certain understanding of the course content, but there is still room for improvement. It indicates that the course has achieved some success in imparting comprehensive environmental theoretical knowledge, yet it may require further reinforcement to bridge the differences among students.

Skill Dimension:

Data regarding the skill dimension show that students' abilities to implement energy-saving, water-saving, and material-saving measures in interior design projects are also at a moderate level, with average scores between 2.73 and 3.05 and standard deviations from 1.28 to 1.34. This indicates that students lack certain practical skills and are unable to apply theoretical knowledge in actual design contexts. The variability in skill levels underscores the ongoing need for skill training.

Attitude and Values Dimension:

The average scores in the attitude and values dimension are relatively high, ranging from 3.73 to 3.95, with standard deviations from 1.02 to 1.12, reflecting a strong recognition and positive attitude among students regarding the importance of environmentally friendly design. These high average scores and relatively small standard deviations suggest that students broadly agree on the value of environmental design and are willing to consider environmental factors in their future design practices.

PBL Project-Based Learning Dimension:

In the PBL project-based learning dimension, students provided feedback on the alignment of course content with national and local teaching standards, with an average score of 3.15 and a standard deviation of 1.532. This indicates a moderate level of acknowledgment regarding the clarity of learning objectives. Students also believe that the connection between course content and teaching standards

facilitates a systematic understanding of important concepts and skills in environmental design, with an average score of 3.09 and a standard deviation of 1.459, suggesting satisfaction with the course structure. The reasonableness of the arrangement of teaching activities, the ability to stimulate learning interest, the systematic nature of teaching management activities, the fairness and constructiveness of design outcome assessments, the motivational aspects of student project evaluations, the timeliness of teacher guidance and feedback, the practicality of learning resources and tools, as well as the significance of reflection and summarization, received varying degrees of acknowledgment from students, with average scores ranging from 3.13 to 3.31 and standard deviations from 1.365 to 1.532, overall reflecting a moderate level.

Work-Integrated Learning (WIL) Theory-Practice Dimension:

In the work-integrated learning (WIL) theory-practice dimension, students rated their opportunities to participate in real work projects or internships relatively low, with an average score of 2.47 and a standard deviation of 1.428. This indicates limited opportunities for students to apply theoretical knowledge in practice. The environmental design projects in collaboration with schools and enterprises or institutions, as well as participation in actual projects, yielded average scores of 2.51 and 2.73, with standard deviations of 1.393 and 1.332, respectively, indicating students' moderate recognition of their experiences and gains from such practical opportunities. These results suggest that educators may need to further strengthen the link between the curriculum and real-world work to enhance students' practical abilities and professional competencies.

4.1.2.2 Normality Test

A normality test was conducted on the collected continuous variable data. The absolute values of skewness for all sample data were less than 3, and the absolute values of kurtosis remained below 10. Both indicators meet the recommended standards for normal distribution. This indicates that the scale data collected in this study conform to a normal distribution.

Table 3

	Min	Max	Mean	SD	Skew	Kurt
1.In the course, I have learned systematic and comprehensive knowledge of environmental protection theories.	1	5	2.88	1.24	0.034	-1.004
2.My course includes content on sustainable design principles and methods.	1	5	2.85	1.322	0.107	-1.1
3.I have studied and understood the 3F and 5R principles in sustainable interior design.	1	5	2.83	1.273	0.118	-1.064
4.I have learned how to save energy, water, and materials in design.	1	5	2.86	1.239	0.102	-0.984
5.I understand the physical qualities of indoor environments (indoor air quality, indoor thermal comfort, indoor lighting, indoor sound environment).	1	5	2.96	1.257	0.036	-1
6.I am able to effectively implement energy saving, water conservation, and material efficiency in interior design projects.	1	5	2.91	1.292	0	-1.109
7.I can apply the 3F principles (environmental harmony, human-centered design, and dynamic development) and the 5R principles (reassess, renew, reuse, recycle, and reduce) in project planning for sustainable interior design.	1	5	2.73	1.304	0.149	-1.197
8.I have acquired sufficient training in environmental protection skills during the course, and I am capable of communicating and addressing issues related to environmental protection.	1	5	3.01	1.335	-0.084	-1.131
9.I can establish specific environmental goals for interior design projects and effectively operate and manage green initiatives.	1	5	2.96	1.307	0.059	-1.109
10.I am capable of evaluating and optimizing indoor	1	5	3.05	1.311	-0.076	-1.141

design schemes for sustainability during the design process, taking into account various sustainable development strategies.						
11.I believe environmental awareness is crucial in interior design.	1	5	3.95	1.024	-1.421	1.921
12.I belienvironmental protection and sustainable development.	1	5	3.81	1.104	-0.798	0.034
13.I willing to explore and incorporate the concept of sustainable development into my designs.	1	5	3.91	1.095	-0.943	0.303
14.I hope that future designs can better balance environmental and economic benefits.	1	5	3.8	1.105	-0.786	0.009
15.I am willing to continuously learn more environmental design knowledge and skills.	1	5	3.87	1.09	-0.843	0.122
16.I believe that environmentally-friendly design can enhance the overall quality of design. It not only improves the environment but also boosts customer satisfaction and market competitiveness.	1	5	3.82	1.12	-0.737	-0.198
17.I consciously consider environmental factors in the design process.	1	5	3.87	1.051	-0.792	0.131
18.I am willing to participate in environmental design research and development projects.	1	5	3.8	1.111	-0.756	-0.062
19.I believe that sustainable design is one of the core values of interior design.	1	5	3.82	1.047	-0.658	-0.147
20.I am willing to promote the importance of environmental protection through my own design works.	1	5	3.73	1.071	-0.528	-0.337
21.The content of the environmental design course is highly consistent with national and local teaching standards, helping me clarify learning objectives.	1	5	3.15	1.532	-0.244	-1.508
22.The connection between course content and teaching standards enables me to systematically grasp important concepts and skills in environmental	1	5	3.09	1.459	-0.139	-1.353

design.						
23.The school's arrangement of teaching activities for the environmental design course is reasonable and effectively stimulates my interest in learning.	1	5	3.31	1.425	-0.327	-1.187
24.The teaching management activities provided by the school help me to learn and master environmental design skills more systematically.	1	5	3.13	1.435	-0.134	-1.327
25.The evaluation of design outcomes assesses my theoretical knowledge of environmental design and my ability to practice sustainable design. Teacher evaluations of our design projects are fair, detailed, and constructive.	1	5	3.26	1.451	-0.297	-1.276
26.The evaluation method of students' environmental design projects effectively motivates my learning and willingness to improve design proposals.	1	5	3.24	1.365	-0.242	-1.147
27.Throughout the learning and practice process, I receive timely, comprehensive, and personalized guidance and feedback from teachers.	1	5	3.23	1.384	-0.203	-1.216
28.The specific guidance and feedback provided by teachers in projects have a positive impact on my learning.	1	5	3.14	1.43	-0.181	-1.26
29.The learning resources and tools provided by teachers in the course are very helpful for my understanding and application of environmental design concepts, helping me to better complete environmental design projects.	1	5	3.21	1.436	-0.217	-1.28
30.After each project, I reflect, summarize, and analyze the gains and losses in environmental design.	1	5	3.19	1.367	-0.205	-1.172
31.I use the results of reflection to improve subsequent designs, which helps enhance my environmental awareness.	1	5	3.19	1.408	-0.141	-1.25
32.I have the opportunity to participate in real work	1	5	2.47	1.428	0.512	-1.227

projects or internships in the course.						
33.Environmental design projects collaborated on by the school with companies or institutions allow me to apply theoretical knowledge to practice, gaining more operational experience and guidance.	1	5	2.51	1.393	0.535	-0.988
34.Participating in actual projects with companies or institutions significantly improves my environmental design capabilities and professional qualities.	1	5	2.73	1.332	0.206	-1.155

4.1.2.3 Validity and Reliability Testing

4.1.2.3.1 . Factor Analysis

To assess the suitability of the measurement items, a factor analysis was conducted, specifically the Kaiser-Meyer-Olkin (KMO) measure and Bartlett's test of sphericity. The KMO value was 0.957, indicating that the sample data is appropriate for factor analysis, as a KMO value greater than 0.8 is generally considered good. Additionally, the approximate chi-square value for Bartlett's test of sphericity reached 11887.216, with 561 degrees of freedom and a significance level of 0.000 ($p<0.001$), which further confirms that the collected data is suitable for factor analysis.

Table 4

KMO and Bartlett's Test		
Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.957
Bartlett's Test of Sphericity	Approx. Chi-Square	11887.216
	df	561
	Sig.	.000

This study employed Principal Component Analysis (PCA) combined with Varimax rotation for factor extraction, ultimately identifying five main dimensions. The first dimension accounts for 37.146% of the total variance. The squared sum of loadings for this dimension is 9.034, contributing a cumulative variance of 26.570%,

further confirming its significance in the measurement structure. The squared sum of loadings for the second dimension is 6.567, bringing the cumulative explained variance of the two dimensions to 45.884%, which enhances the interpretative power of the analysis. The squared sum of loadings for the third dimension is 3.867, resulting in a cumulative explained variance of 57.258%. The squared sum of loadings for the fourth dimension is 3.649, which raises the total cumulative variance to 67.991%. Finally, the squared sum of loadings for the fifth dimension is 2.146, leading to a total cumulative variance of 74.304%. This exceeds the recommended threshold of 60%, indicating that the items have a high explanatory capacity for the dimensions, and the factor structure exhibits good convergent validity.

Table 5

Total Variance Explained

Component	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	12.63	37.146	37.146	12.63	37.146	37.146	9.034	26.57	26.57
2	5.251	15.445	52.591	5.251	15.445	52.591	6.567	19.314	45.884
3	4.709	13.851	66.442	4.709	13.851	66.442	3.867	11.374	57.258
4	1.671	4.914	71.356	1.671	4.914	71.356	3.649	10.733	67.991
5	1.002	2.948	74.304	1.002	2.948	74.304	2.146	6.313	74.304

After performing principal component analysis and applying the maximum variance rotation method, the factor structure reached convergence after six iterations, indicating that the iterative method used has successfully stabilized and extracted factor patterns. Throughout this process, the five extracted dimensions demonstrated good convergence and structural stability. Additionally, the factor loadings of each measurement item on the corresponding dimensions were close to or

exceeded the recommended value of 0.7, validating the measurement model's effectiveness and indicating a correlation between each item and its respective dimension.

Table 6

Rotated Component Matrix[a]

	Component				
	1	2	3	4	5
1.In the course, I have learned systematic and comprehensive knowledge of environmental protection theories.				0.696	
2.My course includes content on sustainable design principles and methods.				0.777	
3.I have studied and understood the 3F and 5R principles in sustainable interior design.				0.754	
4.I have learned how to save energy, water, and materials in design.				0.781	
5.I understand the physical qualities of indoor environments (indoor air quality, indoor thermal comfort, indoor lighting, indoor sound environment).				0.799	
6.I am able to effectively implement energy saving, water conservation, and material efficiency in interior design projects.			0.713		
7.I can apply the 3F principles (environmental harmony, human-centered design, and dynamic development) and the 5R principles (reassess, renew, reuse, recycle, and reduce) in project planning for sustainable interior design.			0.807		
8.I have acquired sufficient training in environmental protection skills during the course, and I am capable of communicating and			0.784		

addressing issues related to environmental protection.	
9.I can establish specific environmental goals for interior design projects and effectively operate and manage green initiatives.	0.799
10.I am capable of evaluating and optimizing indoor design schemes for sustainability during the design process, taking into account various sustainable development strategies.	0.805
11.I believe environmental awareness is crucial in interior design.	0.816
12.I belienvironmental protection and sustainable development.	0.831
13.I willing to explore and incorporate the concept of sustainable development into my designs.	0.822
14.I hope that future designs can better balance environmental and economic benefits.	0.803
15.I am willing to continuously learn more environmental design knowledge and skills.	0.793
16.I believe that environmentally-friendly design can enhance the overall quality of design. It not only improves the environment but also boosts customer satisfaction and market competitiveness.	0.772
17.I consciously consider environmental factors in the design process.	0.781
18.I am willing to participate in environmental design research and development projects.	0.776
19.I believe that sustainable design is one of the core values of interior design.	0.766
20.I am willing to promote the importance of environmental protection through my own design works.	0.749

21.The content of the environmental design course is highly consistent with national and local teaching standards, helping me clarify learning objectives.	0.894
22.The connection between course content and teaching standards enables me to systematically grasp important concepts and skills in environmental design.	0.907
23.The school's arrangement of teaching activities for the environmental design course is reasonable and effectively stimulates my interest in learning.	0.898
24.The teaching management activities provided by the school help me to learn and master environmental design skills more systematically.	0.886
25.The evaluation of design outcomes assesses my theoretical knowledge of environmental design and my ability to practice sustainable design. Teacher evaluations of our design projects are fair, detailed, and constructive.	0.881
26.The evaluation method of students' environmental design projects effectively motivates my learning and willingness to improve design proposals.	0.873
27.Throughout the learning and practice process, I receive timely, comprehensive, and personalized guidance and feedback from teachers.	0.874
28.The specific guidance and feedback provided by teachers in projects have a positive impact on my learning.	0.871
29.The learning resources and tools provided by teachers in the course are very helpful for my understanding and application of environmental design concepts, helping me to better complete	0.86

environmental design projects.		
30.After each project, I reflect, summarize, and analyze the gains and losses in environmental design.	0.868	
31.I use the results of reflection to improve subsequent designs, which helps enhance my environmental awareness.	0.852	
32.I have the opportunity to participate in real work projects or internships in the course.		0.68
33.Environmental design projects collaborated on by the school with companies or institutions allow me to apply theoretical knowledge to practice, gaining more operational experience and guidance.		0.763
34.Participating in actual projects with companies or institutions significantly improves my environmental design capabilities and professional qualities.		0.781

4.1.2.3.2. Reliability Analysis

In this study, a reliability analysis was conducted on multiple dimensional scales, where Cronbach's alpha is a key indicator of scale reliability, with values ranging from 0 to 1; a higher value indicates better reliability of the scale. According to the survey results, the Cronbach's alpha for each dimension exceeded 0.8, surpassing the standard value of 0.7. The overall Cronbach's alpha was 0.947, further confirming the high reliability of the scale.

Table 7

Dimension	N of Items	Cronbach's Alpha	Total Cronbach's Alpha
Knowledge	5	0.879	
Skills	5	0.897	
Attitude and Values	10	0.939	
PBL Project-Based Learning	11	0.976	0.947
Work Integrated Learning (WIL)	3	0.930	

4.1.2.3.3. Internal Consistency and Discriminant Validity

An assessment of internal consistency and discriminant validity was conducted for the multi-dimensional scale. Composite Reliability (CR) and Average Variance Extracted (AVE) are key indicators for measuring the reliability of the scale, while the Pearson correlation coefficient is used to evaluate the correlations between different dimensions. The research findings indicate that the CR values for all dimensions are greater than 0.7, suggesting that the scale has high internal consistency. The AVE values are also all greater than 0.5, further confirming the reliability of the scale. The Pearson correlation coefficients show that the correlations between some dimensions are significant at the 0.01 or 0.05 level (two-tailed), indicating a low to moderate correlation among different dimensions. The square root of the AVE for each dimension is greater than the Pearson correlation coefficients with other dimensions, meeting the requirements for discriminant validity, which indicates that while the dimensions maintain a certain level of correlation, they can also be clearly distinguished from one another.

Table 8

	CR	AVE	Knowledge	Skills	Attitude and Values	PBL Project-Based Learning	Work Integrated Learning (WIL)
Knowledge	0.874	0.581	**0.762**				
Skills	0.887	0.612	.527**	**0.782**			
Attitude and Values	0.944	0.626	.249**	.235**	**0.791**		
PBL Project-Based Learning	0.974	0.772	.352**	.288**	.275**	**0.879**	
Work Integrated Learning (WIL)	0.786	0.552	.609**	.666**	.270**	.394**	**0.743**

** Correlation is significant at the 0.01 level (2-tailed).

The bold text represents the AVE square root value, while the lower triangle indicates the Pearson correlation coefficient.

4.1.2.4 Correlation Analysis

When conducting a correlation analysis to explore the interrelationships among PBL project-based teaching, the integration of theory and practice, the current state of environmental awareness, and the theory of ESD (Education for Sustainable Development), it was found that there are significant positive correlations among all variables. Specifically, the correlation coefficient between PBL project-based teaching and the integration of theory and practice is 0.394, with the current state of environmental awareness is 0.447, and with the theory of ESD is 0.406, all significant at the 0.01 level (two-tailed test). The correlation coefficient between the integration of theory and practice and the current state of environmental awareness is 0.870, and the correlation with the theory of ESD is 0.707, also significant at the 0.01 level. The highest

correlation is between the current state of environmental awareness and the theory of ESD, at 0.916, indicating a very strong positive relationship between the two. These results suggest that there is a positive association between PBL project-based teaching and the enhancement of environmental awareness, the integration of theory and practice, and the theory of ESD, and this association is statistically significant.

Table 9

	PBL Project-Based Learning	Work Integrated Learning (WIL)	Current Status of Environmental Awareness	ESD Sustainable Education Theory
PBL Project-Based Learning	1	.394**	.447**	.406**
Work Integrated Learning (WIL)	.394**	1	.870**	.707**
Current Status of Environmental Awareness	.447**	.870**	1	.916**
ESD Sustainable Education Theory	.406**	.707**	.916**	1

** Correlation is significant at the 0.01 level (2-tailed).

4.1.2.5 Verification of Research Hypotheses

In this study, a multiple regression analysis method was employed to explore the effects of three independent variables——Project-Based Learning (PBL), Work-Integrated Learning (WIL), and Education for Sustainable Development (ESD) theories——on the state of environmental awareness, which serves as the dependent variable. The analysis results indicate that PBL has a significant positive impact on the current state of environmental awareness, with an unstandardized coefficient of 0.022. This suggests that, all else being equal, for each additional unit of PBL, environmental

awareness is expected to increase, on average, by 0.022 units. The standardized coefficient for this variable is 0.034, with a t-value of 2.435 and a significance level of 0.015, indicating that this effect is statistically significant. The Variance Inflation Factor (VIF) is 1.231, suggesting that there is no issue of multicollinearity. The unstandardized coefficient for the combination of theory and practice is 0.279, demonstrating an even more significant effect on environmental awareness, with a t-value of 24.058 and a significance level of 0.000, underscoring the important role of this variable in the model. The standardized coefficient is 0.438, and the VIF value is 2.054, further confirming its positive impact on environmental awareness while indicating no multicollinearity. The unstandardized coefficient for the ESD theory is 0.650, making it the most significant influence among the three independent variables, with a t-value of 32.317 and a significance level of 0.000, which suggests that ESD has a very strong positive impact on the state of environmental awareness. The standardized coefficient is 0.592, and the VIF value is 2.078, similarly indicating that this effect is statistically significant without multicollinearity issues. The overall model's F-value is 1937.554, indicating a high degree of fit for the data. The coefficient of determination (R^2) is 0.939, signifying that the model can explain 93.9% of the variance in the dependent variable, demonstrating a high level of explanatory power. The Durbin-Watson statistic is 2.045, close to 2, suggesting no autocorrelation among the residuals, thereby ensuring the robustness of the model.

In summary, the results of this study indicate that PBL, WIL in conjunction with theoretical practice, and ESD theories all significantly and positively influence the enhancement of environmental awareness, with the ESD theory having the most pronounced impact. These findings provide important insights for educational practice, suggesting that implementing PBL, strengthening the integration of theory and practice, and promoting ESD education can effectively enhance students' environmental awareness.

Table 10

	Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Collinearity Statistics	F-value	R square	Durbin-wasto n
	B	Std. Error	Beta			VIF			
(Constant)	0.215	0.05		4.31	0				
PBL Project-Based Learning	0.022	0.009	0.034	2.435	0.015	1.231			
Work Integrated Learning (WIL)	0.279	0.012	0.438	24.058	0	2.054	1937.554	0.939	2.045
ESD Sustainable Education Theory	0.65	0.02	0.592	32.317	0	2.078			
a Dependent Variable: Current Status of Environmental Awareness									

4.1.3 Collecting Information on the Environmental Awareness Needs of Undergraduate Students in Interior Design in Chengdu Through Interviews

This study aims to conduct in-depth analyses of the environmental awareness development needs of undergraduate students in the interior design program in Chengdu through interviews with students, educational experts, industry professionals, and designers. The goal is to provide a basis for improving new teaching models to enhance students' environmental awareness.

Specifically, it includes understanding the depth and breadth of the theoretical content related to environmental awareness in existing interior design courses, identifying the environmental knowledge and skills that students lack;

discussing the necessity and suggestions for integrating knowledge from other disciplines into interior design courses; clarifying the most important theoretical knowledge of environmental awareness for interior design students; ensuring that students learn cutting-edge knowledge of environmentally friendly design; providing examples of practical activities that enhance students' skills in environmental design; exploring effective teaching methods to establish students' environmental awareness and values; guiding students to transform their personal environmental awareness into a sense of social and industry responsibility through teaching strategies; analyzing the gap between curriculum standards and actual teaching content and ways to bridge that gap; managing and allocating time for learning and activities; designing comprehensive assessment standards for students' overall abilities; guiding students to discover and solve environmental problems and balancing student autonomy with mentor guidance; providing methods and adjustment strategies for scaffolding student learning; enhancing reflection and summarization methods for students' understanding of environmental design; addressing the challenges students face in combining work and study, along with teachers' support strategies; identifying successful teaching models and methods, as well as cases that introduce real work scenarios to enhance students' sustainable design practice abilities. Ultimately, the aim is to provide effective teaching models for cultivating environmental awareness among undergraduate students in Chengdu's interior design program, thereby benefiting both students and society.

4.1.3.1 Interview Subjects and Basic Information

Table 11 Interview Subjects and Basic Information

Serial Number	Identity	Number of interviewees
1	Designer	2 people
2	Educational Expert	2 people
3	Corporate Expert	2 people

The interview subjects consist of a total of six individuals, including two designers who are interior designers from different companies or institutions. They possess practical work experience and can share how the environmental knowledge and skills learned in university are applied in their work. They will point out the shortcomings of current interior design education in cultivating students' environmental awareness and skills, discuss the challenges related to environmental design encountered in actual work and the methods used to overcome them, and elaborate on cases where environmental design has provided added value to clients, as well as its impact on professional attitudes and design decisions. They will describe their own changes in environmental awareness and attitudes, along with the driving forces behind these changes, discuss the deficiencies in school-enterprise cooperation and suggest improvements, provide their views on the future development trends of the interior design industry in terms of environmental design, and offer advice to current students. Additionally, they will contemplate directions for improvement and specific action suggestions to promote the achievement of the Sustainable Development Goals (SDGs) from education to professional practice.

Two education experts from the field of education, familiar with the teaching of interior design, are able to evaluate the depth and breadth of environmental awareness theory content in existing interior design courses, identify the environmental knowledge and skills that students lack, and suggest ways to integrate knowledge from other disciplines into the interior design curriculum, providing examples of interdisciplinary knowledge integration methods. They will articulate the most important environmental theory knowledge for interior design students, recommend how to ensure that the environmental design knowledge students learn is cutting-edge, and give examples of practical activities that enhance students' environmental design skills. Furthermore, they will share effective teaching methods that help students develop environmental awareness and values, propose teaching strategies to guide students in transforming personal environmental consciousness into social and industry responsibility, analyze the gap between curriculum standards and actual teaching

content along with methods to bridge this gap, and explain ways to manage and allocate learning and activity time while ensuring the breadth and depth of course content. They will design standards to assess students' comprehensive abilities, introduce strategies for guiding students to discover and solve environmental issues in project design while balancing student autonomy and mentor guidance, elaborate on methods and adjustment strategies for building learning scaffolding for students, propose reflective and summarizing methods to enhance students' understanding of environmental design, analyze the challenges students face in integrating work and study along with supportive strategies from teachers, and share successful teaching models and methods, as well as cases that introduce real work scenarios to enhance students' sustainable design practice capabilities.

Two industry experts, from China Railway Second Engineering Group Design Institute and Chengdu Yize Architectural Decoration Design Co., Ltd., emphasize the importance of environmental protection capabilities and awareness when recruiting recent graduates in interior design. They evaluate the performance of newly hired graduates in terms of environmental design theory and skills, pointing out existing shortcomings. They believe that comprehensive internships or those emphasizing real project experiences, as well as collaborative projects with enterprises, are the most effective ways to enhance students' environmental design skills. They observe that while graduates exhibit a positive attitude towards environmental design, they face challenges in practical application. The experts highlight that resources and platforms provided by enterprises, such as professional training, seminars, project management systems, design databases, cross-departmental collaboration projects, and research projects with universities, can aid students in understanding and practicing environmental design. They share the challenges encountered in environmental design projects and the methods used to overcome them. They note a gap between the current graduates' environmental awareness and skills and the actual needs of enterprises, offering suggestions for adjustments and improvements. They propose key elements that should be included in an effective educational model for cultivating environmental awareness

and skills. They also discuss the future development trends in the field of interior design concerning environmental protection and recommend that universities deepen collaboration with enterprises to enhance the environmental awareness of undergraduate interior design students in curriculum design and teaching methods, thereby better achieving the Sustainable Development Goals (SDGs).

4.1.3.2 Coding Analysis Framework

Table 12 Analysis Framework

EPW Mode	Coding Theme	Subcode
ESD	Knowledge and Skills	The depth and breadth of environmental awareness theory content in existing courses.
		Interdisciplinary Knowledge Integration
		Important Environmental Protection Theoretical Knowledge
		Ensure the forefront of environmental design knowledge.
		Practical activities to enhance environmental design skills.
	Attitudes and Values	Teaching Methods for Establishing Environmental Awareness and Values
		Teaching Strategies to Transform Students' Environmental Awareness

EPW Mode	Coding Theme	Subcode
PBL	Corresponding to the curriculum standards	The Gap Between Curriculum Standards and Actual Teaching Content and Methods for Bridging It
	Manage Teaching Activities	Management and allocation of learning activity time
	Assessing Student Learning	Standards for Assessing Students' Comprehensive Abilities
	Participation and Guidance	Methods and strategies for guiding students to discover and address environmental issues and achieve balance.
	Building a Learning Scaffold	Methods and Adjustment Strategies for Building Learning Scaffolds for Students
	Review and Reflection	Methods for Reflecting on and Summarizing Students' Understanding of Environmental Design
WIII	Theory combined with practice	Challenges Faced by Students and Support Strategies from Teachers
		Effective Teaching Models and Methods and Their Application in Real Work Scenarios

In the research model, ESD (Education for Sustainable Development) encompasses three important aspects: knowledge, skills, and values. ESD is committed to providing students with comprehensive educational content that not only imparts knowledge but also emphasizes the cultivation of practical skills and the shaping of correct values. It encourages students to recognize the importance of environmental protection and equips them with the ability to apply theoretical knowledge to practical design.

The PBL (Project-Based Learning) component includes several key elements. Firstly, it closely aligns with curriculum standards, ensuring that teaching activities are organized around the syllabus. In the teaching process, PBL places students in real-world problem situations, fostering their problem-solving abilities through self-directed learning. Teachers actively participate in the PBL context, guiding and assisting students, and by assessing students' performance in project activities, they gain timely insights into learning progress and mastery levels. PBL also provides learning scaffolds to help students better understand and master complex concepts, facilitating knowledge internalization. Through review and reflection, the teaching process and learning outcomes are continuously optimized.

WIL (Work-Integrated Learning) represents a proactive attitude and intrinsic motivation to apply theory to practice. It reinforces students' understanding and skills through practical work experience, working in conjunction with ESD and PBL to form a complete EPW (Education for Professional Work) model. This model not only supports students' academic growth but also provides comprehensive support for the cultivation of personal sustainable development awareness and professional competencies, adequately preparing them to face future environmental challenges.

Overall, these coding themes and subcodes cover various aspects of the environmental awareness and capability development of students in the interior design profession, including curriculum design, teaching methods, practical activities, and assessment standards. The aim is to provide comprehensive guidance and support for enhancing students' environmental awareness and capabilities. In terms of knowledge and skills, existing courses lack depth and breadth regarding theories of environmental awareness, and students lack practical application abilities for solving environmental design challenges. Therefore, interdisciplinary knowledge such as environmental science and sustainable development should be integrated into interior design courses through case studies, lectures, workshops, and other methods. Additionally, important environmental theories such as the 3F principle and the 5R principle should be incorporated into practical projects to enhance students'

understanding. Schools must also ensure that students are learning the latest and most cutting-edge knowledge in environmental design, and improve students' environmental design skills through various practical activities such as campus renovations, community competitions, and corporate collaboration projects.

In terms of attitudes and values, teaching methods such as case analysis and simulation projects should be adopted to help students develop environmental awareness and values, guiding them to transform personal environmental consciousness into a sense of social responsibility. Moreover, attention should be given to the gap between curriculum standards and actual teaching content, addressing this through revisions of standards and adjustments to teaching content. In teaching management, a modular and phased approach should be utilized, allowing for flexible adjustment of class hours, with an emphasis on the integration of theory and practice, and a comprehensive assessment of students' overall abilities through various methods. Educators should also guide students in identifying and solving environmental problems, building scaffolding for their learning, and enhancing their understanding of environmental design through reflection reports and comparative analysis. Finally, in response to the challenges faced by students, teachers should provide support in terms of training and resources, and elevate students' sustainable design practical capabilities through project-based learning, internships, and real-world applications.

4.1.3.3 . Statistical Analysis of High-Frequency Words and Their Occurrences

The high-frequency terms indicate that the interviews primarily focus on the cultivation of sustainable design capabilities among students in the interior design profession. This includes aspects such as the establishment of environmental awareness, the imparting of relevant knowledge and skills, improvements in curriculum design and teaching methods, the implementation of practical activities, the strengthening of school-enterprise cooperation, and the adaptation to industry demands. Additionally, there is attention given to the role of teachers in student

development and the support provided by resources and standards for environmentally friendly design.

Table 13 Statistical Analysis of High-Frequency Words and Their Counts

High-frequency words	Frequency	Analysis
Sustainable Design	29	The core theme runs throughout the entire interview content, addressing various aspects of sustainable and environmentally friendly design, including knowledge, attitudes, and the capability to solve environmental design issues.
Student	23	As the main focus of the interview, the discussion addressed the current status of students' knowledge, skills, and attitudes regarding environmental design, as well as areas that need improvement.
Environmental Awareness	18	Emphasize the importance of cultivating students' environmental awareness and how to enhance this awareness through teaching and practice.
Course	16	◦ This text discusses aspects such as curriculum design, course content, and curriculum standards, exploring how improvements in these areas can enhance students' environmental design capabilities.
Practice	15	Practical activities are considered an important means of enhancing students' environmental design skills, including community projects, internships, and collaborative projects between schools and enterprises.

High-frequency words	Frequency	Analysis
Sustainable Development	12	Closely related to environmentally friendly design, this is a goal pursued by the interior design industry and an important direction for student training.
Knowledge	11	Environmental knowledge, theoretical knowledge, and other important content are essential for students to master and should be emphasized in teaching..
Teaching	10	Involving teaching methods, teaching models, and teaching strategies, the aim is to enhance students' environmental design capabilities through effective instruction.
Skills	9	Students need to possess environmental design skills, including energy conservation, water conservation, material conservation, and the selection of eco-friendly materials, which are also key focuses of teaching and practice.
Industry	8	Focus on the demand and trends for environmentally friendly design in the interior design industry, as well as how students can adapt to the industry's development.
Enterprise	7	The requirements of enterprises for students' environmental protection capabilities and awareness during recruitment and actual work, as well as the importance of school-enterprise cooperation in student development.
Values	6	Cultivating students' correct environmental values so that they can transform personal environmental awareness into a sense of social and industry responsibility.

High-frequency words	Frequency	Analysis
Project	6	Through participation in practical projects, students are able to apply theoretical knowledge to practice, enhancing their environmental design capabilities.
Teacher	5	Teachers play a crucial role in teaching and guiding students, and they need to continuously update their knowledge and enhance their teaching abilities.
Resources	5	Including teaching resources and corporate resources, which play a significant supportive role in students' learning and practical application of environmental design.
Innovation	4	Encourage students to innovate in environmental design by proposing new solutions to adapt to the ever-changing environment and demands.
Market	4	The impact of market demand on environmentally friendly design, as well as the necessity for students to understand market trends in order to meet customer needs.
Training	3	Including teacher training and student training, the aim is to enhance the environmental design capabilities and awareness of the relevant personnel through training.
Standard	3	Students need to understand and master standards related to environmental design, such as green building design standards.
Cooperation	3	Collaboration between schools and enterprises, as well as interdisciplinary cooperation, is of significant importance for enhancing students' environmental design capabilities and achieving sustainable development goals.

In discussions within the field of interior design, sustainable design emerges as a core theme, highlighting its significance and high level of attention. Students, as the primary focus, are seen as key targets for the cultivation of environmental awareness and capabilities. To achieve this goal, the optimization and improvement of curriculum design, teaching content, and standards are crucial, as they bear the responsibility of imparting knowledge and skills related to environmental protection. Practical activities are regarded as an important means to enhance students' skills in environmentally friendly design; through hands-on experience and project involvement, students can better apply theoretical knowledge in practice, thereby promoting the implementation of environmentally friendly design.

Moreover, sustainable development, as a pursuit within the interior design industry, is closely related to environmentally friendly design and requires students to possess concepts and capabilities related to sustainability. In terms of knowledge and skills, students need to continuously enrich and update their understanding of environmental protection and theoretical knowledge, while mastering specific skills in environmentally friendly design, such as energy conservation, water conservation, and material conservation. These skills are essential for achieving environmentally friendly design and serve as a foundation for students to adapt to industry developments and meet industry requirements.

In terms of teaching, effective instruction that encompasses teaching methods, models, and strategies can enhance students' learning outcomes and capabilities in environmentally friendly design. Educators must continually improve their professional knowledge and teaching abilities to better guide students. Additionally, collaboration between schools and enterprises, as well as interdisciplinary cooperation, can integrate resources to provide students with richer learning and practical opportunities, thereby promoting the advancement of environmentally friendly design.

Furthermore, the cultivation of values is also crucial, as it encourages students to transform their personal environmental awareness into a sense of responsibility towards society and the industry. Through participation in practical

projects, students can accumulate experience, enhance their capabilities in environmentally friendly design, and achieve a combination of theory and practice. Teaching resources and enterprise resources provide support for students, helping them to better grasp environmentally friendly design. Understanding innovation and market trends is also an essential capability for students. Encouraging students to innovate in environmentally friendly design and propose new solutions is vital to adapt to the ever-changing environment and demands. At the same time, students need to be aware of market trends to meet client needs in their designs.

Finally, standards and collaboration are also critical elements that should not be overlooked. The standards for environmentally friendly design are essential for students to understand and master, as they help ensure compliance with regulations and achieve sustainable development goals. Collaboration between schools and enterprises, along with interdisciplinary cooperation, can provide students with broader platforms for learning and practice, facilitating the continuous progress and development of environmentally friendly design. In summary, these frequently mentioned themes collectively reflect the importance of environmentally friendly design in the field of interior design and the key factors in cultivating students' environmental awareness and capabilities, providing valuable references and guidance for professional education and industry development.

4.1.3.4 Coding Analysis Results

The interview primarily focused on the cultivation of environmental awareness among interior design students and their ability to address environmental design issues. It pointed out the current shortcomings in the theoretical content related to environmental awareness within the curriculum and emphasized the importance of interdisciplinary knowledge integration and the teaching of essential environmental theories. To ensure that students grasp cutting-edge environmental knowledge, various improvement measures were proposed, including the implementation of practical activities, enhancements in teaching methods, adjustments to curriculum standards, and effective management of study time. Additionally, the assessment of students'

comprehensive abilities was highlighted, guiding them to identify and solve environmental problems, while providing a learning scaffold to promote reflection and summarization. In terms of combining work with study, the challenges faced by students and the support strategies from teachers were clarified, alongside suggestions for successful teaching models and the application of real work scenarios to enhance students' sustainable design practice capabilities.

Table 14 Analysis Results

	Coding Theme	Subcode	Main Content
ESD	Knowledge and Skills	Current Course Content on Environmental Awareness Theory	The existing indoor design courses lack sufficient depth in environmental awareness theory and need to expand in breadth. Students are deficient in knowledge and practical abilities related to the selection and evaluation of environmentally friendly materials and processes, as well as lifecycle assessment and the application of sustainable design principles.
		Interdisciplinary Knowledge Integration	The knowledge of disciplines such as environmental science and sustainable development should be integrated into interior design courses through methods such as case studies, lectures, and workshops.

Coding Theme	Subcode	Main Content
Attitudes and Values	Important Environmental Protection Theoretical Knowledge	Knowledge of the 3F principles, 5R principles, energy and water conservation technologies, and the physical quality of indoor environments is very important for students, and theoretical knowledge should be integrated into practical projects.
	Ensure the forefront of environmental knowledge.	Schools need to ensure that students acquire the latest and most cutting-edge knowledge in environmental design through various means, including updating course content, hosting lectures, and participating in exhibitions.
	Practical Activities for Enhancing Environmental Design Skills	Various practical activities, such as campus renovations, community competitions, and corporate collaboration projects, can effectively enhance students' environmental design skills.
	Teaching Methods for Establishing Environmental Awareness and Values	Teaching methods such as case studies, simulation projects, discussions and debates, and literature readings can help students establish environmental awareness and values.
	Teaching Strategies to Transform Students' Environmental Awareness	Through engaging in real project practices, lectures, debates, and research topics, students are guided to transform their environmental awareness into a sense of social responsibility.

	Coding Theme	Subcode	Main Content
PBL	Corresponding to the curriculum standards	The Gap Between Curriculum Standards and Actual Teaching Content and Methods for Bridging It	There is a gap between the curriculum standards and the actual teaching content, which needs to be addressed through revising the standards, adjusting the teaching content, and strengthening cooperation between schools and enterprises.
	Manage Teaching Activities	Management and allocation of learning activity time	Adopting a modular and phased teaching approach, adjusting class hours flexibly, emphasizing the integration of theory and practice, and organizing group discussions are ways to manage time effectively.
	Assessing Student Learning	Standards for Assessing Students' Comprehensive Abilities	The evaluation criteria should encompass multiple dimensions, including theory, skills, attitudes, and values, and be conducted through various methods for a comprehensive assessment.
	Participation and Guidance	Methods and strategies for guiding students to discover and address environmental issues and achieve balance.	Teachers should collaboratively set goals with students, encourage independent exploration, provide appropriate freedom, create a cooperative learning environment, and introduce real-life scenarios.

	Coding Theme	Subcode	Main Content
	Building a Learning Scaffold	Methods and Adjustment Strategies for Building Learning Scaffolds for Students	Initially, cases are analyzed through concept maps and videos of project processes, or by directly visiting project sites to establish foundational frameworks. In the later stages, direct guidance is gradually reduced, while interdisciplinary integration is increased to promote student reflection and self-assessment.
	Review and Reflection	Methods for Reflecting on and Summarizing Students' Understanding of Environmental Design	Methods such as writing reflective reports, conducting comparative analyses, collecting feedback, and inviting expert reviews can enhance students' understanding of environmentally friendly design.
WII	Theory combined with practice	Challenges Faced by Students and Support Strategies from Teachers	Students face challenges such as insufficient technical skills and limited resources, and teachers can support them through strategies like training, providing resources, and encouraging collaboration.
		Effective Teaching Models and Methods and Their Application in Real Work Scenarios	Project-based learning, internships, and other teaching models, along with real work scenarios such as corporate collaboration projects, can enhance students' sustainable design practice abilities.

4.1.3.5 Main Findings and Analysis

1) Insufficient theoretical content on environmental awareness in the existing curriculum.

The existing indoor design courses lack depth in theoretical content related to environmental awareness, and the breadth of such content needs to be expanded. These courses tend to focus on design aesthetics and functional layout, while relatively little attention is given to environmentally friendly materials, energy-efficient design, and indoor environmental quality. Students have a weak understanding of the selection and evaluation of eco-friendly materials and processes, as well as lifecycle assessment (LCA), and their knowledge of the standards for green building design is not sufficiently in-depth.

2) The Necessity of Interdisciplinary Knowledge Integration.

Integrating knowledge from disciplines such as environmental science and sustainable development into interior design courses is crucial for enhancing students' environmental awareness. This integration can be achieved through case studies, thematic lectures, and interdisciplinary workshops. For example, establishing modules like "Green Building and Sustainable Design" and courses on "Indoor Air Quality and Health" combines theory with practice, training students to merge design with environmental responsibility.

3) Important Theoretical Knowledge in Environmental Protection.

The 3F principles (harmony with the environment, people-oriented, and dynamic development) and the 5R principles (Revalue, Renew, Reuse, Recycle, Reduce) along with energy-saving, water-saving, and material-saving technologies, as well as an understanding of the physical quality of indoor environments (such as air quality and thermal comfort), are essential theoretical knowledge for interior design students. Integrating green building evaluation systems, ecological materials science, and indoor environmental simulation software can enhance their depth of environmental knowledge, and these theoretical principles should be incorporated into practical

design projects. Through hands-on experience, students will gain a deeper understanding of the significance of environmentally-friendly design.

4) Suggestions for Ensuring the Cutting-Edge Nature of Environmental Design Knowledge.

Schools should regularly update their curricula and establish a dynamic course updating mechanism, inviting industry experts to participate to ensure the practicality of the courses. Regular lectures and workshops by industry experts should be held, encouraging subscriptions to professional journals and the use of online resources, as well as participation in international seminars and exhibitions. Continuous teacher training should be provided, alongside support for school-enterprise cooperation and field investigations.

5) Practical Activities to Enhance Environmental Design Skills.

Campus green renovation projects, community environmental design competitions, case studies in collaboration with environmental organizations, renovation projects for old buildings, international sustainable development exchange programs, public space design targeted at communities, rural sustainable development design projects, and zero-waste campus initiatives can all enhance students' environmental design skills. By participating in these projects, students can learn to assess building energy efficiency, select eco-friendly materials, design energy-saving solutions, and innovate under resource constraints, while fostering teamwork and a sense of social responsibility.

6) Teaching methods for establishing environmental awareness and values.

Methods such as case analysis, simulating real projects, interactive discussions and debates, recommending documentaries and relevant literature, as well as interdisciplinary collaborative learning can effectively help students develop environmental awareness and values.

7) Teaching strategies to guide students in transforming personal environmental awareness into a sense of social responsibility.

Engaging in social responsibility projects and community service, inviting experts in the environmental field for lectures and experience sharing, conducting debates and discussions on environmental themes, carrying out research topics and design projects, constructing detailed curriculum systems and practical frameworks, and collaborating with enterprises for internships are teaching strategies that can help students understand and assume their social responsibilities.

8) The gap between curriculum standards and actual teaching content, and methods to bridge this gap.

There currently exists a gap between curriculum standards and actual teaching content, primarily reflected in the insufficient breadth and depth of knowledge in environmental design, as well as the loose integration of theory and practice. To bridge this gap, it is necessary to revise and optimize curriculum standards, increase content related to environmental design, adjust teaching content in real-time, strengthen collaboration with enterprises and industry practices, and establish effective teaching assessment and feedback mechanisms.

9) Approaches to managing and allocating learning and activity time.

Employing modular teaching, the course content is divided into several modules, each focusing on a specific theme, ensuring depth of content and time management through theoretical learning, case analysis, and practical operations. The course is implemented in phases, categorized into foundational theory, case analysis, and practical operation stages, allowing for a gradual deepening of knowledge and skills. Flexibly adjusting class schedules based on students' learning progress and feedback ensures that teaching content and pace are timely adjusted, allowing for thorough exploration of each topic. Combining theory with practice, a reasonable ratio of theory to practice is arranged, enabling students to deepen their understanding through practical operations. Regularly organizing group discussions and collaborative learning activities promotes the deepening of knowledge and improvement of teamwork skills. After each module or phase, reflection, summary, and feedback are conducted to help students organize what they have learned and adjust teaching arrangements.

Integrating project-based learning allows students to complete projects related to environmental design within a specified time, enhancing their time management and project planning abilities.

10) Standards for Assessing Students' Comprehensive Abilities.

Designing comprehensive assessment criteria must cover multiple dimensions to ensure a holistic evaluation of students' theoretical knowledge, skills, attitudes and values, as well as their capability for sustainable design actions. In terms of theoretical knowledge, students' understanding and application of the fundamental theories of environmentally friendly design can be assessed through written exams, open-ended questions, and case studies. In assessing design skills, practical operation abilities, innovation, and sustainability can be evaluated through project assignments, design reports, and model production. Regarding attitudes and values, students' values and sense of responsibility towards environmentally friendly design can be measured through self-reflection reports, peer evaluations, and classroom participation. When evaluating students' sustainable design capabilities, real industry project participation can provide assessment opportunities. In these projects, students must collaborate with clients and professionals to clearly identify and solve actual environmental issues. Assessment may focus on the practical effectiveness of the solutions proposed by students in the projects, the extent of innovative environmental applications, feedback from clients and industry experts, as well as leadership and teamwork demonstrated during the project implementation process. This practice-oriented evaluation not only tests students' theories and skills but also provides deeper insights into their abilities to apply sustainable design principles in complex real-world environments. Comprehensive assessments are conducted through oral presentations, field visits, and final presentations with reviews carried out by a jury composed of teachers, industry experts, and fellow students to ensure fairness and diversity in evaluation. Continuous feedback and improvement are crucial; regular feedback and interim evaluations help students identify their strengths and weaknesses, guiding them toward necessary improvements.

11) Guide students in discovering and addressing environmental issues, as well as developing balancing strategies.

Collaborate with students to establish clear environmental protection goals and use guiding questions to help them deeply consider the environmental challenges within the project. Encourage students to conduct independent research and experiments, providing necessary resources and support to enhance their ability to conduct independent studies. During the design process, allow students sufficient freedom and creative space, avoiding excessive intervention, so they can explore independently and express their creativity. Through phased guidance and encouragement of independent decision-making, mentors should offer more suggestions in the early stages of the project, gradually reducing intervention to support students in completing their designs independently. Create a collaborative learning environment that fosters innovative thinking and problem-solving skills through teamwork and group discussions. Introduce real-world scenarios and projects, enabling students to apply their knowledge in practical situations and experience the process of solving actual environmental problems.

12) Methods and Adjustment Strategies for Building Learning Scaffolds for Students.

In the initial stages of instruction, concepts such as concept maps, case analyses, or direct on-site demonstrations in projects are employed to assist students in understanding complex environmental design concepts. Step-by-step teaching breaks down intricate concepts into simpler modules, facilitating a gradual mastery of fundamental skills in environmental design. As the course progresses, direct guidance is gradually reduced, shifting towards guiding questions that encourage students to engage in deeper exploration and independent learning through challenging tasks. Interdisciplinary integration is enhanced by introducing open-ended topics and projects, motivating students to conduct independent research and design comprehensive environmental solutions. The complexity of the scaffolds is dynamically adjusted based on learning feedback, providing additional support to promote student

reflection and self-assessment, helping them recognize their learning progress and shortcomings, thereby fostering their ability for independent thinking and innovative design.

13) Methods for Reflecting on and Summarizing Students' Understanding of Environmental Design.

Write personal reflection reports that analyze design decisions and their effects in depth, enhancing self-reflection on personal philosophies and practices. Conduct comparative analyses by comparing the project with similar designs to explore the environmental pros and cons of various design strategies. Gather feedback from simulated users or community members to understand the environmental performance and social impact of the design in real-world applications. Invite multidisciplinary experts to participate in reviews, providing feedback from multiple perspectives, which aids students in balancing aesthetics, functionality, and sustainability in environmental design.

14) Challenges Faced by Students and Support Strategies from Teachers.

Students may encounter challenges such as insufficient technical skills, limited resources, and difficulties in applying real project issues while integrating work and study. Teachers can assist students in overcoming these challenges through strategies such as enhancing technical training, establishing resource-sharing platforms, encouraging interdisciplinary collaboration and mentorship, and providing opportunities for practical experience with real projects.

Successful teaching models and methods, and the application of real work scenarios.

Teaching models such as project-based learning, thematic seminars, internships and practical training, and blended learning can help students apply the environmental knowledge and design skills acquired in the classroom to real work situations. Introducing real work scenarios, such as corporate environmental design projects, collaboration with environmental organizations, participation in green building

certification, or campus environmental projects, can enhance students' sustainable design practice capabilities.

In summary, to enhance the environmental awareness of undergraduate students in interior design in Chengdu, comprehensive improvements and optimizations are needed in curriculum design, teaching methods, practical activities, and assessment standards. It is essential to strengthen interdisciplinary knowledge integration, emphasize the combination of theory and practice, and cultivate students' innovative abilities and sense of social responsibility.

4.1.3.6 Conclusion and Recommendations

Through an in-depth analysis of six interviews, it can be observed that the current interior design curriculum lacks depth and breadth in the theoretical content related to environmental awareness, and students lack relevant knowledge and skills in this area. Integrating interdisciplinary knowledge, introducing important environmental theories and enhancing practical applications, ensuring the cutting-edge nature of knowledge, conducting a variety of practical activities, employing effective teaching methods, refining curriculum standards and teaching content, managing teaching activities and time effectively, establishing comprehensive assessment criteria for student capabilities, guiding students to identify and solve environmental issues, providing suitable learning scaffolding, emphasizing reflection and summarization, assisting students in overcoming the challenges of integrating work with study, and adopting successful teaching models while incorporating real work scenarios are all crucial for enhancing students' environmental awareness and improving their sustainable design practice capabilities.

In the future, efforts and improvements are needed in the following areas: First, curriculum optimization should further enhance the interior design curriculum system by increasing the depth and breadth of environmental awareness theory content, integrating interdisciplinary knowledge such as environmental science and sustainable development. It is essential to update course content in a timely manner to ensure that students learn the latest and most advanced knowledge and techniques

in environmentally conscious design. Second, innovation in teaching methods should involve diverse approaches such as case analysis, simulating real projects, interactive discussions, and debates to stimulate students' interest and initiative in learning. Strengthening practical teaching through internships, project design, and competitions can improve students' environmental design skills and practical abilities. Third, strengthening school-enterprise cooperation is necessary to deepen partnerships and establish long-term stable relationships that provide students with more internship and practical opportunities. Enterprises should actively participate in the school's curriculum design and teaching activities, offering real project cases and industry experience to help students better understand market demands and industry trends. Fourth, teacher training should be enhanced to improve teachers' knowledge of environmental design and teaching levels, enabling them to better guide students in learning and practice. Encouraging teachers to engage in research projects and industry exchange activities will continuously update teaching content and methods. Fifth, students should enhance their environmental awareness, proactively learn environmental knowledge and skills, and improve their overall competencies. They should cultivate innovative thinking and problem-solving abilities, continuously accumulate experience in practice, and prepare for future career development.

Looking to the future, as people's awareness of environmental protection continues to rise, the interior design industry will place greater emphasis on eco-friendly design and pursue sustainable development. The integration of smart technology and sustainable practices will become a significant trend in future interior design, with the application of smart lighting and temperature control systems enhancing energy efficiency and user comfort. Designers will pay more attention to the selection of materials and processes, promoting the use of recyclable and renewable materials to reduce resource consumption and waste generation. The quality of the indoor environment will become a focal point in design, with designers committed to creating healthy and comfortable living and working spaces. Designers will collaborate closely with engineers, environmental scientists, and other professionals to develop innovative

eco-friendly solutions. As society's concern for environmental issues continues to grow, the environmental awareness and capabilities of interior design students will become an important demand for the industry's development. Through the joint efforts of all parties and continuous improvement of teaching models, it is believed that more outstanding interior design talents with environmental awareness and capabilities can be cultivated, contributing to the achievement of sustainable development goals. At the same time, the interior design industry will also move towards a more eco-friendly, intelligent, healthy, and sustainable direction.

4.2 To develop the teaching model of interior design to enhance environmental awareness(Draft)

A comprehensive analysis of the current environmental awareness and needs of undergraduate interior design students in Chengdu provides a foundation for developing a design teaching model. Based on this document, a teaching model aimed at enhancing the environmental awareness of undergraduate students in the interior design profession (SDCM) has been ultimately formed.

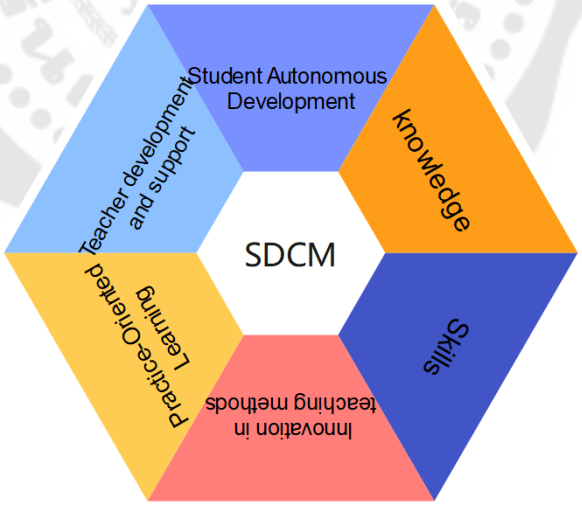


Figure 2 Teaching Model to Enhance Environmental Awareness Among Undergraduate Students in Interior Design(SDCM)

This study proposes a multidimensional Sustainable Design Competence Model (SDCM) to comprehensively assess key elements in educational practices and promote the holistic development of students. The framework includes six core dimensions: a focus on the foundational knowledge that students must master, laying a solid groundwork for their practice and innovation. It emphasizes the cultivation of practical skills, enabling students to apply theory to solve real-world problems. Furthermore, the framework advocates for teachers to adopt innovative teaching methods to inspire students' creativity. It also highlights practice-oriented learning, providing students with authentic work environment experiences through school-enterprise collaboration. Teacher development and support are also crucial components of the framework, aimed at enhancing teachers' professional competence through regular training and participation in research activities. The framework encourages students' autonomous development, supporting them in achieving self-improvement and innovation through personalized learning pathways.

4.2.1 Knowledge

Figure 3 Composition of Knowledge

Table 15 Knowledge Composition Table

Dimension	Sub-dimension	Main Content
Knowledge	Current Course Content on Environmental Awareness Theory	The existing indoor design courses lack sufficient depth in the theoretical content related to environmental awareness, and the breadth of this content needs to be expanded. It is essential to increase the theoretical content on environmental awareness within the curriculum to enhance students' understanding and application of the fundamental concepts and principles of environmentally friendly design.
	Interdisciplinary knowledge such as environmental science and sustainable development	Integrating knowledge from disciplines such as environmental science and sustainable development into interior design courses is achieved through case studies, lectures, and workshops, thereby enhancing students' comprehensive and diverse theoretical understanding of environmental protection.
	Update the course content to include the latest knowledge and technologies in environmentally friendly design.	Update the course content to include the latest knowledge and technologies in environmentally friendly design, ensuring that students master cutting-edge knowledge and skills.

The existing indoor design courses need to enhance both the depth and breadth of their theoretical content on environmental awareness. To address this issue, it is essential to increase the theoretical content related to environmental awareness within the curriculum, systematically explaining and analyzing the fundamental concepts and principles of environmentally friendly design. This approach will enable students to understand these concepts within a broader academic context and reinforce their understanding of these principles through practical application cases. Such enriched course content will help students consciously apply environmentally friendly design principles in their design practices, cultivating designers who possess both theoretical depth and practical ability.

To further enhance students' capabilities in environmentally friendly design, interdisciplinary knowledge such as environmental science and sustainable development should be integrated into the indoor design curriculum. This integration can be achieved through various methods, including case studies, lectures, and workshops, helping students establish a comprehensive and diverse theoretical knowledge structure related to environmental protection. By engaging in communication and interaction with experts in the fields of environmental science and sustainable development, students can improve their practical application of interdisciplinary knowledge, stimulate innovation, and adopt more sustainable solutions in their designs, thereby enhancing their overall problem-solving abilities.

As the field of environmentally friendly design continues to evolve, it is crucial to update course content to encompass the latest knowledge and technologies in this area to maintain students' competitiveness. The curriculum should dynamically reflect current industry trends and technological advancements, ensuring that students acquire the most up-to-date knowledge by introducing the latest design concepts and innovative technologies. This strategy for course updates not only enhances the modernity and practicality of the curriculum but also ensures that students can adapt flexibly to the rapidly changing industry environment, becoming creative and technically forward-thinking professionals.

4.2.2 Skills

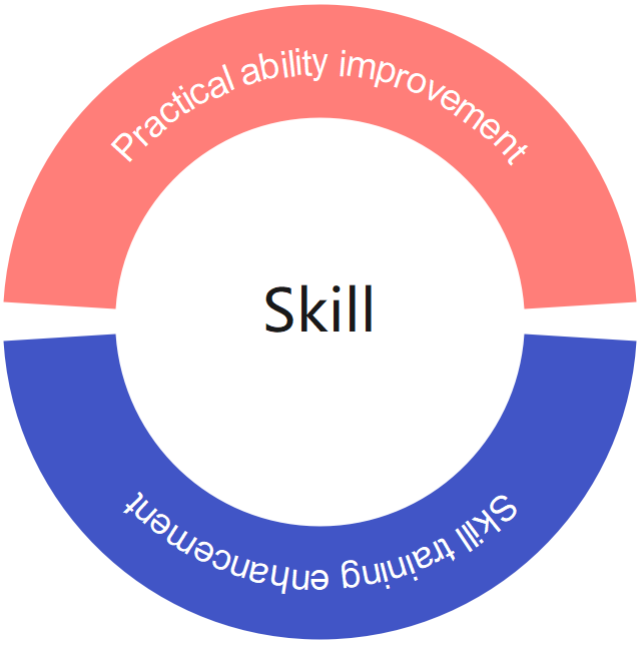


Figure 4 Composition of Skill

Table 16 Skills Composition Table

Dimension	Sub-dimension	Main Content
Skill	Enhancement of Practical Skills	Integrate the concepts of 3F (environmentally harmonious, people-oriented, dynamic development) and 5R (Revalue, Renew, Reuse, Recycle, Reduce) along with energy-saving, water-saving, and material-saving environmental protection measures directly into the curriculum. By continuously practicing these principles within the course, students will be able to apply environmental theory knowledge in project design, thereby enhancing their practical skills.
	Skills Training Enhancement	Implement systematic skills training, including project training, competition activities, case studies, simulated projects, workshops, skills training courses, as well as regular assessments and feedback to enhance students' application abilities in practical design.

The goal of enhancing practical abilities is to enable students to grasp and apply the core principles and measures of environmentally friendly design through strengthened practical teaching. In the course design, the concepts of 3F (environmentally harmonious, human-centered, dynamic development) and 5R (Revalue, Renew, Reuse, Recycle, Reduce), along with energy-saving, water-saving, and material-saving measures, are directly integrated into the curriculum. Through continual practice of these principles in the courses, students can apply theoretical knowledge in real-life environments. During the design of course projects, the implementation details of these environmentally friendly design principles are clearly outlined, allowing students to directly participate in the design and implementation process. This approach not only aids students in theoretically understanding the importance of environmentally friendly design but also fosters their ability to apply these principles in actual projects through hands-on practice, thereby enhancing their skills in environmental design.

The goal of skill training is to broaden and deepen students' capabilities in applying their knowledge to practical design through a series of systematic activities and continuous assessments. Project training and competition activities provide students with opportunities to engage in project design and design competitions, helping them accumulate practical experience and stimulate innovation. Through detailed case studies and simulated project operations, students can understand the challenges and solution strategies present in specific scenarios. Workshops and skill training courses offer opportunities for in-depth learning of new technologies and trends, assisting students in continually updating their knowledge base. Regular evaluation and feedback mechanisms ensure that students can identify shortcomings in their learning and improve their application abilities by adjusting their learning strategies. This systematic training and evaluation method provides students with a comprehensive and in-depth learning platform, enabling them to flexibly apply their skills in diverse design

contexts and meet the demands and challenges of the modern field of environmental design.

4.2.3 Innovation in Teaching Methods

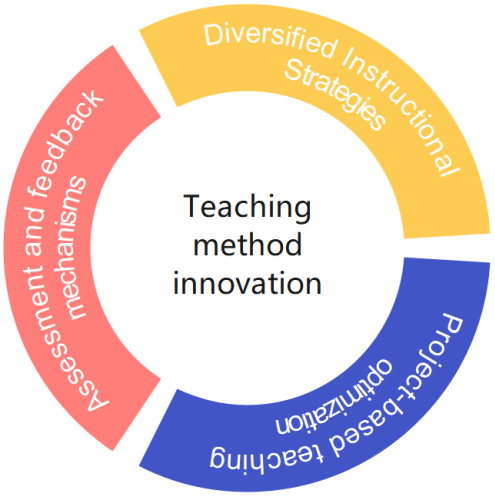


Figure 5 Innovative Teaching Methodology Diagram

Table 17 Table of Components for Innovative Teaching Methods

Dimension	Sub-dimension	Main Content
Innovation in Teaching Methods	Diverse Teaching Strategies	Through methods such as case analysis, simulated projects, interactive discussions, and debates, teachers play a guiding and inspiring role in the process, encouraging students to actively participate and engage.
		Provide various learning and support strategies to help students acquire the necessary skills and information at different stages.
	Project Teaching Optimization	Ensure that the teaching content is consistent with national and local standards.
		Reasonably arrange activities to ensure a systematic grasp of concepts, involving the design and implementation of overall teaching activities, reflecting the requirement to connect teaching activities to learning objectives and standards.
	Evaluation and Feedback Mechanism	By establishing continuous assessments of students' learning progress, we ensure alignment between their learning experiences and market demands.
		Utilize feedback to promote reflection among students and teachers, adjust teaching content and methods, and continuously improve the processes of learning and instruction.

In terms of teaching methods, there is an emphasis on diverse approaches such as case analysis, simulated projects, interactive discussions, and debates. Teachers play a crucial role in guiding and inspiring students in the classroom. These methods not only enrich the classroom experience but also stimulate active participation and interaction among students, promoting the development of deep learning and critical thinking. In case analysis, teachers guide students to apply theoretical knowledge to real-world problem-solving through authentic or simulated scenarios, cultivating their analytical abilities and decision-making skills. Simulated projects provide a practical platform for students, with teachers acting as facilitators, helping students apply what they have learned in a near-real environment, thereby enhancing teamwork and project management skills. Interactive discussions and debates encourage students to express their viewpoints, share insights, and engage in critical thinking through open-ended questions and group exchanges, improving their communication skills and fostering an open mindset. Through these methods, teachers not only enrich the teaching content but also provide students with a diverse learning experience, aiding their comprehensive development in knowledge, skills, and attitudes, and becoming an important driving force for students' growth and success.

Providing comprehensive learning and support strategies for students is key to ensuring their success. These strategies should encompass all stages of learning, from introductory to advanced levels, ensuring that students acquire the necessary skills and information throughout their educational journey. Firstly, curriculum design should include a solid foundation of basic knowledge to help students establish a strong theoretical base. This can be achieved by introducing foundational courses, online resources, and self-study materials, allowing students to grasp fundamental concepts and principles at their own pace.Secondly, at the intermediate stage, teaching should focus on practical application, utilizing project-based learning and real case analyses to help students translate theoretical knowledge into practical skills. This practice-oriented approach not only enhances students' hands-on abilities but also strengthens their capacity to solve real-world problems. At the advanced stage, support strategies should

become more personalized and specialized, offering opportunities such as mentorship, industry internships, and research projects to help students delve into the complex issues of sustainable design. Through interactions with industry experts and academic mentors, students can receive valuable feedback and guidance, further enhancing their professional skills and innovative thinking. Additionally, schools should provide career development support, including career planning, job search skills training, and alumni networks, to assist students in smoothly transitioning into their careers after graduation. In summary, comprehensive learning and support strategies not only help students acquire the necessary skills and information at various stages of their education but also lay a solid foundation for their long-term development in the field of sustainable design.

In the educational process, ensuring that the teaching content aligns with national and local standards is fundamental to enhancing teaching quality and student learning outcomes. This consistency not only guarantees the legitimacy and normative nature of the curriculum but also ensures that the knowledge and skills acquired by students meet societal and industry expectations. Curriculum design should strictly adhere to national and local educational standards to ensure the scientific and systematic nature of the teaching content. When designing the curriculum, teachers should carefully study relevant standard documents to clarify the specific requirements and objectives for each learning stage. This standardized curriculum design helps students gradually accumulate knowledge during the learning process, forming a systematic understanding and capability. Furthermore, teachers should regularly update the curriculum content to reflect the latest standards and industry developments. This can be achieved through participation in professional development training, communication with peers, and involvement in educational seminars. By continuously updating the curriculum content, teachers can ensure that students acquire the most current knowledge and skills, maintaining their competitiveness in both academic and professional realms. Finally, schools and educational institutions should establish effective supervision and evaluation mechanisms to ensure that the implementation of teaching content meets standard requirements. Such mechanisms may include regular

curriculum assessments, teaching quality checks, and the collection of student feedback, helping to identify and address issues in teaching.

A well-organized arrangement of teaching activities is an important strategy to ensure that students systematically grasp key concepts. During the design and implementation of teaching activities, teachers should closely align activities with learning objectives and standards to ensure that each activity effectively supports student learning. First, teachers should design a variety of teaching activities based on learning objectives, such as group discussions, project-based practices, experimental operations, and case analyses. These activities should have clear goals and expected outcomes, helping students apply the knowledge they have learned in practice and deepen their understanding of concepts.Second, the arrangement of activities should consider students' learning progress and individual differences, providing appropriate challenges and support. Teachers can ensure that each student can learn and grow at their own pace through differentiated instruction, personalized guidance, and varied assignments. Finally, teachers should reflect and summarize after the activities conclude, helping students consolidate what they have learned and transform their experiences into long-term memory. This reflection can be achieved through classroom discussions, learning journals, and self-assessments, promoting deep learning and continuous progress among students.In summary, by ensuring that teaching content aligns with standards and organizing teaching activities effectively, teachers can support students' systematic learning. This approach not only enhances the effectiveness of teaching but also lays a solid foundation for students' overall development and future success.

By establishing a continuous assessment mechanism, educational institutions can effectively monitor students' learning progress and ensure that their learning experiences align with market demands. This mechanism should include a variety of assessment methods, such as regular quizzes, project evaluations, presentations of work, self-assessments, peer evaluations, teacher assessments, evaluations by industry experts, and client assessments, to comprehensively reflect students' learning

outcomes. Through these diverse assessment methods, teachers can obtain performance data on students across different areas, allowing for a more accurate identification of their learning progress and areas needing improvement. Furthermore, the assessment mechanism should be closely aligned with market demands by collaborating with industry experts to regularly update assessment standards and content, ensuring that the knowledge and skills students acquire meet the current practical needs of the market. This alignment with market demands not only enhances students' employability but also ensures that they can quickly adapt to professional environments after graduation. The continuous assessment mechanism not only aids students in making ongoing progress in sustainable design learning but also provides solid support for their academic and professional success, promoting the enhancement of educational quality and the holistic development of students. This mechanism lays a strong foundation for cultivating students' comprehensive abilities in sustainable design, ensuring they can effectively address the challenges of sustainable development in their future careers.

Utilizing feedback to promote reflection among students and teachers is an important strategy for enhancing teaching quality and learning outcomes. Through a systematic feedback mechanism, both students and teachers can continuously engage in self-assessment and adjustment throughout the teaching process, thereby achieving ongoing improvements in teaching content and methods. Firstly, feedback should be viewed as a two-way communication process. While students receive feedback from teachers, they should also be encouraged to provide feedback on course content, teaching methods, and their learning experiences. This two-way feedback mechanism not only helps teachers understand students' learning needs and difficulties but also provides them with valuable perspectives to make corresponding adjustments in their teaching. Secondly, teachers should utilize feedback information for in-depth reflection to identify shortcomings in the teaching process. This reflection can be conducted through regular teaching seminars, peer evaluations, and self-assessments. By analyzing student feedback, teachers can discover which teaching methods are most

effective and which content requires further explanation or adjustment, thus optimizing their teaching strategies. In terms of adjusting teaching content and methods, teachers can introduce new teaching resources, adjust the pace of the course, or adopt different teaching techniques based on feedback information. For example, if students indicate that a particular topic is difficult to understand, teachers might consider adding relevant case studies or practical activities to help students better grasp the subject. Moreover, feedback can also facilitate students' self-reflection, helping them identify shortcomings in their learning habits and strategies. Through reflection, students can adjust their learning methods, set clearer learning goals, and become more proactive and self-disciplined in their learning process. In summary, utilizing feedback to promote reflection and adjustment is a dynamic and ongoing process. Through continuous reflection and adjustment, both teachers and students can make progress in their learning and teaching processes, ultimately achieving higher educational quality and better learning outcomes. This culture of continuous improvement not only enhances the effectiveness of teaching but also provides a solid foundation for the holistic development of students.

4.2.4 Practice-Oriented Learning

Table 18 Components of Practice-Oriented Learning

Dimension	Sub-dimension	Main Content
Practice-Oriented Learning	Collaboration between Schools and Enterprises and the Integration of Practice	By establishing long-term and stable partnerships between schools and enterprises, opportunities for students to engage in real work projects can be increased. Enterprises should actively participate in curriculum design, providing authentic industry cases that allow students to observe, learn, and engage with cutting-edge technologies and real-world issues. Integrating projects that combine theory and practice into the curriculum enhances students' ability to apply knowledge in real work environments, particularly in solving complex and diverse problems, while fostering their innovative thinking and sustainable design capabilities.

Practice-oriented learning emphasizes the integration of academic knowledge with practical work experience, where collaboration between schools and enterprises is a core strategy to achieve this goal. By establishing solid partnerships with businesses, schools and enterprises jointly provide students with opportunities to engage in real work projects, enhancing their practical experience and allowing them to directly encounter cutting-edge industry technologies and real-world challenges. In this process, enterprises not only actively participate in curriculum design but also provide authentic industry cases, giving students the chance to engage in observational learning and hands-on practice. The curriculum incorporates projects that blend theory and practice, aiming to enhance students' ability to apply classroom knowledge in real work environments. This collaborative model particularly emphasizes cultivating students' innovative thinking and sustainable design capabilities when addressing complex and diverse problems, laying a solid foundation for their future careers.

In real projects, students can deeply learn about every aspect and process of the project, rather than merely skimming the surface with project presentations or simple case analyses. By participating in actual projects, students experience the complete process from project planning, design, implementation to evaluation, understanding the specific requirements and challenges of each stage. This deep involvement not only helps students master professional skills but also fosters their critical thinking and problem-solving abilities, especially in the application of sustainable design. Participation in real projects also enhances students' communication skills and teamwork spirit, which are essential qualities in the modern workplace. Through this practice-oriented teaching model, students can apply and deepen their acquired knowledge in real work environments, particularly in the fields of environmental protection and sustainable design. The close collaboration between schools and enterprises provides students with valuable professional networks and employment opportunities, aiding their smooth transition into the workforce after graduation. Through continuous feedback and evaluation mechanisms, schools and enterprises can continually optimize their collaborative model, ensuring that educational content remains

aligned with industry demands, thereby cultivating more competitive professionals, particularly in sustainable design capabilities.

4.2.5 Teacher Development and Support

Table 19 Components of Practice-Oriented Learning

Dimension	Sub-dimension	Main Content
Teacher Development and Support	Teacher Training Program	Enhance teachers' knowledge of environmental design and teaching standards through regular training. Encourage teachers to participate in research and industry exchanges to ensure the curriculum remains cutting-edge and practical.

Teacher development and support enhance educators' expertise and teaching skills in the field of environmental design through regular training activities. While improving their teaching standards, it also encourages teachers to engage in scientific research and industry exchanges, ensuring that the course content they deliver keeps pace with the latest industry trends, maintaining its relevance and practicality. Through this ongoing professional development model, teachers can continuously update their teaching methods and course materials to adapt to the rapidly changing educational demands and environmental challenges. This form of support is crucial for fostering teachers' professional growth and enhancing their ability to address the challenges of modern education.

4.2.6 Student Autonomous Development

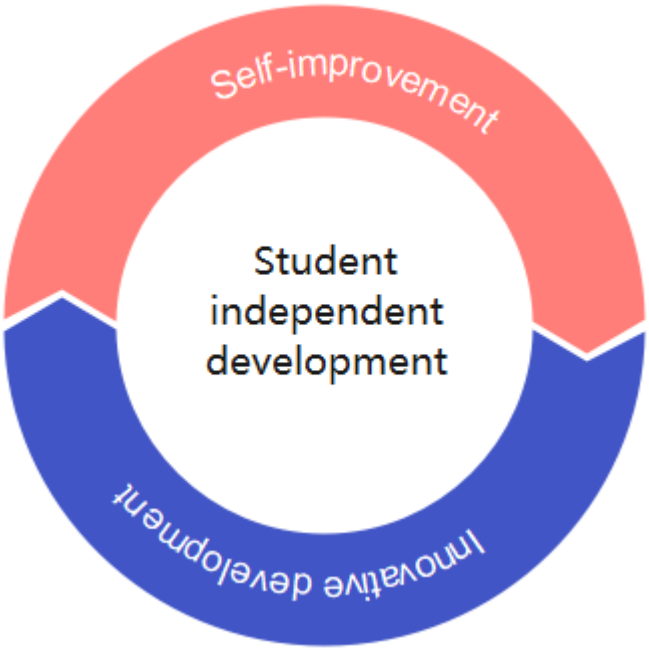


Figure 6 Diagram of Student Autonomous Development

Table 20 Components of Practice-Oriented Learning

Dimension	Sub-dimension	Main Content
Student Autonomous Development	Self-improvement	Encourage students to enhance their problem-solving abilities through self-directed learning and exploration. Provide open-ended learning tasks and customized mentoring programs to assist students in achieving personalized learning goals, while accumulating experience in practice and improving their overall competencies.
	Innovative Development	Cultivate students' innovative thinking by enhancing their creativity and adaptability in environmental design through participation in practical projects and research opportunities. Support students in proposing novel solutions within diverse practices, encouraging their in-depth exploration of innovation in both academic and practical fields.

Student autonomous development is a core objective in the educational process, aimed at promoting self-improvement and innovative growth among students. This is particularly significant in enhancing the environmental awareness of undergraduate students in the Chengdu Interior Design program. In terms of self-improvement, students are encouraged to enhance their problem-solving abilities through independent learning and exploration. To support this, open-ended learning tasks and customized mentoring programs are provided to help students achieve personalized learning goals. This approach not only assists students in accumulating practical experience but also enhances their overall competencies, enabling them to better tackle challenges in the field of environmental design.

Regarding innovative development, the focus is on cultivating students' innovative thinking, especially in sustainable design and environmental awareness. By involving students in real projects and research opportunities, their creativity and adaptability in the field of environmental design are strengthened. This involvement extends beyond classroom learning to include collaborations with enterprises and community service activities, allowing students to apply their knowledge in real-world contexts and explore innovative solutions. Encouraging in-depth exploration in academic fields also lays a foundation for their future success in practical applications. Through this approach, student autonomous development is effectively promoted, establishing a solid foundation for their future careers and personal growth. This teaching model not only enhances students' professional capabilities but also fosters their environmental awareness and sense of social responsibility, preparing them to become active advocates for sustainable development in their future careers.

4.3 To confirm the model of interior design to enhance environmental awareness

During a focus group discussion aimed at evaluating the appropriateness and feasibility of certifying a newly developed teaching model designed to enhance environmental awareness among interior design students, a total of six assessment experts participated. These included two scholars engaged in the development of art and design education models and the field of art education, two teachers specializing in

best practices in interior design, and two practitioners with practical experience in sustainable design within the realm of interior design.

The model involves the development of six dimensions that vary based on research findings. Within this model, there should be six core dimensions: knowledge, skills, innovative teaching methods, practice-oriented learning, teacher development and support, and student autonomous development. The appropriateness and feasibility of the assessment model are based on findings from the fourth phase of the research.

Table 21 Assessment of Suitability and Feasibility for Certification Models.

	Applicability			Feasibility		
	Mean	SD	Percentage	Mean	SD	Percentage
General Model	5.00	0	100.00%	4.83	0.41	96.67%
Model Name	5.00	0	100.00%	4.83	0.41	96.67%
Knowledge	4.33	0.52	86.67%	4.67	0.52	93.33%
Skills	4.67	0.52	93.33%	4.67	0.52	93.33%
Innovative Teaching Methods	4.67	0.52	93.33%	4.67	0.52	93.33%
Teacher Development and Support	4.83	0.41	96.67%	4.67	0.52	93.33%
Practice-Oriented Learning	5.00	0	100.00%	5.00	0	100.00%
Student Autonomous Development	4.83	0.41	96.67%	4.67	0.52	93.33%

According to a comprehensive evaluation by experts on the applicability of the model, it was found that applicability reached a level as high as 100% (x = 5.00, standard deviation = 0), and feasibility assessment reached 97% (x = 4.83, standard deviation = 0.41). When considering various dimensions, the results are as follows: 1) The suitability and feasibility of the model name both reached 100% (x = 5.00, standard deviation = 0) and 97% (x = 4.83, standard deviation = 0.41), respectively; 2) Regarding knowledge related to environmentally friendly design, suitability and feasibility reached 87% (x = 4.33, standard deviation = 0.52) and 93% (x = 4.67, standard deviation = 0.52), respectively; 3) In terms of environmental design skills, both suitability and

feasibility reached 93% (x = 4.67, standard deviation = 0.52); 4) Regarding innovative teaching methods, both suitability and feasibility reached 93% (x = 4.67, standard deviation = 0.52); 5) Practice-oriented learning achieved the highest level, with both suitability and feasibility reaching 100% (x = 5.00, standard deviation = 0); 6) In the area of teacher development and support, suitability and feasibility reached 97% (x = 4.83, standard deviation = 0.41) and 93% (x = 4.67, standard deviation = 0.52), respectively; 7) In terms of student self-development, suitability reached 97% (x = 4.83, standard deviation = 0.41), and feasibility reached 93% (x = 4.67, standard deviation = 0.52).

In response to additional suggestions regarding applicability and feasibility, six experts provided the following insights:

1) Regarding the applicability and feasibility of the model name, the experts believe the name is already quite appropriate, as it is both concise and easy to understand, clearly conveying the model's objectives.

2) Concerning the applicability and feasibility of the model development, senior experts suggested clearly defining each model to facilitate user understanding, incorporating essential content of each dimension's model into the formatting guidelines, enabling both users and recipients to easily comprehend the document's contents.

3) In the dimension of teacher development and support, Professor Luo Xue suggested enhancing knowledge exchange and collaboration among teachers, which would further improve overall teaching capacity.

4) In the knowledge dimension, sustainable design expert Zhao Shiguang emphasized the need for timely updates to theoretical knowledge to align with industry standards and to implement environmental knowledge annually based on the latest national environmental protection standards. These components complement each other, forming a crucial foundation for providing comprehensive support in the field of sustainable development education.

5) Regarding the dimension of student autonomous development, Professor Peng Huaji proposed integrating sustainable projects from schools and communities to

offer students more practical and display platforms, thereby enhancing their initiative and sense of achievement in learning.

6) In the dimension of practice-oriented learning, both experts Huang Yalàng and Chen Fangfang cautioned that deep cooperation with businesses may encounter challenges due to differing interests, necessitating the exploration of harmonious cooperation models.

Therefore, a comprehensive teaching model for developing environmental awareness among undergraduate students in the field of interior design can be summarized, consisting of the following five important components.

4.3.1 Model Name

"Teaching Model for Enhancing Environmental Awareness among Undergraduate Students in Interior Design"

4.3.2 Principles and Importance

In the process of globalization, environmental issues have become a common challenge faced by countries worldwide. Rapid economic development has led to excessive resource extraction and irrational energy use, resulting in problems such as climate change, ecological destruction, and resource depletion. The international community is highly concerned about sustainable development, prompting the United Nations to adopt 17 Sustainable Development Goals in 2015, which include environmental and climate protection. China has elevated ecological and environmental protection to a national strategy, implementing a series of policy measures to practice the concept that "lucid waters and lush mountains are invaluable assets," aiming to achieve sustainable development. The global consensus on the importance of environmental protection is continuously strengthening, and Education for Sustainable Development (ESD) has become a focal point of international attention. Environmental awareness is crucial for addressing environmental problems, encompassing knowledge, values, and attitudes related to environmental protection, which can effectively promote the formation of environmentally friendly behaviors.

In this context, the importance of interior design education is increasingly prominent. Interior design not only pertains to the built environment and aesthetic effects but also involves material selection and energy consumption, factors that have a profound impact on environmental sustainability. Traditional interior design has overly emphasized aesthetics while neglecting ecological protection. However, as society's focus on environmental sustainability increases, designers are expected to possess the ability to formulate sustainable solutions. Higher education institutions must cultivate students' environmental awareness, enabling them to understand the long-term impacts of professional decisions on the environment and develop the ability to integrate environmental sustainability theory with practice, thereby nurturing high-quality professionals with a sense of environmental responsibility and sustainable design capabilities.

The traditional teaching model of interior design has failed to effectively incorporate environmental awareness, resulting in students facing difficulties in practical applications and lacking the theoretical knowledge and problem-solving abilities related to environmental protection. To address the disconnect between education and industry, the Chinese government has recently promoted the integration of industry and education as well as school-enterprise cooperation through a series of policies, aiming to enhance students' environmental awareness and sustainable design capabilities, so they can apply the theories learned in real enterprise projects. This teaching model helps students better adapt to future industry demands and promotes sustainable development in the field of interior design.

This study analyzes the current situation and needs regarding the cultivation of environmental awareness in undergraduate interior design programs in Chengdu, identifying problems and deficiencies to provide a basis for improving teaching models. Based on Education for Sustainable Development, and integrating the conceptual frameworks of Work-Integrated Learning (WIL) and Problem-Based Learning (PBL), a new perspective for interior design education is offered. The new model emphasizes project practice, combining theory with practice, and work with learning, allowing

students to learn by doing and apply environmental concepts to real projects, thereby cultivating their genuine ability to address environmental issues. Assessing the feasibility of the new model provides empirical support for sustainable development education in interior design programs in Chengdu and across the country. This research not only cultivates high-quality talents with environmental awareness but also promotes the transformation of the interior design industry towards sustainable development, contributing to the achievement of sustainable development goals, and holds significant practical significance and historical value.

4.3.3 Goals of the Teaching Model for Enhancing Environmental Awareness Among Undergraduate Students in Interior Design

The aim is to enhance the environmental awareness of undergraduate students in the Interior Design program by integrating theoretical knowledge of environmental protection, fostering values and attitudes towards sustainability, applying theory to practice, and improving their capacity for sustainable design behaviors to promote the advancement of sustainable goals.

4.3.4 Composition of the Model

The environmental awareness of undergraduate students in interior design at Chengdu should encompass six core dimensions: knowledge, skills, innovative teaching methods, practice-oriented learning, teacher development and support, and student autonomous development. Each of these aspects has its own characteristics and aims to integrate theoretical knowledge of environmental protection, attitudes and values, and the application of theory into practice, thereby enhancing the capability for sustainable design behavior.

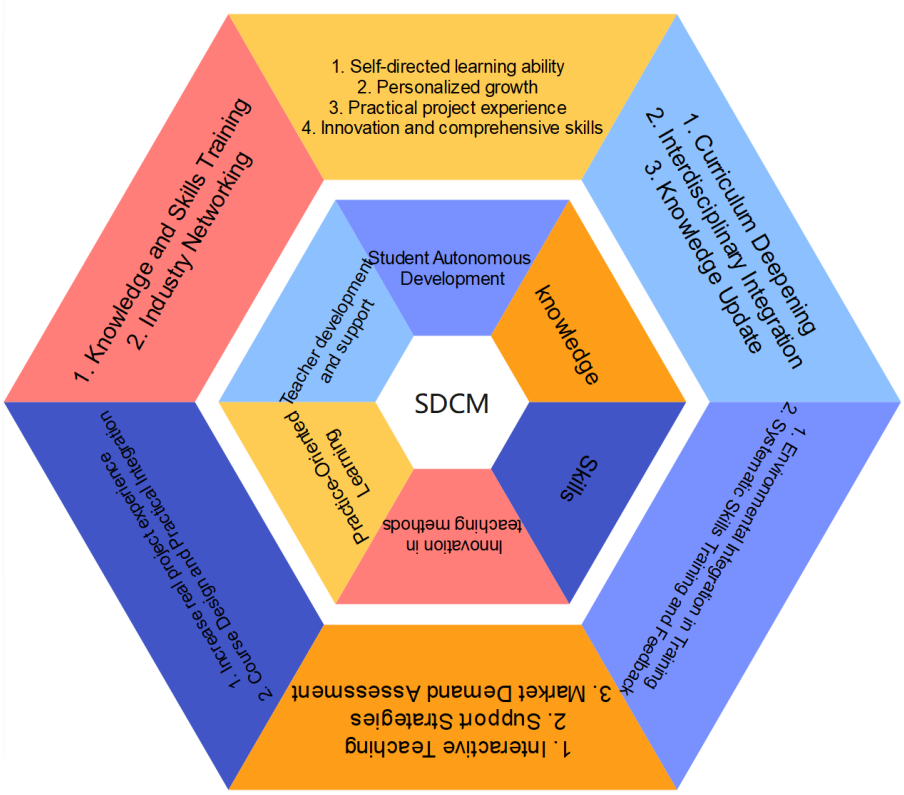


Figure 7 Teaching Model to Enhance Environmental Awareness Among Undergraduate Students in Interior Design(SDCM)

4.3.4.1 Knowledge

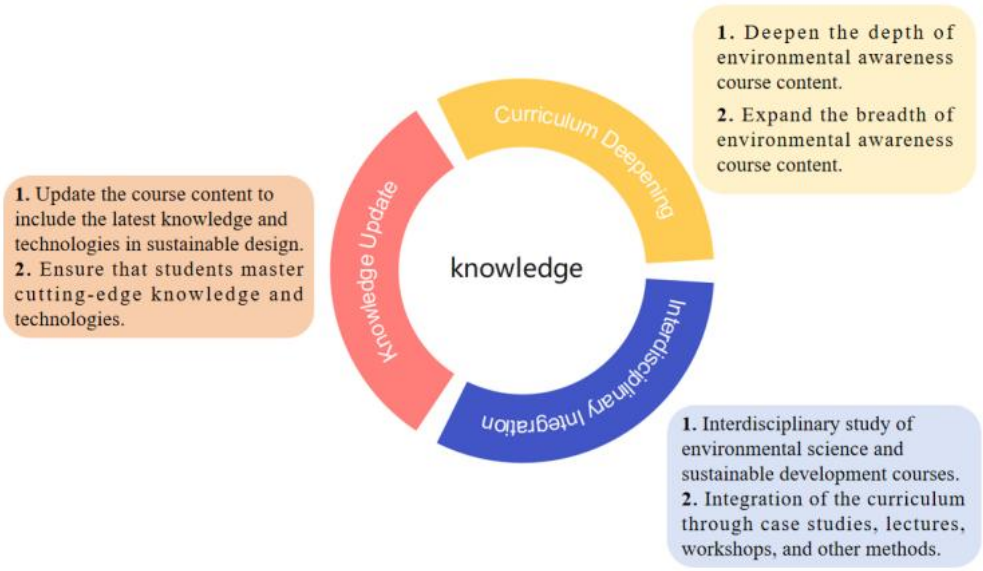


Figure 8 Composition of Knowledge

The existing indoor design courses need to enhance the depth and breadth of their theoretical content on environmental awareness. To address this issue, it is essential to increase the theoretical content related to environmental protection within the curriculum, systematically explaining the fundamental concepts and principles of eco-friendly design, and reinforcing understanding through practical case studies. This will help students consciously apply environmental principles in their design practice, cultivating designers who possess both theoretical depth and practical application skills. Furthermore, interdisciplinary knowledge such as environmental science and sustainable development should be integrated into the curriculum. Through case studies, lectures, workshops, and other methods, students can establish a comprehensive knowledge structure regarding environmental protection. Engaging in interactive exchanges with experts can enhance students' interdisciplinary application abilities, stimulate innovation, and encourage the adoption of more sustainable design solutions. Additionally, as the field of eco-friendly design evolves, the course content must be dynamically updated to encompass the latest knowledge and technologies, reflecting industry trends and technological advancements. By introducing the latest

design concepts and innovative technologies, we ensure that students are equipped with modern knowledge reserves, enabling them to adapt flexibly to industry changes and become creative and forward-thinking professionals.

4.3.4.2 Skills

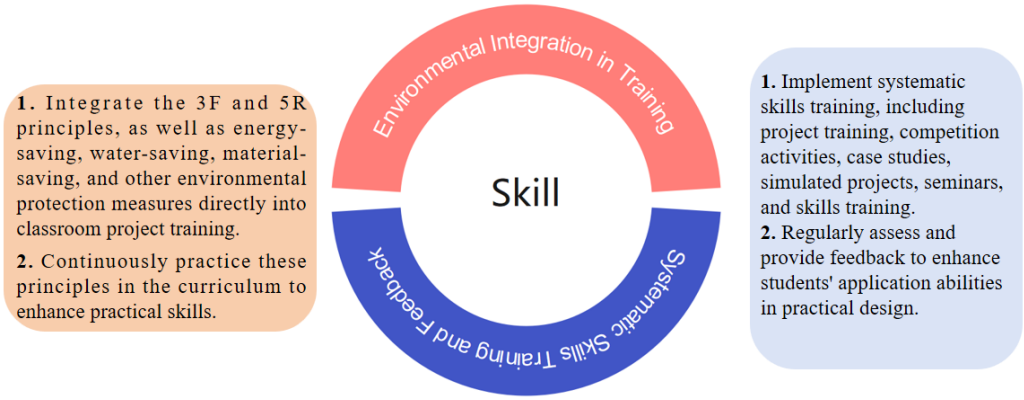


Figure 9 Composition of Skill

Through practical teaching and systematic skills training, the course aims to enhance students' capabilities in environmentally friendly design. The curriculum incorporates the 3F principles (coordinating with the environment, being people-centered, and promoting dynamic development) and the 5R measures (Revalue, Renew, Reuse, Recycle, Reduce), along with energy-saving and other environmental protection measures. Students actively participate in practical projects, thereby strengthening their ability to apply what they have learned in real-world contexts. Additionally, through project training, competitions, case studies, and skills courses, students accumulate practical experience, stimulate innovation, and regularly receive evaluations and feedback to identify deficiencies and make improvements, enabling them to apply their knowledge flexibly in diverse environments and meet the demands of modern environmental design.

4.3.4.3 Teaching Methods Innovation

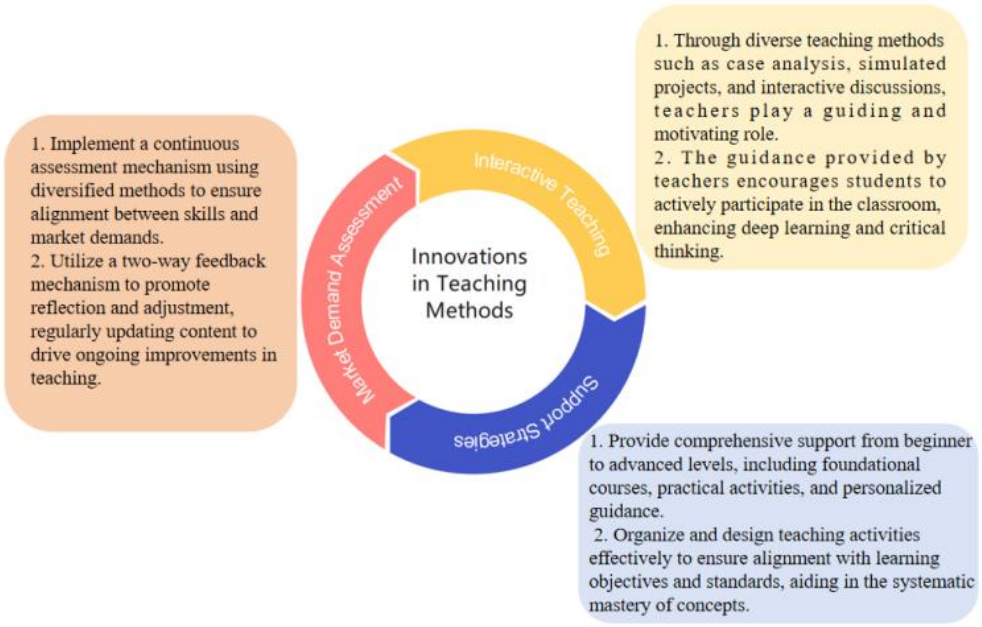


Figure 10 Innovative Teaching Methodology Diagram

The teaching methods emphasize diversity, including case analysis, simulated projects, interactive discussions, and debates, with teachers playing a guiding and inspiring role. These methods enrich the classroom experience, stimulate student engagement, and promote deep learning and critical thinking. Case analysis helps students apply theory to practical problems, cultivating analytical and decision-making skills; simulated projects provide a practical platform, enhancing teamwork and project management abilities; interactive discussions encourage the expression of viewpoints and critical thinking, improving communication skills. Through these methods, teachers facilitate the comprehensive development of students in knowledge, skills, and attitudes.

To ensure student success, comprehensive learning and support strategies should cover all stages from beginner to advanced. The beginner stage helps students establish a solid theoretical foundation through foundational courses, online resources, and self-study materials. The intermediate stage focuses on practical application, enhancing hands-on and problem-solving abilities through project-based learning and

case analysis. The advanced stage offers personalized support, such as mentorship, industry internships, and research projects, helping students delve into complex issues. By interacting with industry experts and academic mentors, students receive feedback and guidance, enhancing their professional capabilities and innovative thinking. Additionally, career development support, such as career planning, job-seeking skills training, and alumni networks, assists students in smoothly entering the workforce. These strategies lay a solid foundation for students' long-term development in the field of sustainable design.

Ensuring that the teaching content aligns with national and local standards is fundamental to enhancing teaching quality and student learning outcomes. This alignment guarantees the legitimacy and normative nature of the curriculum, ensuring that the knowledge and skills students acquire meet societal and industry expectations. Curriculum design should strictly adhere to relevant standards, with teachers clearly defining the specific requirements and objectives for each learning stage to help students systematically accumulate knowledge. Teachers should also regularly update course content to reflect the latest standards and industry developments, achieved through professional training and peer exchanges. Schools should establish effective supervision and evaluation mechanisms, including course assessments, teaching quality checks, and student feedback, to ensure that the teaching content meets standard requirements.

Reasonably arranging teaching activities is an important strategy to ensure that students systematically grasp key concepts. Teachers should closely align activities with learning objectives and standards, designing a variety of instructional activities such as group discussions, project-based learning, experiments, and case analyses. These activities must have clear goals and expected outcomes to help students apply knowledge and deepen their understanding. When arranging activities, consideration should be given to students' learning progress and individual differences, providing appropriate challenges and support through differentiated instruction, personalized guidance, and varied assignments. After activities conclude, teachers should reflect and

summarize through classroom discussions, learning journals, and self-assessments to reinforce knowledge and promote deep learning. By ensuring that teaching content is consistent with standards and reasonably arranging activities, teachers can effectively support students' systematic learning, enhance teaching effectiveness, and lay a solid foundation for students' holistic development and future success.

By establishing a continuous assessment mechanism, educational institutions can effectively monitor students' learning progress, ensuring that the learning experience aligns with market demands. This mechanism should include a variety of assessment methods, such as quizzes, project evaluations, presentations, and assessments by industry experts, to comprehensively reflect student outcomes. These assessments help teachers identify students' learning advancements and areas for improvement, and in conjunction with market demands, regularly update assessment standards to ensure that students' skills meet actual needs. This mechanism enhances students' competitiveness in the job market, supports their academic and career success, and cultivates comprehensive abilities to address sustainable development challenges.

Utilizing feedback to promote reflection among students and teachers is an important strategy for enhancing teaching quality. Through a systematic feedback mechanism, both students and teachers can self-assess and adjust, achieving continuous improvement in teaching content and methods. Feedback should be a two-way exchange, where students provide input while receiving feedback from teachers, helping educators understand needs and challenges. Teachers should use feedback to reflect on teaching shortcomings and optimize strategies through workshops and self-assessments. For example, if students indicate that a certain topic is difficult to understand, teachers could increase the use of case analyses. Additionally, feedback fosters student self-reflection, assisting them in adjusting learning methods and setting goals. In summary, feedback promotes reflection and adjustment, continuously improving educational quality and learning outcomes, thereby laying a foundation for students' comprehensive development.

4.3.4.4 Practice-Oriented Learning

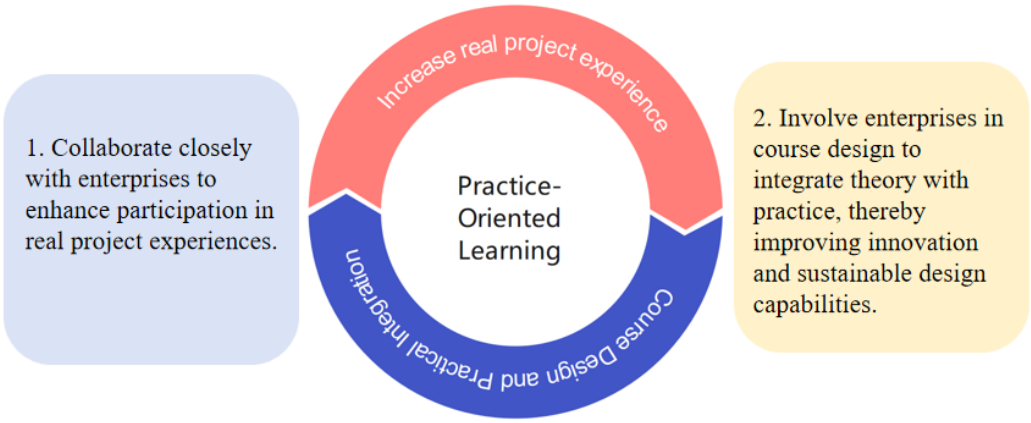


Figure 11 Practice-Oriented Learning Framework Diagram

Practice-oriented learning emphasizes the integration of academic knowledge with practical work experience, and school-enterprise cooperation is a core strategy to achieve this goal. By establishing partnerships with businesses, schools provide students with opportunities to engage in real work projects, enhancing their practical experience and exposing them to cutting-edge technologies and real-world challenges. Enterprises participate in course design and provide real case studies, assisting students in observational learning and practical operations, thereby improving their ability to apply classroom knowledge to actual work, particularly in the area of sustainable design.

In real projects, students delve into every aspect of the project, experiencing the complete process from planning to evaluation, mastering professional skills, and cultivating critical thinking and problem-solving abilities. This practice-oriented teaching model also fosters students' communication skills and teamwork spirit, providing them with professional networks and employment opportunities. Through continuous feedback and assessment, schools and enterprises optimize their cooperation model, ensuring that educational content aligns with industry demands and cultivating more competitive professionals.

4.3.4.5 Teacher Development and Support

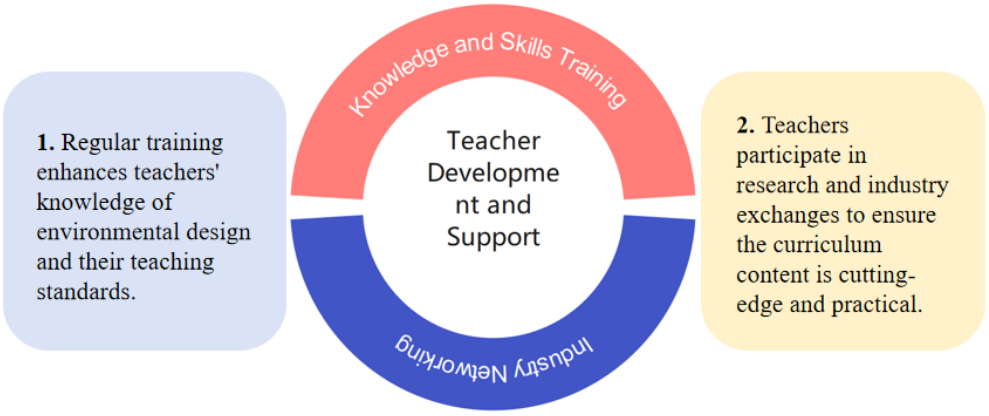


Figure 12 Teacher Development and Support Framework

Teacher development and support enhance educators' professional knowledge and teaching skills in the field of environmental design through regular training activities. At the same time, it encourages participation in scientific research and industry exchanges to ensure that the curriculum content keeps pace with the latest industry trends. A continuous professional development model enables teachers to update their teaching methods and course materials, adapting to the rapidly changing educational demands and environmental challenges, thereby fostering teachers' professional growth and enhancing their ability to meet the challenges of modern education.

4.3.4.6 Student Autonomous Development

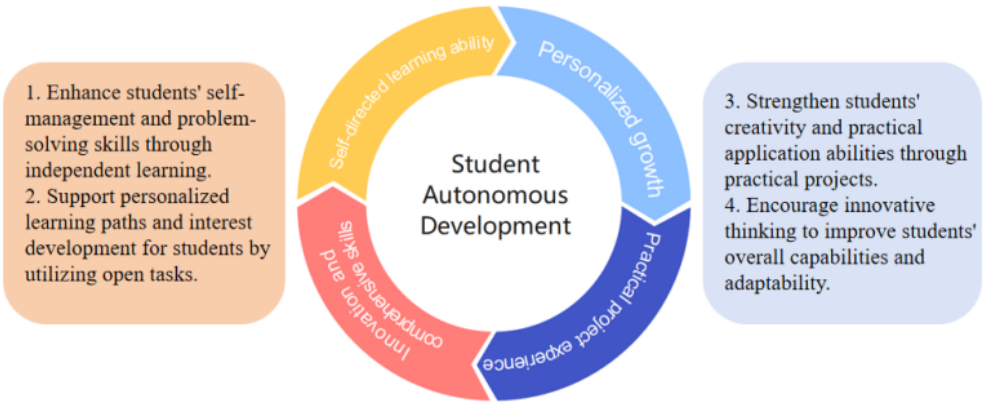


Figure 13 Diagram of Student Autonomous Development

Student autonomous development is a core objective in the educational process, aimed at promoting self-improvement and innovative growth. This is particularly significant in enhancing the environmental awareness of undergraduate students in the interior design program in Chengdu. Through open-ended learning tasks and customized mentorship programs, students are encouraged to engage in self-directed learning, improve their problem-solving abilities, accumulate practical experience, and enhance their overall competencies to meet the challenges in the field of environmental design.

In terms of innovative development, the focus is on cultivating students' innovative thinking, especially regarding sustainable design and environmental awareness. By participating in real projects, industry-academia collaborations, and community service activities, students can apply their knowledge in authentic settings and explore innovative solutions. This teaching model effectively promotes student autonomous development, laying a foundation for future careers and personal growth, enhancing professional capabilities, and fostering environmental consciousness and social responsibility, thereby enabling them to become active advocates for sustainable development.

4.3.5 The benefits obtained

1) Students have the opportunity to systematically transform the environmental knowledge they have learned into practical design solutions, enhancing their capacity for sustainable design actions to address environmental issues while simultaneously strengthening their innovative thinking skills and ability for self-directed development.

2) By the time of graduation, students will not only possess professional skills in interior design but will also have mastery over cutting-edge knowledge in sustainable development and environmental protection, providing them with a significant competitive advantage in the job market.

3) By cultivating a large number of professionals with environmental awareness, the interior design industry in Chengdu and other regions will be able to transition more toward sustainable development, reducing negative impacts on the environment. The implementation of this project will directly support the United Nations Sustainable Development Goals, including "Sustainable Cities and Communities," "Responsible Consumption and Production," "Quality Education," and "Climate Action," thereby increasing the contribution of education to environmental sustainability.

4) The project will provide educators in the field of interior design with a replicable teaching model and experience, promoting curriculum reform and innovation, and enhancing overall teaching quality.

CHAPTER 5
DISCUSSION OF RESEARCH FINDINGS

The research on "Teaching model to enhance environmental awareness for interior design undergraduate students in Chengdu, China" aims to: 1) To study stage and need of environmental awareness of interior design courses; 2) To develop the teaching model of interior design to enhance environmental awareness; 3) To confirm the model of interior design to enhance environmental awareness.

This research employs a Mixed Method Research approach. The population, sample, and data sources are categorized into five groups: 1) relevant literature and studies; 2) education experts; 3) industry experts; 4) designers; 5) undergraduate students majoring in interior design. It is essential to emphasize that the determination of the population and sample at each stage is primarily based on the research objectives and the characteristics of the required information. Data collection for this research utilizes various research tools, including: 1) a questionnaire assessing the environmental awareness of undergraduate students majoring in interior design; 2) interviews regarding the environmental awareness needs of undergraduate students majoring in interior design; 3) focus group discussions evaluating the suitability and feasibility of new models. The data analysis methods for this research are categorized into three forms: 1) content analysis; 2) basic statistical analysis, which includes percentage (%) analysis, mean (x) analysis, and standard deviation (SD) analysis; 3) analysis of necessity, conducted using SPSSPRO software.

5.1 Summary of Research Findings

The results of the study on enhancing environmental awareness in undergraduate students of interior design can be summarized into three significant aspects based on the research objectives: 1) the current state and needs of environmental awareness among undergraduate students in the interior design program in Chengdu; 2) teaching models aimed at enhancing environmental awareness among

undergraduate students in Chengdu's interior design program; 3) the evaluation results of the teaching models for environmental awareness in interior design.

The specific details of the research findings are as follows:

5.1.1 To study stage and need of environmental awareness of interior design courses.

5.1.1.1The current state of environmental awareness among undergraduate students in the interior design program in Chengdu.

Research findings indicate that undergraduate students in the interior design program in Chengdu have varying levels of environmental awareness. In terms of knowledge dimension, the average degree of students' mastery of environmental theoretical knowledge ranges from 2.83 to 2.96, with a standard deviation between 1.22 and 1.32. This suggests that the curriculum has achieved some effectiveness in imparting theoretical knowledge related to environmental protection, although disparities exist among students that need to be further reinforced. In terms of the skills dimension, the average level of students' skills in implementing energy-saving, water-saving, and material-saving measures ranges from 2.73 to 3.05, with a standard deviation between 1.28 and 1.34, indicating a continued necessity for practical skill training. The average values in the attitude and values dimension are relatively high, ranging from 3.73 to 3.95, with a standard deviation between 1.02 and 1.12, suggesting that students generally have a strong recognition of and positive attitude towards the importance of environmentally friendly design. In the PBL (Project-Based Learning) dimension, the average feedback score regarding the alignment of course content with national and local teaching standards is 3.15, with a standard deviation of 1.532; the satisfaction rating for course structure is 3.09, with a standard deviation of 1.459; and the effectiveness of other teaching activities averages between 3.13 and 3.31, indicating moderate levels of approval. Lastly, in the Work-Integrated Learning (WIL) dimension, the average score for students' opportunities to participate in real work projects is 2.47, with a standard deviation of 1.428. The average scores for school-enterprise cooperation projects and actual participation projects are 2.51 and 2.73, respectively, reflecting a moderate level of recognition for practical opportunities. These results

suggest a need to enhance the integration of theory and practice in course design to improve students' environmental awareness and practical capabilities. By strengthening school-enterprise cooperation and providing internship projects, students' professional competence and abilities can be significantly improved.

Therefore, when considering the components of the new model, it is found that the most lacking aspect across various dimensions is the opportunity for Work-Integrated Learning (WIL) that combines theory with practice, with an average score of 2.47 and a standard deviation of 1.428, indicating students' inadequacies in applying theoretical knowledge to practical situations. Additionally, the skills dimension averages between 2.73 and 3.05, demonstrating a clear lack of practical skills among students. The knowledge dimension averages between 2.83 and 2.96, showing that while students' understanding of environmental theoretical knowledge is acceptable, there is still room for improvement. The PBL dimension averages between 3.09 and 3.15, indicating a moderate level of recognition for the alignment of course content with teaching standards. Finally, the average values in the attitude and values dimension range from 3.73 to 3.95, reflecting students' high recognition and positive attitude towards the importance of environmentally friendly design. In summary, while students perform well in terms of attitude and values, there is still a need for further enhancement in practical opportunities, skill application, and mastery of theoretical knowledge to improve their overall environmental awareness and practical capabilities.

5.1.1.2 The Current Demand for Environmental Awareness Among Undergraduate Students in Interior Design in Chengdu

The results obtained from the in-depth analysis of six interview subjects regarding six interviews reveal the current shortcomings and demands of environmental awareness in interior design courses. The curriculum needs further improvement in both theoretical depth and breadth, as students lack relevant environmental knowledge and skills. Therefore, optimizing the curriculum is urgent; it should incorporate richer theoretical content on environmental awareness and integrate interdisciplinary

knowledge from environmental science and sustainable development to ensure the curriculum remains cutting-edge and practical.

Innovations in teaching methods are also necessary, employing diverse approaches such as case studies, simulated projects, and interactive discussions to stimulate students' interest and initiative in learning. Additionally, enhancing practical teaching through abundant internships and competition activities can improve students' hands-on abilities.

The deepening of school-enterprise cooperation is emphasized as crucial. By establishing long-term and stable partnerships, enterprises can actively participate in the school's curriculum design and teaching, providing real project cases and industry experience to help students better understand market demands and trends. This collaboration not only offers students more internship and practical opportunities but also helps narrow the gap between curriculum standards and actual teaching content. Furthermore, training teachers to enhance their knowledge of environmentally friendly design and teaching skills can better guide students in their learning and practice, enabling educators to continuously update their teaching content and methods in response to the ever-changing environmental and educational requirements.

On the level of students' personal development, they should enhance their self-driven environmental awareness, actively learn relevant knowledge and skills, and cultivate innovative thinking and problem-solving abilities. Such competencies are vital for accumulating experience in practice and for their future career development. Looking ahead, as societal awareness of environmental protection increases, the interior design industry will focus more on the integration of intelligent and sustainable technologies, with designers placing greater emphasis on the use of eco-friendly materials and the improvement of indoor environmental quality. Through the collective efforts of all parties, continuously improving and optimizing teaching models can significantly enhance the environmental awareness and capabilities of students in the

interior design profession, better serving the sustainable development needs of the industry.

5.1.2 To develop the teaching model of interior design to enhance environmental awareness

The complete teaching model for enhancing environmental awareness among undergraduate students in Interior Design in Chengdu consists of five important components: 1) Model Name 2) Principles and Importance 3) Objectives of the Teaching Model for Environmental Awareness among Interior Design Undergraduates in Chengdu 4) Components of the Model 5) Benefits Obtained.

5.1.2.1 Model Name

"Teaching Model for Enhancing Environmental Awareness among Undergraduate Students in Interior Design"

5.1.2.2 Principles and Importance

In the process of globalization, environmental issues have become a common challenge faced by countries worldwide. Rapid economic development has led to excessive resource extraction and irrational energy use, resulting in problems such as climate change, ecological destruction, and resource depletion. The international community is highly concerned about sustainable development, prompting the United Nations to adopt 17 Sustainable Development Goals in 2015, which include environmental and climate protection. China has elevated ecological and environmental protection to a national strategy, implementing a series of policy measures to practice the concept that "lucid waters and lush mountains are invaluable assets," aiming to achieve sustainable development. The global consensus on the importance of environmental protection is continuously strengthening, and Education for Sustainable Development (ESD) has become a focal point of international attention. Environmental awareness is crucial for addressing environmental problems, encompassing knowledge, values, and attitudes related to environmental protection, which can effectively promote the formation of environmentally friendly behaviors.

In this context, the importance of interior design education is increasingly prominent. Interior design not only pertains to the built environment and

aesthetic effects but also involves material selection and energy consumption, factors that have a profound impact on environmental sustainability. Traditional interior design has overly emphasized aesthetics while neglecting ecological protection. However, as society's focus on environmental sustainability increases, designers are expected to possess the ability to formulate sustainable solutions. Higher education institutions must cultivate students' environmental awareness, enabling them to understand the long-term impacts of professional decisions on the environment and develop the ability to integrate environmental sustainability theory with practice, thereby nurturing high-quality professionals with a sense of environmental responsibility and sustainable design capabilities.

The traditional teaching model of interior design has failed to effectively incorporate environmental awareness, resulting in students facing difficulties in practical applications and lacking the theoretical knowledge and problem-solving abilities related to environmental protection. To address the disconnect between education and industry, the Chinese government has recently promoted the integration of industry and education as well as school-enterprise cooperation through a series of policies, aiming to enhance students' environmental awareness and sustainable design capabilities, so they can apply the theories learned in real enterprise projects. This teaching model helps students better adapt to future industry demands and promotes sustainable development in the field of interior design.

This study analyzes the current situation and needs regarding the cultivation of environmental awareness in undergraduate interior design programs in Chengdu, identifying problems and deficiencies to provide a basis for improving teaching models. Based on Education for Sustainable Development, and integrating the conceptual frameworks of Work-Integrated Learning (WIL) and Problem-Based Learning (PBL), a new perspective for interior design education is offered. The new model emphasizes project practice, combining theory with practice, and work with learning, allowing students to learn by doing and apply environmental concepts to real projects, thereby cultivating their genuine ability to address environmental issues. Assessing the

feasibility of the new model provides empirical support for sustainable development education in interior design programs in Chengdu and across the country. This research not only cultivates high-quality talents with environmental awareness but also promotes the transformation of the interior design industry towards sustainable development, contributing to the achievement of sustainable development goals, and holds significant practical significance and historical value.

5.1.2.3 Goals of the Teaching Model for Enhancing Environmental Awareness Among Undergraduate Students in Interior Design

The aim is to enhance the environmental awareness of undergraduate students in the Interior Design program by integrating theoretical knowledge of environmental protection, fostering values and attitudes towards sustainability, applying theory to practice, and improving their capacity for sustainable design behaviors to promote the advancement of sustainable goals.

5.1.2.4 Composition of the Model

The environmental awareness of undergraduate students in interior design at Chengdu should encompass six core dimensions: knowledge, skills, innovative teaching methods, practice-oriented learning, teacher development and support, and student autonomous development. Each of these aspects has its own characteristics and aims to integrate theoretical knowledge of environmental protection, attitudes and values, and the application of theory into practice, thereby enhancing the capability for sustainable design behavior.

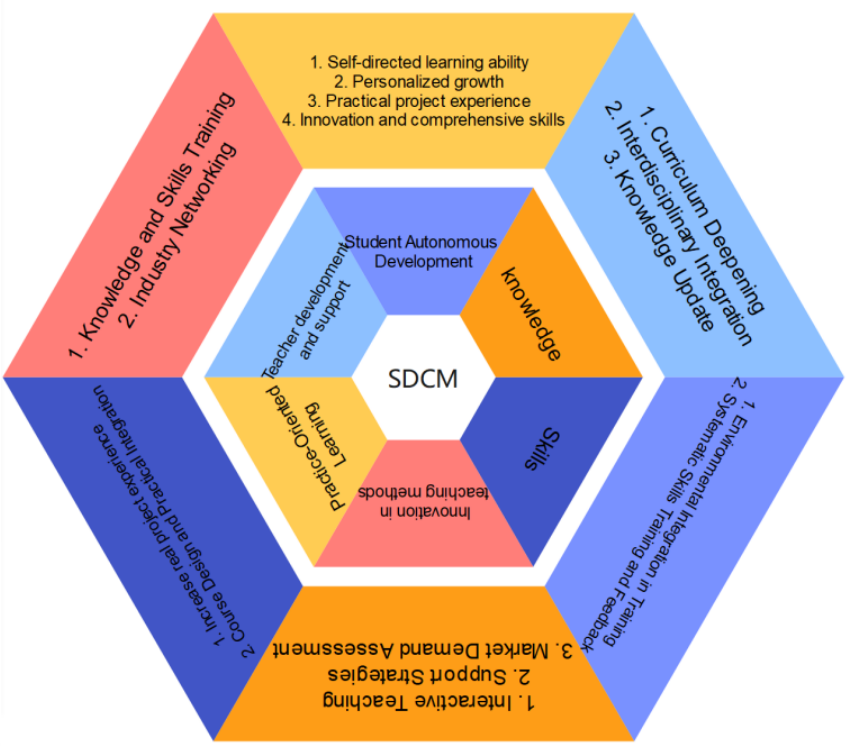


Figure 14 Teaching Model to Enhance Environmental Awareness Among Undergraduate Students in Interior Design(SDCM)

1) Knowledge

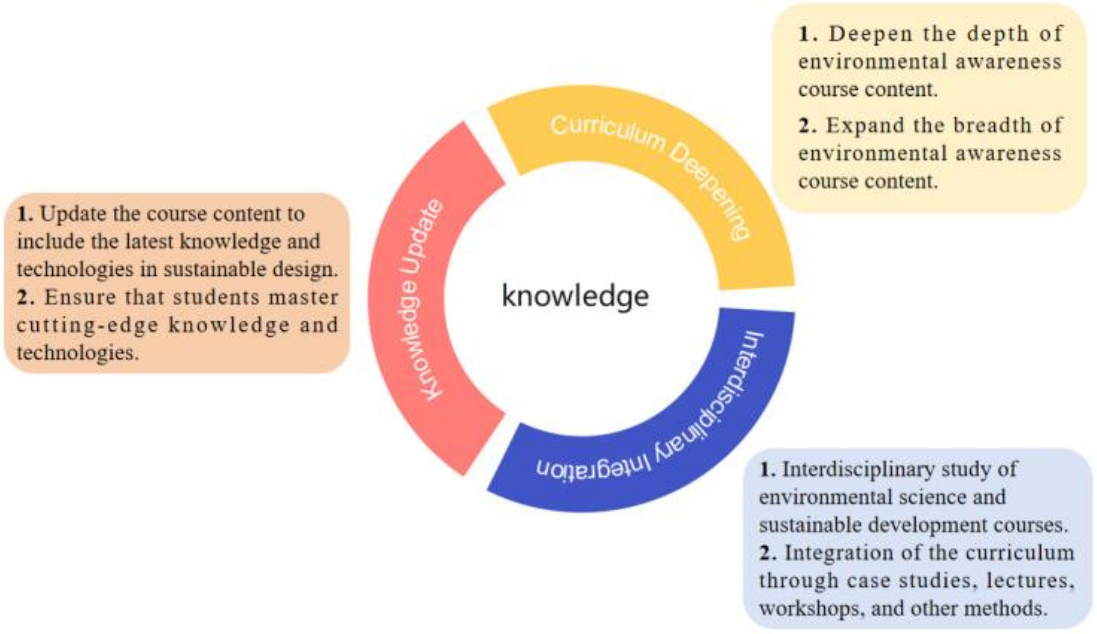


Figure 15 Composition of Knowledge

The existing indoor design courses need to enhance the depth and breadth of their theoretical content on environmental awareness. To address this issue, it is essential to increase the theoretical content related to environmental protection within the curriculum, systematically explaining the fundamental concepts and principles of eco-friendly design, and reinforcing understanding through practical case studies. This will help students consciously apply environmental principles in their design practice, cultivating designers who possess both theoretical depth and practical application skills. Furthermore, interdisciplinary knowledge such as environmental science and sustainable development should be integrated into the curriculum. Through case studies, lectures, workshops, and other methods, students can establish a comprehensive knowledge structure regarding environmental protection. Engaging in interactive exchanges with experts can enhance students' interdisciplinary application abilities, stimulate innovation, and encourage the adoption of more sustainable design solutions. Additionally, as the field of eco-friendly design evolves, the course content must be dynamically updated to encompass the latest knowledge and technologies,

reflecting industry trends and technological advancements. By introducing the latest design concepts and innovative technologies, we ensure that students are equipped with modern knowledge reserves, enabling them to adapt flexibly to industry changes and become creative and forward-thinking professionals.

2) Skills

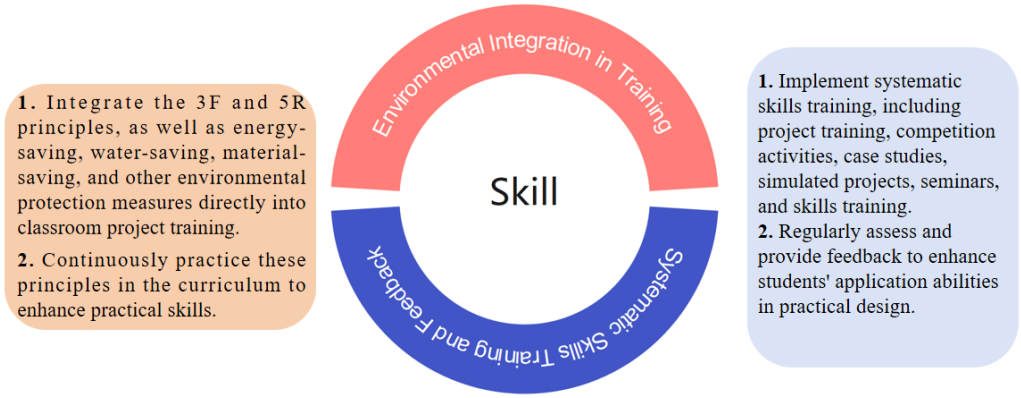


Figure 16 Composition of Skill

Through practical teaching and systematic skills training, the course aims to enhance students' capabilities in environmentally friendly design. The curriculum incorporates the 3F principles (coordinating with the environment, being people-centered, and promoting dynamic development) and the 5R measures (Revalue, Renew, Reuse, Recycle, Reduce), along with energy-saving and other environmental protection measures. Students actively participate in practical projects, thereby strengthening their ability to apply what they have learned in real-world contexts. Additionally, through project training, competitions, case studies, and skills courses, students accumulate practical experience, stimulate innovation, and regularly receive evaluations and feedback to identify deficiencies and make improvements, enabling them to apply their knowledge flexibly in diverse environments and meet the demands of modern environmental design.

3) Teaching Methods Innovation

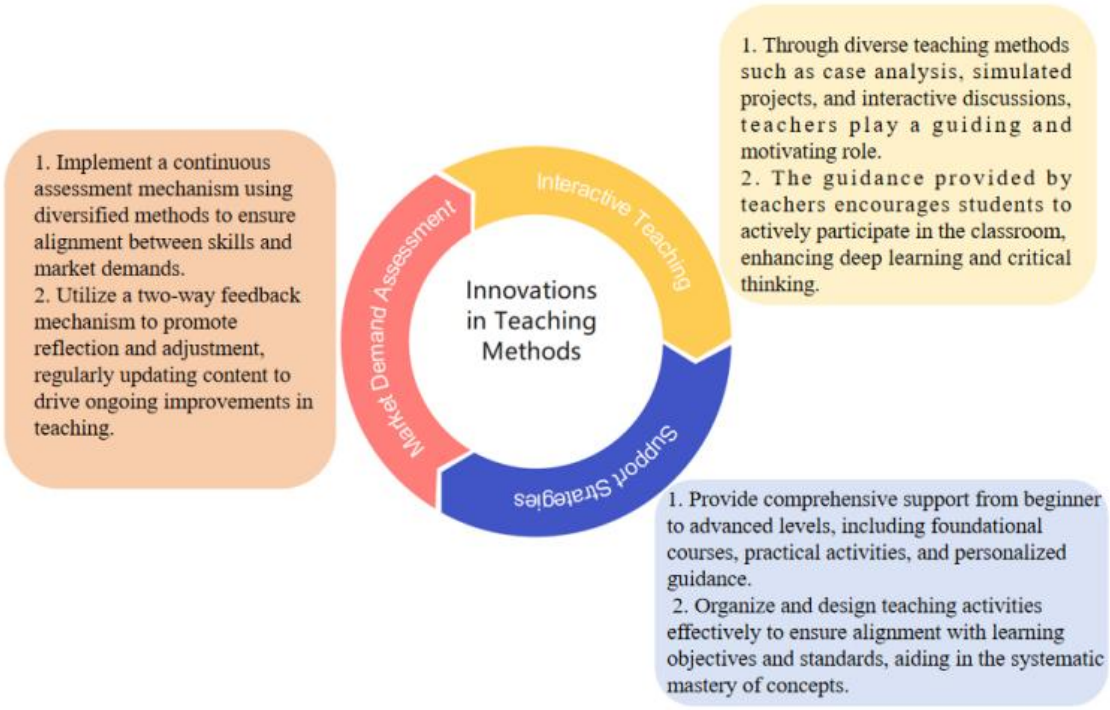


Figure 17 Innovative Teaching Methodology Diagram

The teaching methods emphasize diversity, including case analysis, simulated projects, interactive discussions, and debates, with teachers playing a guiding and inspiring role. These methods enrich the classroom experience, stimulate student engagement, and promote deep learning and critical thinking. Case analysis helps students apply theory to practical problems, cultivating analytical and decision-making skills; simulated projects provide a practical platform, enhancing teamwork and project management abilities; interactive discussions encourage the expression of viewpoints and critical thinking, improving communication skills. Through these methods, teachers facilitate the comprehensive development of students in knowledge, skills, and attitudes.

To ensure student success, comprehensive learning and support strategies should cover all stages from beginner to advanced. The beginner stage helps students establish a solid theoretical foundation through foundational courses, online resources, and self-study materials. The intermediate stage focuses on practical

application, enhancing hands-on and problem-solving abilities through project-based learning and case analysis. The advanced stage offers personalized support, such as mentorship, industry internships, and research projects, helping students delve into complex issues. By interacting with industry experts and academic mentors, students receive feedback and guidance, enhancing their professional capabilities and innovative thinking. Additionally, career development support, such as career planning, job-seeking skills training, and alumni networks, assists students in smoothly entering the workforce. These strategies lay a solid foundation for students' long-term development in the field of sustainable design.

Ensuring that the teaching content aligns with national and local standards is fundamental to enhancing teaching quality and student learning outcomes. This alignment guarantees the legitimacy and normative nature of the curriculum, ensuring that the knowledge and skills students acquire meet societal and industry expectations. Curriculum design should strictly adhere to relevant standards, with teachers clearly defining the specific requirements and objectives for each learning stage to help students systematically accumulate knowledge. Teachers should also regularly update course content to reflect the latest standards and industry developments, achieved through professional training and peer exchanges. Schools should establish effective supervision and evaluation mechanisms, including course assessments, teaching quality checks, and student feedback, to ensure that the teaching content meets standard requirements.

Reasonably arranging teaching activities is an important strategy to ensure that students systematically grasp key concepts. Teachers should closely align activities with learning objectives and standards, designing a variety of instructional activities such as group discussions, project-based learning, experiments, and case analyses. These activities must have clear goals and expected outcomes to help students apply knowledge and deepen their understanding. When arranging activities, consideration should be given to students' learning progress and individual differences, providing appropriate challenges and support through differentiated instruction,

personalized guidance, and varied assignments. After activities conclude, teachers should reflect and summarize through classroom discussions, learning journals, and self-assessments to reinforce knowledge and promote deep learning. By ensuring that teaching content is consistent with standards and reasonably arranging activities, teachers can effectively support students' systematic learning, enhance teaching effectiveness, and lay a solid foundation for students' holistic development and future success.

By establishing a continuous assessment mechanism, educational institutions can effectively monitor students' learning progress, ensuring that the learning experience aligns with market demands. This mechanism should include a variety of assessment methods, such as quizzes, project evaluations, presentations, and assessments by industry experts, to comprehensively reflect student outcomes. These assessments help teachers identify students' learning advancements and areas for improvement, and in conjunction with market demands, regularly update assessment standards to ensure that students' skills meet actual needs. This mechanism enhances students' competitiveness in the job market, supports their academic and career success, and cultivates comprehensive abilities to address sustainable development challenges.

Utilizing feedback to promote reflection among students and teachers is an important strategy for enhancing teaching quality. Through a systematic feedback mechanism, both students and teachers can self-assess and adjust, achieving continuous improvement in teaching content and methods. Feedback should be a two-way exchange, where students provide input while receiving feedback from teachers, helping educators understand needs and challenges. Teachers should use feedback to reflect on teaching shortcomings and optimize strategies through workshops and self-assessments. For example, if students indicate that a certain topic is difficult to understand, teachers could increase the use of case analyses. Additionally, feedback fosters student self-reflection, assisting them in adjusting learning methods and setting goals. In summary, feedback promotes reflection and adjustment, continuously

improving educational quality and learning outcomes, thereby laying a foundation for students' comprehensive development.

4) Practice-Oriented Learning

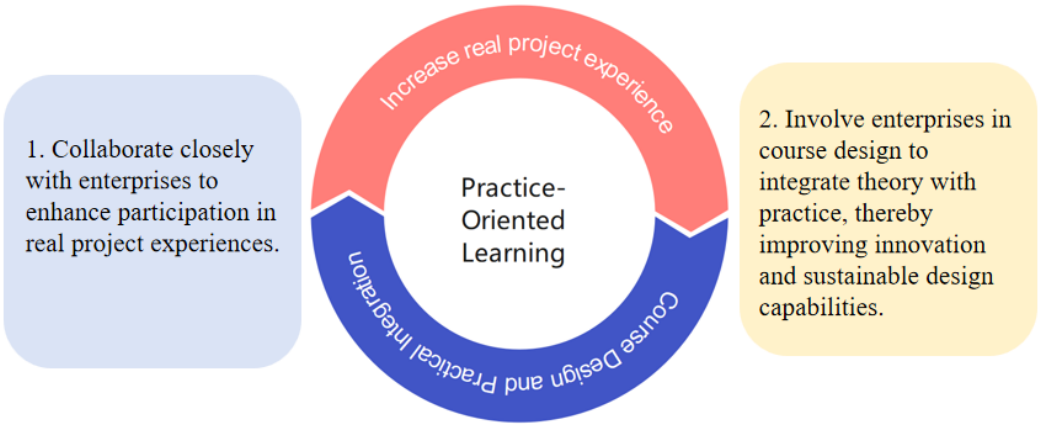


Figure 18 Practice-Oriented Learning Framework Diagram

Practice-oriented learning emphasizes the integration of academic knowledge with practical work experience, and school-enterprise cooperation is a core strategy to achieve this goal. By establishing partnerships with businesses, schools provide students with opportunities to engage in real work projects, enhancing their practical experience and exposing them to cutting-edge technologies and real-world challenges. Enterprises participate in course design and provide real case studies, assisting students in observational learning and practical operations, thereby improving their ability to apply classroom knowledge to actual work, particularly in the area of sustainable design.

In real projects, students delve into every aspect of the project, experiencing the complete process from planning to evaluation, mastering professional skills, and cultivating critical thinking and problem-solving abilities. This practice-oriented teaching model also fosters students' communication skills and teamwork spirit, providing them with professional networks and employment opportunities. Through continuous feedback and assessment, schools and enterprises optimize their

cooperation model, ensuring that educational content aligns with industry demands and cultivating more competitive professionals.

5) Teacher Development and Support

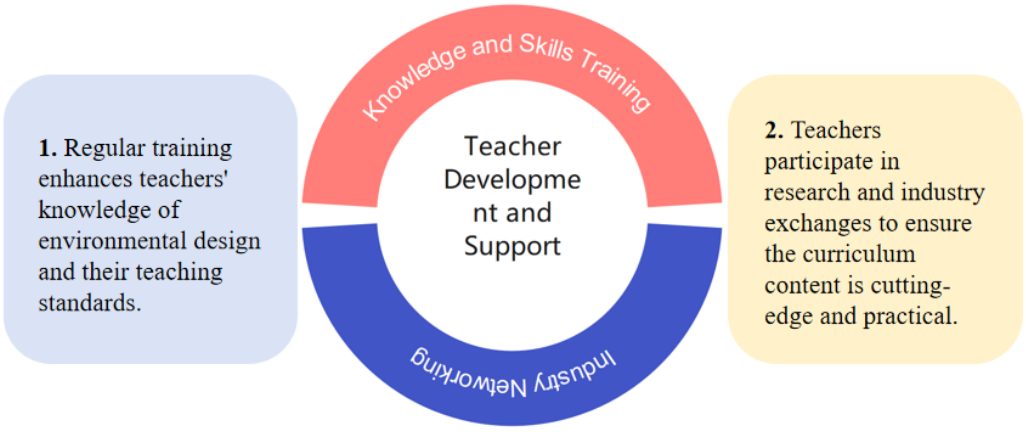


Figure 19 Teacher Development and Support Framework

Teacher development and support enhance educators' professional knowledge and teaching skills in the field of environmental design through regular training activities. At the same time, it encourages participation in scientific research and industry exchanges to ensure that the curriculum content keeps pace with the latest industry trends. A continuous professional development model enables teachers to update their teaching methods and course materials, adapting to the rapidly changing educational demands and environmental challenges, thereby fostering teachers' professional growth and enhancing their ability to meet the challenges of modern education.

6) Student Autonomous Development

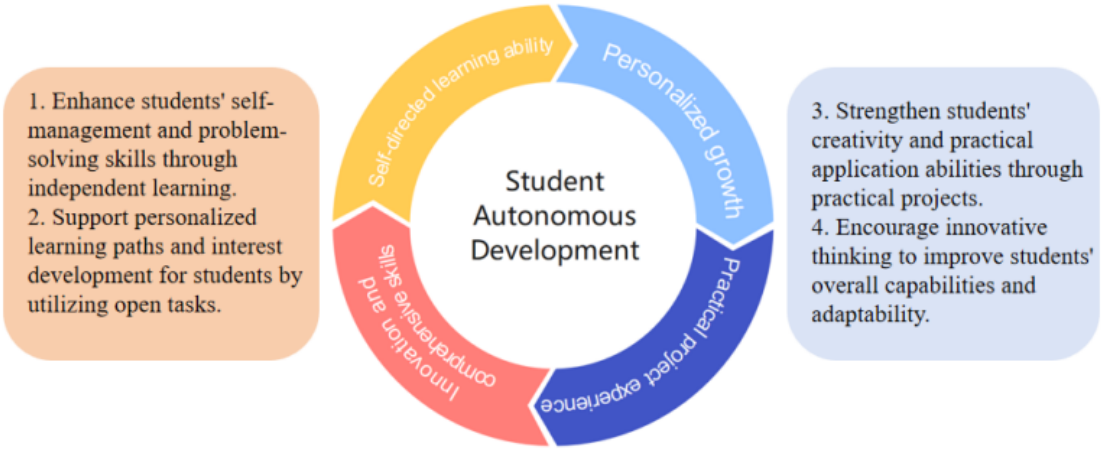


Figure 20 Diagram of Student Autonomous Development

Student autonomous development is a core objective in the educational process, aimed at promoting self-improvement and innovative growth. This is particularly significant in enhancing the environmental awareness of undergraduate students in the interior design program in Chengdu. Through open-ended learning tasks and customized mentorship programs, students are encouraged to engage in self-directed learning, improve their problem-solving abilities, accumulate practical experience, and enhance their overall competencies to meet the challenges in the field of environmental design.

In terms of innovative development, the focus is on cultivating students' innovative thinking, especially regarding sustainable design and environmental awareness. By participating in real projects, industry-academia collaborations, and community service activities, students can apply their knowledge in authentic settings and explore innovative solutions. This teaching model effectively promotes student autonomous development, laying a foundation for future careers and personal growth, enhancing professional capabilities, and fostering environmental consciousness and social responsibility, thereby enabling them to become active advocates for sustainable development.

5.1.2.5 The benefits obtained

1) Students have the opportunity to systematically transform the environmental knowledge they have learned into practical design solutions, enhancing their capacity for sustainable design actions to address environmental issues while simultaneously strengthening their innovative thinking skills and ability for self-directed development.

2) By the time of graduation, students will not only possess professional skills in interior design but will also have mastery over cutting-edge knowledge in sustainable development and environmental protection, providing them with a significant competitive advantage in the job market.

3) By cultivating a large number of professionals with environmental awareness, the interior design industry in Chengdu and other regions will be able to transition more toward sustainable development, reducing negative impacts on the environment. The implementation of this project will directly support the United Nations Sustainable Development Goals, including "Sustainable Cities and Communities," "Responsible Consumption and Production," "Quality Education," and "Climate Action," thereby increasing the contribution of education to environmental sustainability.

4) The project will provide educators in the field of interior design with a replicable teaching model and experience, promoting curriculum reform and innovation, and enhancing overall teaching quality.

5.2 Discussion of Research Findings

Based on the research findings regarding the teaching model for enhancing environmental awareness among undergraduate students in interior design, five discoveries can be summarized and discussed, specifically including:

1) The disparity between the results of the current state analysis and the actual needs

2) The necessity trend for enhancing the environmental awareness teaching model for undergraduate students in interior design

3) The enhancement of the teaching model for environmental awareness among undergraduate students in interior design across various dimensions

4) The importance of emphasizing environmental awareness among undergraduate students in interior design in all aspects

5) The components and development of a suitable teaching model for enhancing environmental awareness in undergraduate students in interior design

The following are the discussion details for each topic:

5.2.1 The gap between the results of the current situation analysis and the requirements.

The data reveals shortcomings among students in terms of environmental awareness and practical skills. The analysis of the current situation indicates that while students hold a positive attitude towards the importance of environmentally friendly design (with attitude and values dimensions averaging between 3.73 and 3.95), their opportunities to apply theory to practice (Work Integrated Learning) are notably low, averaging only 2.47 with a standard deviation of 1.428. This indicates a significant deficit. Furthermore, the average scores for the skills dimension range from 2.73 to 3.05, while the knowledge dimension averages between 2.83 and 2.96, suggesting there is still room for improvement in students' mastery of practical skills and theoretical knowledge. The average score for Project-Based Learning (PBL) methods is between 3.09 and 3.15, indicating a moderate level of recognition from students regarding the alignment of course content with teaching standards.

From a needs perspective, the curriculum urgently requires optimization. By introducing more diverse and interdisciplinary content, its relevance and practicality can be enhanced. Teaching methods also need innovation; it is recommended to stimulate active learning among students through case analysis, simulated projects, and interactive discussions, while strengthening practical teaching through internships and competitions. Deepening collaboration between schools and enterprises can provide more practical opportunities, helping students better understand market demands and narrow the gap between curriculum standards and actual teaching content. Additionally,

enhancing teachers' knowledge in environmental design and their teaching levels through training is essential to address the ever-changing educational and environmental requirements. In summary, despite existing shortcomings, adjustments in curriculum and teaching models, along with strengthened partnerships, can effectively elevate students' environmental awareness and capabilities, propelling the interior design profession towards a new stage of sustainable development.

5.2.2 The Demand Trends for Enhancing Environmental Awareness Teaching Models for Undergraduate Students in Interior Design

Through the component analysis of the teaching model for environmental awareness among undergraduate students in the interior design major, it was found that each dimension has its own suitability when considering the various aspects and specific content of the primary development model. The research results indicate that the development of knowledge and skills should incorporate an increase in theoretical content related to environmental awareness within the curriculum, integrating interdisciplinary knowledge such as environmental science and sustainable development into interior design courses, and updating course content to include the latest knowledge and technologies in environmentally friendly design. In terms of skills, enhancing practical abilities and reinforcing skill training will enable students to master and apply the core principles and measures of environmentally friendly design. Innovations in teaching methods can be achieved through diversified teaching strategies, optimized project-based learning, and assessment and feedback mechanisms. Practice-oriented learning emphasizes the combination of academic knowledge with practical work experience. Teacher development and support are enhanced through regular training activities to improve teachers' professional knowledge and teaching skills in the field of environmentally friendly design. Student autonomous development focuses on self-improvement and innovative growth.

When considering the components of the applied model, it was found that practice-oriented learning is the most urgent need. The research results establish practice-oriented learning as a key strategy for enhancing the environmental awareness

and sustainable design capabilities of undergraduate students in the interior design major in Chengdu. Through school-enterprise cooperation, students can not only combine academic knowledge with practical work experience but also exercise and enhance their abilities in a real industry environment. The effectiveness of this teaching model is reflected in several aspects:

Firstly, the collaboration between schools and enterprises provides students with valuable practical opportunities, allowing them to engage in real work projects. This not only enhances students' practical experience but also gives them the chance to encounter cutting-edge technologies and real-world issues in the industry. The involvement of enterprises extends beyond providing projects; it also includes participation in curriculum design and offering real case studies. This deep collaboration helps students apply the theoretical knowledge learned in the classroom to actual work, particularly in the area of sustainable design, through observation and hands-on practice. This integration of theory and practice enables students to better understand and apply the principles of sustainable design.

Secondly, by participating in real projects, students can delve into every aspect of the project, from planning to evaluation, experiencing the complete project process. This comprehensive involvement not only helps students master professional skills but also cultivates their critical thinking and problem-solving abilities. Through practical project experience, students' communication skills and teamwork spirit are significantly enhanced. Furthermore, the collaboration between schools and enterprises provides students with a platform to establish professional networks and gain employment opportunities, facilitating their smoother transition into the workforce after graduation.

Finally, through continuous feedback and evaluation, schools and enterprises can continually optimize their collaboration model, ensuring that educational content remains aligned with industry needs. This dynamic adjustment mechanism not only enhances the relevance and effectiveness of education but also ensures that the talents cultivated can meet the actual demands of the industry and possess the

capability for sustainable design, thereby promoting sustainable development. This dimension resonates with the rationalist design education philosophy of the Bauhaus and the Ulm School of Design, emphasizing the integration of theoretical knowledge and practical operation. This integration is concretely reflected in the "industry-university-research" teaching model, encouraging students to apply theoretical knowledge in real projects and enhancing their ability to solve practical environmental problems. This dimension aligns with the goals of sustainable development education, which aims to cultivate students' ability to address real-world issues.

5.2.3 Teaching Model for Environmental Awareness among Undergraduate Students in Interior Design and Its Enhancement Across Various Dimensions

In terms of knowledge, the sustainable development of interior design first requires designers to have a solid theoretical foundation. In facing the challenges of global climate change and limited resources, sustainable design thinking becomes a necessary strategy for interior designers to guide and constrain their design behavior. Li (2019) points out that sustainable development not only pertains to meeting current needs but also profoundly considers the needs of future generations, which demands that designers take into account the long-term environmental impacts throughout the creative process. In the education of interior design, expanding the curriculum to include interdisciplinary knowledge such as environmental science and sustainable development is a key step in enhancing designers' environmental awareness. This integration not only exposes students to cutting-edge knowledge and technologies in eco-friendly design but also guides them to carefully select materials, optimize resource utilization, and reduce the carbon footprint of design proposals, ultimately achieving the fundamental goal of improving quality of life.

The enhancement of skills is a prerequisite for ensuring that students can put theoretical knowledge into practice. Lu (2023) emphasizes that a scientific design guiding ideology is not only a reflection on the social cost of environmental development but also a symbol of the designer's ethics and social responsibility. This necessitates that interior design education must strengthen training in practical skills and enable

students to proficiently master and apply the core principles and measures of eco-friendly design. Specifically, through project-driven learning, students can apply their learned skills in real situations, such as making sustainable material choices, designing energy-efficient optimization systems, and effectively managing waste. These practical trainings not only enhance students' professional capabilities and sense of social responsibility but also lay a solid foundation for their careers in the field of sustainable development, thereby promoting the healthy and sustainable development of the interior design industry.

In the dimension of innovative teaching methods, diverse teaching strategies such as case analysis, simulated projects, interactive discussions, and debates play a crucial role. In this process, teachers are not only transmitters of knowledge but also guides and inspirers, encouraging students to actively participate and engage. This approach enables students to apply the knowledge they have learned in real-life situations, fostering their critical thinking and problem-solving abilities. Additionally, providing various learning and support strategies helps students acquire the necessary skills and information at different stages, ensuring they can learn and grow effectively within the project. Furthermore, optimizing project-based teaching ensures that the content aligns with national and local standards, which is a fundamental requirement. By systematically arranging teaching activities, teachers can help students grasp core concepts. This involves the design and implementation of overall teaching activities, reflecting the need to connect teaching activities to learning objectives and standards. In this way, students not only understand theoretical knowledge but also apply it in practice, enhancing their adaptability and creativity in real projects. This systematic teaching design ensures that students can gradually accumulate experience during the learning process and continuously improve their abilities through practice. Finally, through assessment and feedback mechanisms, a continuous evaluation system is established, allowing teachers to ensure that students' learning progress aligns with market demands. Assessment is not only a verification of students' learning outcomes but also an important tool for promoting reflection among both students and teachers.

Through feedback, teachers can adjust teaching content and methods, continuously improving the learning and teaching process. This dynamic assessment and feedback mechanism not only enhances the effectiveness of teaching but also stimulates students' interest and initiative in learning, helping them achieve self-improvement and innovative development within the project.

In teacher training and support, the role of teachers in environmental education is crucial. As noted by Ganatsios et al. (2021), the knowledge of environmental education is often formed through teachers' self-study of relevant environmental theories, which leads to deficiencies in the accuracy and rigor of that knowledge. Due to a lack of specialized environmental education faculty, teaching models tend to be singular, lacking innovative teaching methods, and the content appears to be brief and generalized. This situation causes teaching to overly rely on the transmission of textbook knowledge, neglecting the cultivation of students' ability to apply knowledge in real-life contexts. To address these challenges, the interior design program in Chengdu needs to invest more resources in teacher development to enhance teachers' theoretical knowledge and practical skills in sustainable design. Through regular training activities, teachers can strengthen their professional knowledge and teaching skills in the field of environmental design, while also encouraging them to engage in scientific research and industry exchanges. This ongoing professional development model ensures that teachers have access to the latest theories and technologies in environmental design, maintaining the relevance and practicality of the curriculum content. Teachers not only need a solid theoretical foundation but must also continuously enhance their understanding and practical application skills. By continually updating teaching methods and course materials, teachers can adapt to the rapidly changing educational demands and environmental challenges. This form of support is vital for fostering teachers' professional growth and enhancing their ability to meet modern educational challenges, not only improving the effectiveness of teaching but also stimulating students' interest and initiative in learning, cultivating their critical

thinking and innovative abilities, thereby nurturing talents in the interior design industry with a high level of environmental awareness and sustainable design capabilities.

In the dimension of self-development for students, the German Academy of Fine Arts has developed a student-centered teaching model based on the Bauhaus "dual-teacher" teaching method and "inquiry-based" teaching approach. This model emphasizes a dominant role for the instructor during teaching, while placing the learner in a leading position during learning, thereby forming a "learning community" (Meyer & Norman, 2020). In this environment, students' self-development becomes one of the core objectives of education. By encouraging autonomous learning and exploration, the school provides open-ended learning tasks and customized mentoring programs to help students achieve personalized learning goals. This approach not only enhances students' problem-solving abilities but also accumulates valuable experience in practice, improving their overall competencies. With this support, students are better able to internalize the knowledge they acquire and continuously reflect on and improve their practical applications. Furthermore, innovative development is another important sub-dimension of students' self-development. The German Academy of Fine Arts fosters students' innovative thinking and enhances their creativity and adaptability in environmental design by providing opportunities to participate in real projects and research. Students are encouraged to propose novel solutions in diverse practical contexts, which not only drives their in-depth exploration and innovation in academic and practical fields but also lays a foundation for addressing complex design challenges in their future careers. Through this teaching model, students not only become recipients of knowledge but also creators and applicators of knowledge, promoting the continuous development and innovation of design education. This student-centered teaching model not only enhances students' personal capabilities but also cultivates professionals equipped with innovative thinking and practical skills for the design industry.

5.2.4 Emphasizing the Importance of Environmental Awareness Among Undergraduate Students in Interior Design from Various Perspectives

In modern interior design education, emphasizing an environmental awareness teaching model for undergraduates is crucial for cultivating professionals with sustainable design capabilities. By focusing on the comprehensive development across six dimensions, educational institutions can effectively enhance students' environmental awareness and their ability to take action in sustainable design.

In terms of knowledge and skills, it is essential to incorporate theoretical content on environmental awareness into the curriculum. Integrating interdisciplinary knowledge such as environmental science and sustainable development into interior design courses, and updating course content to include the latest knowledge and technologies in eco-friendly design, can help students establish a solid theoretical foundation. This interdisciplinary integration not only enriches students' knowledge systems but also enables them to understand and apply the core principles and measures of eco-friendly design, allowing them to make more sustainable decisions in their design practices.

Innovative teaching methods are an important avenue for achieving environmental awareness education. By employing diverse teaching strategies such as case studies, simulated projects, interactive discussions, and debates, educators can guide students to actively participate and engage, fostering their critical thinking and problem-solving abilities. Project-based teaching optimization ensures that the teaching content aligns with national, local, and industry standards, and through well-organized activities, helps students systematically grasp core concepts. The assessment and feedback mechanism promotes reflection and improvement for both students and teachers through continuous evaluation and feedback, ensuring the effectiveness and relevance of the teaching process.

Practice-oriented learning emphasizes the combination of academic knowledge with practical work experience, enabling students to apply what they have learned in real-world contexts, thereby enhancing their adaptability and creativity.

Teacher development and support involve regular training activities to enhance educators' expertise and teaching skills in the field of eco-friendly design, ensuring they can effectively guide students. Finally, student self-development aims to encourage students to accumulate experience through self-improvement and innovative development, enhancing their overall quality. This comprehensive teaching model not only improves students' personal capabilities but also supplies the interior design industry with talents possessing high levels of environmental awareness and sustainable design abilities, promoting the healthy and sustainable development of the industry.

5.2.5 Components and Development of Teaching Models Suitable for Enhancing Environmental Awareness Among Undergraduate Students in Interior Design

Research findings indicate that the teaching model aimed at enhancing environmental awareness among undergraduate students in interior design encompasses six dimensions: knowledge, skills, innovative teaching methods, practice-oriented learning, teacher development and support, and student autonomous development. Each of these dimensions has its unique characteristics and aims to integrate theoretical knowledge and values related to environmental protection while applying theory to practice, thereby enhancing students' capabilities in sustainable design.

In the assessment of appropriateness and feasibility, experts emphasize the need for continuous updating of theoretical knowledge to maintain consistency with industry standards, as well as the implementation of environmental education based on the latest national environmental protection standards each year. These components complement each other and collectively form an important foundation for providing comprehensive support in the field of sustainable development education. Furthermore, the development of teachers also supports student growth. Researchers suggest that, in the knowledge dimension, the use of the latest industry cases can promote student understanding and interest, enhancing the relevance and timeliness of course content. Therefore, students are encouraged to participate in projects involving environmental science and engineering technology to foster interdisciplinary learning. In the skills

dimension, through project training, competitions, case studies, and skills courses, students apply the theoretical knowledge they have learned to practical skills. By accumulating practical experience, stimulating innovation, and regularly receiving evaluations and feedback, students can identify shortcomings and improve, enabling them to flexibly apply what they have learned in diverse environments to meet the demands of modern environmental design.

Teachers need to engage in more communication and learning with the industry to enhance their own knowledge and skills related to environmental protection. Such exchanges and practical activities not only help teachers stay in sync with industry developments but also provide students with more practical guidance. This practice is closely related to the concept of "dual-qualified" teachers. The concept was first introduced in 1995 by the former National Education Commission in the "Notice on the Construction of Demonstration Vocational Universities," aimed at improving teachers' professional practical abilities to address the challenges in vocational education at that time—specifically, the weakness in professional practical skills. By hiring technical personnel from industry enterprises to serve as teachers and strengthening the practical abilities of existing teachers, vocational colleges have promoted the development of "dual-qualified" teachers. Over time, this concept has deepened. In 2022, the General Office of the Ministry of Education issued the "Notice on the Identification Work of 'Dual-Qualified' Teachers in Vocational Education," clarifying the identification standards, marking the systematization and standardization of the construction of the "dual-qualified" teacher team. Through these policy frameworks, teachers can engage in deeper considerations of environmental protection issues in practice, thereby promoting the development of sustainable design practices and ultimately providing students with support for practical and innovative learning experiences.

In innovative teaching methods, it is essential to provide problem-solving tasks in authentic contexts to promote students' critical thinking and innovative abilities. Furthermore, through a continuous evaluation and feedback mechanism, the ongoing improvement of teaching content and methods can be encouraged, ensuring that

education remains aligned with industry developments. In practice-oriented learning, students enhance their practical skills and career readiness by participating in projects supported by enterprises. The integration of industry, academia, and research encourages the collaboration between education and businesses, thereby improving the effectiveness of the curriculum. This aligns with John Dewey's pragmatic educational theory, which emphasizes "learning by doing" and posits that education should be closely connected to real life, allowing students to learn through practical experiences and reflection in authentic contexts. Regular assessments and feedback support students' continuous improvement in environmentally sustainable design experiences. Through ongoing practice and reflection, students can develop a deeper understanding and stronger capabilities in real situations. Additionally, experiential learning emphasizes the cultivation of communication skills and teamwork spirit, providing students with professional networks and greater employment opportunities.

Student autonomous development is also a core objective in the educational process, aimed at promoting self-improvement and innovative development. This is particularly significant in enhancing the environmental awareness of undergraduate students in the field of interior design in Chengdu. This concept is closely related to humanistic education theory, which was proposed by psychologists Carl Rogers and Abraham Maslow, emphasizing individual self-actualization and potential development. Furthermore, it has evolved into a student-centered teaching model based on the "dual-teacher" teaching model and "inquiry-based" teaching model from Germany's Bauhaus. This model emphasizes a teacher-led approach during instruction while promoting a student-led approach during learning, thereby forming a "learning community" (Meyer & Norman, 2020). Through open learning tasks and customized mentoring programs, students are encouraged to engage in self-directed learning, enhance their problem-solving abilities, accumulate practical experience, and improve their overall competencies to meet the challenges in the field of environmental design.

In terms of innovative development, the focus is on cultivating students' innovative thinking, particularly regarding sustainable design and environmental awareness. By participating in real projects, industry-academia collaborations, and community service activities, students can apply their knowledge in real-world settings and explore innovative solutions. This teaching model not only promotes students' autonomous development, laying a foundation for their future careers and personal growth, but also enhances their professional capabilities, fosters environmental awareness, and cultivates a sense of social responsibility, making them active proponents of sustainable development. This aligns with humanistic theory, which supports personalized learning and self-directed educational environments, encouraging students to achieve autonomous development through self-exploration and personal growth.

5.3 Recommendations

The recommendations from this study can be divided into two parts: suggestions for applying the research results and suggestions for future research. The specific recommendations are as follows:

5.3.1 Suggestions for Applying the Research Results

1) Education Department

The education department can play a key role in applying research findings. Firstly, the education department should reassess and adjust existing curriculum standards to incorporate environmental design and sustainable development concepts into the core curriculum framework. This not only helps cultivate students' environmental awareness but also ensures they possess the necessary sustainable design skills in their academic and professional careers. Additionally, the education department can encourage schools to develop and implement innovative teaching projects by formulating policies and providing financial support, thereby promoting interdisciplinary collaboration and resource sharing.

2) School Level

Administrators should actively respond to the policies set forth by the education department to promote the comprehensive implementation of environmental design education. Schools can establish dedicated sustainability offices responsible for coordinating and overseeing the progress of related projects. At the same time, schools should provide teachers and students with abundant learning resources and practical opportunities, such as hosting lectures, workshops, and competitions on environmental design, to inspire enthusiasm and innovation among the entire school community.

3) Teacher Level

Teachers play an important role in environmental design education, and they need to continually enhance their professional knowledge and teaching skills. Schools should provide regular training and development opportunities for teachers, enabling them to grasp the latest theories and technologies in environmental design. Moreover, teachers should actively adopt diverse teaching methods, such as project-based learning and case analysis, to improve students' learning outcomes and practical abilities. By establishing a cooperative network among teachers to share teaching experiences and resources, they can collectively enhance the quality of education.

4) Student Level

For students, environmental design education is not only about acquiring knowledge but also about developing skills. Schools should encourage students to participate in various activities and projects related to sustainable development, fostering their practical abilities and teamwork spirit. By providing career guidance and internship opportunities, students can gain better insight into the career prospects within the environmental design field and prepare for their future professional development. Students should also be encouraged to utilize online resources for self-directed learning, enhancing their environmental awareness and design capabilities.

5.4 Limitations of the Research

In this study, despite certain progress being made, there are still some shortcomings that require further exploration and improvement. Firstly, the sample range of the research is relatively limited, primarily focusing on interior design students in the Chengdu area, which may restrict the generalizability and broad applicability of the research conclusions. Secondly, although the current status and needs of students regarding environmental awareness were derived from questionnaire and interview analyses, the depth and breadth of data collection may be insufficient, failing to comprehensively capture the dynamic changes in students at different stages of learning. Furthermore, while suggestions for curriculum optimization and innovative teaching methods have been proposed, the new teaching model has yet to be experimentally validated in actual teaching environments; it has only been theoretically discussed through expert evaluations, which may affect its operability and effectiveness assessment in practical applications. Although school-enterprise cooperation has been emphasized as an important way to enhance students' practical abilities, achieving deep cooperation in the domestic context still faces numerous challenges, such as insufficient enterprise participation and imperfect cooperation mechanisms, which have not been adequately addressed in the research.

5.5 Recommendations for Future Research

To ensure the continuous improvement and application effectiveness of the research, future studies should focus on obtaining more comprehensive and diverse data. Researchers can conduct long-term tracking surveys and cross-cultural comparisons to analyze the effects and challenges of environmental design education in different contexts, engaging in longitudinal studies to capture the dynamic changes and developmental trajectories of students at various learning stages. Additionally, in terms of school-enterprise collaboration, it is essential to explore innovative cooperation models and mechanisms to ensure that enterprises can actively participate and provide substantial practical opportunities. Finally, by integrating emerging technologies such as virtual reality and augmented reality, the potential applications in environmental design

education should be explored to enhance students' learning experiences and outcomes.

REFERENCES

Abdallah, K. (2022). A Strategy for Teaching Interior Design Through Reality-Based Project (An Experiential study). *International Design Journal, 12*(4), 93-104.

Abdellatif, H. (2022). Environmental Education Through Shocking Photos: An Innovative Way of Creating Environmental Awareness. *Journal of Positive School Psychology, 6*(7), 4044-4057.

Abdullah, S. N. C., Khalil, N., Haron, S. N., Hamid, M. Y., & Yan, Y. (2023). Unveiling the Impact of Sustainable Interior Design Criteria on Hotel's Operational Performance Effectiveness and User's Hedonic Consumption. *International Journal of Sustainable Construction Engineering and Technology, 14*(3), 154-165.

Adomßent, M. (2013). Exploring universities' transformative potential for sustainability-bound learning in changing landscapes of knowledge communication. *Journal of Cleaner Production, 49*, 11-24.

Ahn, Y. H., Pearce, A. R., Wang, Y., & Wang, G. (2013). Drivers and barriers of sustainable design and construction: The perception of green building experience. *International Journal of Sustainable Building Technology and Urban Development, 4*(1), 35-45.

Akl, A. (2014). Problem Based Learning (PBL) in Teacher Education: A Review of the Effect of PBL on Pre-Service Teachers' Knowledge and Skills. *European Journal of Educational Sciences, 1*(1), 7-18.

Aktas, G. G. (2013). Design parameters and initiatives for ecological and green design in interior architecture. *WSEAS Transactions on Environment and Development, 9*(2), 57-67.

Alshuwaikhat, H. M., & Abubakar, I. (2008). An integrated approach to achieving campus sustainability: assessment of the current campus environmental management practices. *Journal of Cleaner Production, 16*(16), 1777-1785.

Ambarini, R., Faridi, A., Sukarno, S., & Yuliasri, I. (2023). Tadaluring Microteaching Learning Model: A Practical and Applicable Key to Improve Teacher Students'

Qualified Teaching Achievements. *International Journal of Research in Education and Science, 9*(2), 546-570.

Amran, A., Perkasa, M., Satriawan, M., Jasin, I., & Irwansyah, M. (2019). *Assessing students 21st century attitude and environmental awareness: promoting education for sustainable development through science education.* Paper presented at the Journal of Physics: Conference Series.

Anbalagan, G., & Shanthi, K. (2015). A study on environmental awareness and related practices among the high school students at Madurai district, Tamil Nadu. *Indian Streams Research Journal, 5*(9), 1-9.

Anwar, K., Sajid, M. R., Cahusac, P., Shaikh, A. A., Elgammal, A., Alshedoukhy, A., & Kashir, J. (2017). Can Facebook pages be a mode of blended learning to supplement in-class teaching in Saudi Arabia? *Advances in physiology education, 41*(3), 472-477.

Ao-tian, P. (2017). Reform and practice of the teaching content system based on the management course system of PBL. *Eurasia Journal of Mathematics, Science and Technology Education, 13*(7), 2897-2910.

Ariyanto, S. R., Hidayatullah, R. S., & Nurtanto, M. (2020). Practical Learning Innovation: Real Condition Video-Based Direct Instruction Model in Vocational Education. *Online Submission, 6*(1), 79-91.

Asojo, A. O. (2012). An instructional design for building information modeling (BIM) and revit in interior design curriculum. *Art, Design & Communication in Higher Education, 11*(2), 143-154.

Assali, I. M. (2017). The contribution of interior design studio in promoting sustainable design in Bahrain. *International Journal of Mechanical Engineering and Technology, 8*(10), 25-34.

Ayçiçek, B., & Yanpar Yelken, T. (2018). The Effect of Flipped Classroom Model on Students' Classroom Engagement in Teaching English. *International journal of instruction, 11*(2), 385-398.

Azimi, M. N., Rahman, M. M., & Nghiem, S. (2023). Linking governance with environmental

quality: a global perspective. *Scientific Reports, 13*(1), 15086.

Bergman, B. G. (2016). Assessing impacts of locally designed environmental education projects on students' environmental attitudes, awareness, and intention to act. *Environmental Education Research, 22*(4), 480-503.

Bhamra, T., & Lofthouse, V. (2016). *Design for sustainability: a practical approach*: Routledge.

Bilan, Y., Vasilyeva, T., Kryklii, O., & Shilimbetova, G. (2019). The creative industry as a factor in the development of the economy: dissemination of European experience in the countries with economies in transition. *Creativity Studies, 12*(1), 75-101.

Bo, L., Ding, X., & Wang, S. (2022). *A Comparative Analysis of Traditional Teaching and PBL Model.* Paper presented at the 2022 8th International Conference on Humanities and Social Science Research (ICHSSR 2022).

Bolscho, D., & Hauenschild, K. (2006). From environmental education to education for sustainable development in Germany. *Environmental Education Research, 12*(1), 7-18.

Bosio, E., & Waghid, Y. (2023). Cultivating students' critical consciousness through global citizenship education: Six pedagogical priorities. *Prospects*, 1-12.

Braun, T., Cottrell, R., & Dierkes, P. (2018). Fostering changes in attitude, knowledge and behavior: Demographic variation in environmental education effects. *Environmental Education Research, 24*(6), 899-920.

Brown, R., & Pressley, M. (2023). Self-regulated reading and getting meaning from text: The transactional strategies instruction model and its ongoing validation. In *Self-regulation of learning and performance* (pp. 155-179): Routledge.

Bunz, K. R., Henze, G. P., & Tiller, D. K. (2006). Survey of sustainable building design practices in North America, Europe, and Asia. *Journal of architectural engineering, 12*(1), 33-62.

Burt, C. (1962). The concept of consciousness. *British Journal of Psychology, 53*(3), 229-242.

Carless, D. (2007). The suitability of task-based approaches for secondary schools:

Perspectives from Hong Kong. *System, 35*(4), 595-608.

Celadyn, M. (2018). Adaptive reuse design method in a sustainable interior design model. *World Trans. on Engng. and Technol. Educ, 16*(4), 338-343.

Celadyn, M. (2019a). Green Building Awards as a tool for building knowledge of sustainable design of interior. *World Trans. on Engng and Technol. Educ, 17*(3), 254-259.

Celadyn, M. (2019b). Resource-efficient sustainable design as a leading interior design guideline. *Glob. J. Eng. Educ, 21*, 103-108.

Chand, V. S., & Shukla, S. (2003). Biodiversity contests': indigenously informed and transformed environmental education. *Applied Environmental Education and Communication/JTL>, 2*(4), 229-236.

Chawla, L. (2008). Participation and the ecology of environmental awareness and action. In *Participation and learning: Perspectives on education and the environment, health and sustainability* (pp. 98-110): Springer.

Chen, N., Tsay, Y., & Chiu, W. (2017). Influence of vertical greening design of building opening on indoor cooling and ventilation. *International Journal of Green Energy, 14*(1), 24-32.

Chen, X., Huang, B., & Lin, C.-T. (2019). Environmental awareness and environmental Kuznets curve. *Economic Modelling, 77*, 2-11.

Chen Xiangyi, C. Y. (2003). Background analysis of sustainable development theory. *lanzhou academic journal* (05), 37-39. Retrieved from https://kns.cnki.net/kcms2/article/abstract?v=bnuN6dG7iIBd81IM6d6mK72iznWnxLveUcp7DvFmHLCE7jxUIbwkHDLqpolPA355mc_k2pcWvOHq6ARFwjsLvR2YVU57luRKrl4JhagllyHboZKZZt25ri-_fYkhVLD4uBstT3LsrOk=&uniplatform=NZKPT&language=CHS

Cheng, X. (2023). A Learner-Centered Teaching Model. *Science Insights Education Frontiers, 15*(2), 2285-2286.

Cho, Y., & Park, K. S. (2023). Designing Immersive Virtual Reality Simulation for Environmental Science Education. *Electronics, 12*(2), 315.

Choi, S., Slaubaugh, M., & Tian, X. (2021). Integrating learning interpersonal skills through team-based learning (TBL) in a management course. *Journal of Education for Business, 96*(8), 498-509.

Choudhury, K. (2021). Non-Formal Environment al Education and NGO-School Link for Environmental Awareness and Protection. *RESEARCH REVIEW International Journal of Multidisciplinary, 6*(12), 75-81.

Chuanhui, Z., & Hanwei, Z. (2011). Cultivation of environmental values for university students under strategic background of environmental informationization. *Energy Procedia, 5*, 945-951.

Conglin, Z. (2023). Research on the sustainable development direction of residential design. *Popular Standardization*(20), 117-119. Retrieved from https://kns.cnki.net/kcms2/article/abstract?v=9w9hjx65dORYV-VxSy8KA1NRfDjOsErZsgu9AeCUdqAZ4qvGFUYbiFR8km9Ouv52w5ijpN8YMiCxpWilyCv2E47dOEWHB9-exXj92hGy5NGTfeANtM_ixS4ihXquDFquuWlftWYaTjUEGblm3bbv3Q==&uniplatform=NZKPT&language=CHS

Cotton, D. R. (2019). Implementing curriculum guidance on environmental education: The importance of teachers' beliefs. In *Curriculum and Environmental Education* (pp. 298-314): Routledge.

Dada, D. O., Eames, C., & Calder, N. (2017). Impact of environmental education on beginning preservice teachers' environmental literacy. *Australian Journal of Environmental Education, 33*(3), 201-222.

Danza, L., Barozzi, B., Bellazzi, A., Belussi, L., Devitofrancesco, A., Ghellere, M., . . . Scrosati, C. (2020). A weighting procedure to analyse the Indoor Environmental Quality of a Zero-Energy Building. *Building and Environment, 183*, 107155.

DiPaola, M., & Wagner, C. A. (2018). *Improving instruction through supervision, evaluation, and professional development*: IAP.

Dunlap, R. E. (2008). The new environmental paradigm scale: from marginality to worldwide use. *Journal of environmental education, 40*(1).

Ebreo, A., & Vining, J. (2001). How similar are recycling and waste reduction? Future orientation and reasons for reducing waste as predictors of self-reported behavior. *Environment and behavior, 33*(3), 424-448.

Education, M. o., Ren, S., & Dai, X. (2018). Notice of the Ministry of Education on issuing the "Key Points of Work of the Ministry of Education in 2018". In.

Elmore, L., Skelley, J., & Woolley, T. (2014). Impact of adapted team-based learning methods on student self-assessment of professionalism, teamwork, and skills in a self-care course. *Currents in Pharmacy Teaching and Learning, 6*(4), 488-493.

Eulefeld, G., & Shaw, G. (1991). Environmental education in the Federal Republic of Germany: a survey. *European Journal of Education, 26*(4), 301-306.

Fang, X. (2020). *Discussion on Green Interior Design Creativity Based on 3R Concept.* Paper presented at the IOP Conference Series: Earth and Environmental Science.

Feng, Y. (2019). Research on teaching reform of Interior design Basic curriculum system. *Industrial Design* (11), 38-39.

Fisman, L. (2005). The Effects of Local Learning on Environmental Awareness in Children: An Empirical Investigation. *Journal of environmental education, 36*(3).

Forgács, É. (1995). *The Bauhaus idea and Bauhaus politics*: Central European University Press.

Freeman, M. (2012). To adopt or not to adopt innovation: A case study of team-based learning. *The international journal of Management Education, 10*(3), 155-168.

Fu, L., Sun, Z., Zha, L., Liu, F., He, L., Sun, X., & Jing, X. (2020). Environmental awareness and pro-environmental behavior within China's road freight transportation industry: Moderating role of perceived policy effectiveness. *Journal of Cleaner Production, 252*, 119796.

Fu, L., Zhang, Y., & Bai, Y. (2017). Pro-environmental awareness and behaviors on campus: Evidence from Tianjin, China. *Eurasia Journal of Mathematics, Science and Technology Education, 14*(1), 427-445.

Fytopoulou, E., Karasmanaki, E., Tampakis, S., & Tsantopoulos, G. (2023). Effects of Curriculum on Environmental Attitudes: A Comparative Analysis of Environmental

and Non-Environmental Disciplines. *Education Sciences, 13*(6), 554.

Ganatsios, H. P., Filippou, A. F., Mpekiri, S., & Danahy, K. E. (2021). Education for cultivation of awareness as an important factor of raising environmental consciousness. *International Journal of Higher Education and Sustainability, 3*(3), 231-265.

Gao, Q., & Gu, Y. (2021). The concept of Sustainable Development in Interior Design. *Art and Design (Theory)*.

Garcia, E. C., & Luansing, B. (2016). Environmental awareness among select graduating college students in Region IV-A. *LPU-Laguna Journal of Multidisciplinary Research, 5*(1), 1-10.

Gibson, K. (2015). A Reflective Journey in Teaching Interior Design: The Virtual Studio. *The Handbook of Interior Design*, 524-537.

Goldman, D., Ayalon, O., Baum, D., & Weiss, B. (2018). Influence of 'green school certification'on students' environmental literacy and adoption of sustainable practice by schools. *Journal of Cleaner Production, 183*, 1300-1313.

Gopalan, C., & Klann, M. C. (2017). The effect of flipped teaching combined with modified team-based learning on student performance in physiology. *Advances in physiology education, 41*(3), 363-367.

Hadzigeorgiou, Y., & Skoumios, M. (2013). The Development of Environmental Awareness through School Science: Problems and Possibilities. *International Journal of Environmental and Science Education, 8*(3), 405-426.

Ham, M., Mr**Č**ela, D., & Horvat, M. (2016). Insights for measuring environmental awareness. *Ekonomski vjesnik: Review of Contemporary Entrepreneurship, Business, and Economic Issues, 29*(1), 159-176.

Handoyo, B., Astina, I., & Mkumbachi, R. (2021). *Students' environmental awareness and pro-environmental behaviour: preliminary study of geography students at state university of malang*. Paper presented at the IOP Conference Series: Earth and Environmental Science.

Hayyolalam, V., & Kazem, A. A. P. (2018). A systematic literature review on QoS-aware

service composition and selection in cloud environment. *Journal of Network and Computer Applications, 110*, 52-74.

Hoffman, L. (2011). Urban modeling and contemporary technologies of city - building in China: the production of regimes of green urbanisms. *Worlding cities: Asian experiments and the art of being global*, 55-76.

Hu, J., Hu, X., Shan, Z., & Wang, R. (2020). The Efficacy of PBL Model in Pathology and Pathophysiology Teaching in China: A Meta-analysis. *Indian Journal of Pharmaceutical Education and Research, 54*, 556-564.

Huang, J., Lucash, M. S., Simpson, M. B., Helgeson, C., & Klippel, A. (2019). *Visualizing natural environments from data in virtual reality: Combining realism and uncertainty.* Paper presented at the 2019 IEEE conference on virtual reality and 3D user interfaces (VR).

Huang, Y., Wang, J., & Yang, S. (2019). *Research and analysis on how to improve the awareness of environmental protection.* Paper presented at the IOP Conference Series: Earth and Environmental Science.

Inui, T., & Kato, H. (2002). Review of environmental policy and energy conservation policy in Japan. *Protecting the Global Environment: Initiatives by Japanese Business*, 23-46.

Jain, N., Burman, E., Robertson, C., Stamp, S., Shrubsole, C., Aletta, F., . . . Raynham, P. (2020). Building performance evaluation: Balancing energy and indoor environmental quality in a UK school building. *Building Services Engineering Research and Technology, 41*(3), 343-360.

Jia, Z. (2021). Research on the application of Sustainable development Concept in residential space design from the perspective of art. *Jushe*(28), 23-24. Retrieved from https://kns.cnki.net/kcms2/article/abstract?v=0m5erL8TawOVj_oPTpVWoxdVdWqaFNFxU5lOZItZOD_IFAhFfoznEjc4lLrKeuq9fcfYWF9qGkIOaqOyph6DkbsHKUu0RjedHoFKswbeOOCGdbYOl31v86v4b0bdAtshz6BXVgRz-IHUeGvGhxupfg==&uniplatform=NZKPT&language=CHS

Jiang, Z., & Wang, F. (2022). Study on environmental art design based on ecology concept. *Journal of Sensors, 2022*, 1-8.

Jiefeng, W., & Qianxian, L. (2020). Building Interior Design based on Sustainable development concept. *Jushe, Jushe*(02), 106. Retrieved from https://kns.cnki.net/kcms2/article/abstract?v=0m5erL8TawNzrTxEEgUOExzia2D-h-CVpKrNTksa-vaOFS1Q0nnwJJTNxoUYLlI3sJheu4t62HdOq6TPZWg0dmKIZVD4UTUyMgULkTFLX8f2UEAgMRVAkcKPpCWdBGkRg30Wi16zgBI7xldLUkUDGA==&uniplatform=NZKPT&language=CHS

Jingjin, L., & Jianjun, Y. (2022). Analysis of sustainable application aesthetics of decorative materials in indoor environment design. *china housing facilities*(10), 31-33. Retrieved from https://kns.cnki.net/kcms2/article/abstract?v=bnuN6dG7iIAXXDusSTFJRlRAjYl6YFKvS-uTaKdPlhESTLnPAAiFJkxTnQsWByJta6JFb8uy8NynnKJGtyzvobbGF2lfprsKKjzkSrFeOreKXgcxmi-0gUdwZbapfMayAOlhOeu6AfxPpA27tmNwzA==&uniplatform=NZKPT&language=CHS

Jones, L. (2008). *Environmentally responsible design: Green and sustainable design for interior designers*: John Wiley & Sons.

Joyce, B. R., Weil, M., & Wald, R. (1973). The teacher-innovator: Models of teaching as the core of teacher education. *Interchange, 4*(2-3), 47-60.

Jun, Y., & Meimei, X. (2013). Investigation on Environmental Awareness of Urban Residents in Fuzhou. *Research World, 10*, 21-24.

Kaletová, T., Mezeyová, I., Mezey, J., Bihuňová, M., Štěpánková, R., Tárník, A., . . . Candráková, K. (2022). Embedding Sustainability into the Education Process in the Faculty of Horticulture and Landscape Engineering, SUA in Nitra, Slovakia. *The Wiley Handbook of Sustainability in Higher Education Learning and Teaching*, 353-376.

Kartamiharja, M. R., Sopandi, W., & Anggraeni, D. (2020). Implementation of problem-

based learning (PBL) approach in chemistry instructional with context of tofu liquid waste treatment. *International Journal of Learning, Teaching and Educational Research, 19*(5), 47-77.

Kaur, M., & Sharma, L. (2019). An Insight into Teacher Education System in Japan: A Brief Historical Development and Current System. *International Journal of Reviews and Research in Social Sciences, 7*(2), 384-391.

Keitsch, M. (2012). Sustainable design: A brief appraisal of its main concepts. *Sustainable Development, 20*(3), 180-188.

Kestin, T., van den Belt, M., Denby, L., Ross, K., Thwaites, J., & Hawkes, M. (2017). Getting started with the SDGs in universities: A guide for universities, higher education institutions, and the academic sector.

Kikuchi-Uehara, E., Nakatani, J., & Hirao, M. (2016). Analysis of factors influencing consumers' proenvironmental behavior based on life cycle thinking. Part I: effect of environmental awareness and trust in environmental information on product choice. *Journal of Cleaner Production, 117*, 10-18.

Kim, J., & Kang, E. (2022). An Empirical Study of How Both Environmental Awareness and Interest in Artwork Can Be Incorporated into the Interior Design of Urban Hotels. *Sustainability, 14*(2), 1005.

Kirsch, C. J. (2020). A three-person teaching machine designed for crisis: The Geromat III in Berlin and Ulm. *IEEE Annals of the History of Computing, 42*(4), 39-52.

Kleespies, M. W., & Dierkes, P. W. (2022). The importance of the Sustainable Development Goals to students of environmental and sustainability studies—A global survey in 41 countries. *Humanities and Social Sciences Communications, 9*(1).

Knight, A. R., & Allan, C. (2021). Intentional Ecology: Integrating environmental expertise through a focus on values, care and advocacy. *Humanities and Social Sciences Communications, 8*(1), 1-9.

Kolmos, A., Holgaard, J. E., & Clausen, N. R. (2021). Progression of student self-assessed learning outcomes in systemic PBL. *European Journal of Engineering Education, 46*(1), 67-89.

Kopnina, H. (2018). Education for sustainable development (ESD): The turn away from 'environment'in environmental education? In *Environmental and sustainability education policy* (pp. 135-153): Routledge.

Kotzias, D., & Pilidis, G. (2017). Building design and indoor air quality-experience and prospects. *Fresenius Environmental Bulletin, 26*(1), 323-326.

Krismadinata, U. V., Jalinus, N., Rizal, F., Sukardi, P. S., Ramadhani, D., Lubis, A. L., . . . Novaliendry, D. (2020). Blended learning as instructional model in vocational education: literature review. *Universal Journal of Educational Research, 8*(11B), 5801-5815.

Kuang, Y. (2021). Research on the teaching reform path of "Interior Design" course for Environmental design majors in universities. *Beauty and The Times (Part 1)*(04), 119-120. doi:10.16129/j.cnki.mysds.2021.04.043

Kuppusamy, S., & Mari, T. (2017). *Relationship between environmental awareness and environmental knowledge using "AKASA" model among architecture students in private universities, Klang Valley, Malaysia.* Paper presented at the 2017 2nd International Conference on Knowledge Engineering and Applications (ICKEA).

KUTS, T., & MAKARCHUK, O. (2023). ENVIRONMENTAL AWARENESS OF STUDENTS OF NATIONAL UNIVERSITY OF LIFE AND ENVIRONMENTAL SCIENCES (NULES) OF UKRAINE IN THE CONTEXT OF MODERN CHALLENGES. *Scientific Papers Series Management, Economic Engineering in Agriculture & Rural Development, 23*(2).

Larson, M. B., & Lockee, B. B. (2019). *Streamlined ID: A practical guide to instructional design*: Routledge.

Leerberg, M., Riisberg, V., & Boutrup, J. (2010). Design responsibility and sustainable design as reflective practice: An educational challenge. *Sustainable Development, 18*(5), 306-317.

Lestari, H., & Siskandar, R. (2021). Cultivating green behavior of eco literation-based elementary school students during the covid-19 pandemic. *Jurnal Penelitian Pendidikan IPA, 7*(1), 49-53.

Li, D., Zhao, L., Ma, S., Shao, S., & Zhang, L. (2019). What influences an individual's pro-

environmental behavior? A literature review. *Resources, Conservation and Recycling, 146*, 28-34.

Li, N. (2022). The application of sustainable design concept in interior design. *China Architectural Decoration*(01), 57-58. Retrieved from https://kns.cnki.net/kcms2/article/abstract?v=9w9hjx65dOQCZkbR1uJhaHgFkukFDB4KkebJo3-Glom3KFbcBXn0xT5ue64tRZyRNJJkcAw-rqlmojScJ7t-J2gPJbqjHu3sk0HOb5qCpGhDPphZa4chcuGDUf1bWiK7T9xlpy_hFq7-8_3dbpHBQw==&uniplatform=NZKPT&language=CHS

Li, R., & Antiohos, A. (2021). *Problem Based Learning (PBL) in four-week term block mode teaching.* Paper presented at the 2021 IEEE Global Engineering Education Conference (EDUCON).

Li, W. (2023). Effective application of sustainable design concept in interior design. *Popular literature and art* (04), 31-33. Retrieved from https://kns.cnki.net/kcms2/article/abstract?v=bnuN6dG7iIBxSvvzPRiGfdLZmpNt6ZA3ALXeluEEKp4cKbce1R9EPiC5xS67y7XXjYY_BFs3ttevVsp-iAyi82XVbXTzsUsJvCyc_aiB2msYqdopgZ8vaEp7TwlOPbqk0t6n_eEMsKPgbu0M9JTwCg==&uniplatform=NZKPT&language=CHS

Li, Y. (2018). Study of the effect of environmental education on environmental awareness and environmental attitude based on environmental protection law of the People's Republic of China. *Eurasia Journal of Mathematics, Science and Technology Education, 14*(6), 2277-2285.

Li, Y., & Zong, M. (2021). *The Influence of Technological Progress on the Future Development of Design Teaching.* Paper presented at the 7th International Conference on Arts, Design and Contemporary Education (ICADCE 2021).

Liang, L., Huang, X., Huang, F., Yuan, M., & Liu, X. (2022). The Reform of GIS Practice Curriculum for Geography Science (Normal) Major Integrating Geographic Big Data and Multi-track Teaching Mode. *The Educational Review, USA, 6*(9), 473-481.

Liu Lanfang , L. J. (2017). Research on Geography Teaching and Cultivation of Middle School Students' Environmental Awareness. *Journal of Hengyang Teachers*

College, 38(06), 67-72. doi:10.13914/j.cnki.cn43-1453/z.2017.06.012

Liu, S., Chen, F., & Zhang, J. (2020). Research on the "four-in-one" mode of Promoting the integration of production and education based on industry-university-research. *Education in Heilongjiang (Theory and Practice)*.

Liu, S., Zhu, F., & Ma, Y. (2021). A practical research on Interior design curriculum teaching mode under the background of integration of industry and education. *Journal of Jinan Vocational College*.

Liu, X. (2010). Concept, development and practice of sustainable design. *Creat. Des.(2)*, 38-41.

Long, L. (2023). Research on the Application of TBL Teaching Method in Mathematics Teaching in Secondary Vocational Schools. *Scientific Consultation (Education and Research)* (07), 145-147. Retrieved from https://kns.cnki.net/kcms2/article/abstract?v=bnuN6dG7iIAr8O6aYg3w0eFac77nxnrKcorh5cNlEd0L4MrmA0IfKqX3osptvBVVtVien8ES1d8LBCWzmf02RfEeps4bQT-RFv4sbzFJwpVF5zy_uTnjgiL_E8caOtp2fpjq8vn07200nKnHmblOpg==&uniplatform=NZKPT&language=CHS

Lozano, R. (2006). Incorporation and institutionalization of SD into universities: breaking through barriers to change. *Journal of Cleaner Production, 14*(9-11), 787-796.

Lubo. (2023). Application of sustainable building materials in modern interior design. *Jushe*(31), 12-14. Retrieved from https://kns.cnki.net/kcms2/article/abstract?v=bnuN6dG7iIAzSkR9RlQa33D1tWjoNFhE8dq5jFsgp9XFJM3jKXSRadlpUzZzXPeLNj_9XbECVJa4VVliAP9xY1LZd02lVRWQ_lyEnKOkWmwXPG04E8wtEf2JP9lUH4ZYVoG6gwqa82kdaqX8m7M7Bw==&uniplatform=NZKPT&language=CHS

Ma, J., Liu, Y., Wu, Z., & Guo, K. (2019). Exploration on the Cultivation of College Students' Environmental Protection Awareness under the Background of Ecological Civilization. *DEStech Trans. Soc. Sci. Educ. Hum. Sci*, 43-48.

Makhtar, S. Z., Amirah, A., Ab Wahab, M., Hassan, Z., & Hamid, S. (2021). *Study of environmental awareness, practices and behaviours among UniMAP students.* Paper presented at the IOP Conference Series: Earth and Environmental Science.

Makransky, G., & Petersen, G. B. (2021). The cognitive affective model of immersive learning (CAMIL): A theoretical research-based model of learning in immersive virtual reality. *Educational Psychology Review*, 1-22.

Maloney, M. P., & Ward, M. P. (1973). Ecology: Let's hear from the people: An objective scale for the measurement of ecological attitudes and knowledge. *American psychologist, 28*(7), 583.

Manzini, E. (2007). Design research for sustainable social innovation. In *Design research now: Essays and selected projects* (pp. 233-245): DE GRUYTER.

Mao, W. S. (2014). Study on the advantages and role of soft decoration materials in shaping the indoor environment art atmosphere. *Applied Mechanics and Materials, 644*, 4896-4899.

Margolin, V. (1998). Design for a sustainable world. *Design issues, 14*(2), 83-92.

Maria, Irham, Hartono, S., & Rahayu Waluyati, L. (2022). The effect of environmental awareness on motivation in adopting farming conservation techniques in the various agro-ecological zones: a case study in critical land of Java Island, Indonesia. *Environment, Development and Sustainability, 24*(2), 1878-1896.

Mawsally, D. A., & Sudarmilah, E. (2019). A Virtual-Reality Edu-Game: Save The Environment from the Dangers of Pollution. *Khazanah Informatika: Jurnal Ilmu Komputer dan Informatika, 5*(2), 140-145.

McGee, B., Park, N. K., Portillo, M., Bosch, S., & Swisher, M. (2019). DIY Biophilia: development of the Biophilic Interior Design Matrix as a design tool. *Journal of Interior Design, 44*(4), 201-221.

Mei, N. S., Wai, C. W., & Ahamad, R. (2016). Environmental awareness and behaviour index for Malaysia. *Procedia-Social and Behavioral Sciences, 222*, 668-675.

Mei, N. S., Wai, C. W., & Ahamad, R. (2017). Public environmental awareness and behaviour in Malaysia. *Asian Journal of Quality of Life, 2*(5), 43-53.

Meipry, A., & Sudibyo, Y. A. (2023). The effect of environmental awareness, the role of accountants, and sustainable development on climate change. *Technium Soc. Sci. J., 39*, 716.

Mengyao, Q., & Bin, H. (2023). Research on the application of participatory teaching in the construction of a new practical teaching mode of "social investigation+ideological and political education". *Taste Classics*(19), 132-135. Retrieved from https://kns.cnki.net/kcms2/article/abstract?v=bnuN6dG7iICXcaNFgXXGmRXbSdrJ_YTH4FRmeAizelo0qKRsT_SC629sneA_UyS_ZLO6wnYvmmYdRj8gvUAvRtOckkhzouEcJ1P7eWrfOKvaq0-NeWDWI9bT5zphPqrdXxjreNBYYyO6AVYYeHLtNg==&uniplatform=NZKPT&language=CHS

Meyer, M. W., & Norman, D. (2020). Changing design education for the 21st century. *She Ji: The Journal of Design, Economics, and Innovation, 6*(1), 13-49.

Mitcham, C. (2022). *Thinking through technology: The path between engineering and philosophy*: University of Chicago Press.

Mitton, M., & Nystuen, C. (2021). *Residential interior design: A guide to planning spaces*: John Wiley & Sons.

Mohsen, M. S., & Matarneh, R. (2023). Exploring the Interior Designers' Attitudes toward Sustainable Interior Design Practices: The Case of Jordan. *Sustainability, 15*(19), 14491.

Morrison, G. R., Ross, S. J., Morrison, J. R., & Kalman, H. K. (2019). *Designing effective instruction*: John Wiley & Sons.

Moya, T. A., van den Dobbelsteen, A., Ottele, M., & Bluyssen, P. M. (2019). A review of green systems within the indoor environment. *Indoor and built environment, 28*(3), 298-309.

Nations, U. (2015). Transforming our world: The 2030 agenda for sustainable development. *New York: United Nations, Department of Economic and Social Affairs*.

Novotný, R., Huttmanová, E., Valentiny, T., & Kalistová, A. (2021). Evaluation of environmental awareness of university students: The case of the university of Presov, Slovakia. *European Journal of Sustainable Development, 10*(2), 59-59.

Nursimloo, S., Ramdhony, D., & Mooneeapen, O. (2020). Influence of board characteristics

on TBL reporting. *Corporate Governance: The International Journal of Business in Society, 20*(5), 765-780.

Oğuz, D., Çakci, I., & Kavas, S. (2010). Environmental awareness of university students in Ankara, Turkey. *African Journal of Agricultural Research, 5*(19), 2629-2636.

Oh, J.-Y., & Kim, M.-H. (2009). A Comparison of the Awareness and Preferences of Interior Designers and Housewives for Environment Friendly Interior Finishing Materials in Apartments. *Journal of the Korean housing association, 20*(1), 19-26.

Orthel, B. D. (2015). Implications of design thinking for teaching, learning, and inquiry. *Journal of Interior Design, 40*(3), 1-20.

Parrish, C. W., Williams, D. S., & Estis, J. M. (2021). Integrated online team - based learning: Using synchronous engagement and asynchronous flexibility to implement TBL online. *New Directions for Teaching and Learning, 2021*(165), 91-105.

Pastore, L., & Andersen, M. (2019). Building energy certification versus user satisfaction with the indoor environment: Findings from a multi-site post-occupancy evaluation (POE) in Switzerland. *Building and Environment, 150*, 60-74.

Petermans, A., & Cain, R. (2019). *Design for wellbeing: An applied approach*: Routledge.

PF, K. A. P. D. (2017). The Empowerment Of Role Of The Family In Developing Character Of Environmental Awareness In Elementary School-Age Children. *Vidyottama Sanatana: International Journal of Hindu Science and Religious Studies, 1*(1), 77-83.

Pikkarainen, E. (2012). Signs of reality: the idea of general Bildung by JA Comenius. In *Theories of Bildung and Growth* (pp. 19-29): Brill.

Pujie, Q., & Fenghua, W. (2022). Research on the Application of Green Concept in Modern Household Product Design. *Industrial Design*(02), 100-102. Retrieved from https://kns.cnki.net/kcms2/article/abstract?v=bnuN6dG7ilCVgEa-goTuuu7dUO3XOmw1tnI3EqD5alTdUsq2FGzUlsOrc2ZlE1S4LbpThUEgX3c89XDK1vLj-5GfUOdwGae0OY1erGtw5VX64Xm_Azlxz-hgitmpHm6bvPmEOzgIbcjNFxKYXTW5Rg==&uniplatform=NZKPT&language=CHS

Qin, J. (2020). *Research on minimalism interior design based on the concept of sustainable development.* Xi 'an University of Architecture and Technology,

Rashdan, W. (2016). The impact of innovative smart design solutions on achieving sustainable interior design. *WIT Transactions on Ecology and the Environment, 204*, 623-634.

Rashdan, W., & Ashour, A. F. (2017). Criteria for sustainable interior design solutions. *WIT Transactions on Ecology and the Environment, 223*, 311-322.

Rasoulinezhad, E., & Taghizadeh-Hesary, F. (2022). Role of green finance in improving energy efficiency and renewable energy development. *Energy Efficiency, 15*(2), 14.

Ravimohan, A. (2021). *Ways of Teaching—Simulating Real-Life Scenarios into Twenty-First Century Interior Design Education.* Paper presented at the Design for Tomorrow—Volume 2: Proceedings of ICoRD 2021.

Redman, E., & Redman, A. (2014). Transforming sustainable food and waste behaviors by realigning domains of knowledge in our education system. *Journal of Cleaner Production, 64*, 147-157.

Renhua, Z. (2014). Research on the education of sustainable product design for industrialization-based on the realistic thinking of the disconnection between design education and design industrialization. *Ecological Economy (Academic Edition)*(02), 75-78. Retrieved from https://kns.cnki.net/kcms2/article/abstract?v=9w9hjx65dORlxZu07jabvz2WjjbB4qTNtUBKFZa2ShOH8YkOX1OgHSUgwyYL8Y8CQdO2inEXAI6Spk2awPt92NnBXzoVOeRptxAfHhxRhKjvo7wmG2ZdObqNZS3QL_Z6-E4OKG7-h-0=&uniplatform=NZKPT&language=CHS

Rhein, D. (2018). African American student sociocultural adjustment to Thai international higher education. *Globalisation, Societies and Education, 16*(4), 381-394.

Roessingh, H. (2014). TBL and teacher preparation: Toward a curriculum for pre-service teachers. *TESL Canada Journal*, 157-157.

Rosenthal, D. M. (1998). Two concepts of consciousness. In *Consciousness and Emotion*

in Cognitive Science (pp. 1-31): Routledge.

Ruijia, W. (2023). Ecological residential landscape design based on sustainable development. *Modern horticulture, 46*(14), 87-89. doi:10.14051/j.cnki.xdyy.2023.14.035

Saari, A., & Mullen, J. (2020). Dark places: Environmental education research in a world of hyperobjects. *Environmental Education Research, 26*(9-10), 1466-1478.

Salman, M., Fobler-Cressy, P., Habib, R., Elkady, D., & Mohammed, G. (2021). Remote Synchronous Delivery for Interior Design Education: The Shift Toward Innovative Paradigms in Design Teaching Approaches. *Teaching in the Post COVID-19 Era: World Education Dilemmas, Teaching Innovations and Solutions in the Age of Crisis*, 281-289.

Sannathimmappa, M. B., Nambiar, V., Aravindakshan, R., & Kumar, A. (2022). Are Online Synchronous Team-Based-Learning (TBL) pedagogy effective?: Perspectives from a study on medical students in Oman. *Journal of Advances in Medical Education & Professionalism, 10*(1), 12.

Saputra, M. D., Joyoatmojo, S., Wardani, D. K., & Sangka, K. B. (2019). Developing critical-thinking skills through the collaboration of jigsaw model with problem-based learning model. *International journal of instruction, 12*(1), 1077-1094.

Schild, R. (2016). Environmental citizenship: What can political theory contribute to environmental education practice? *The Journal of Environmental Education, 47*(1), 19-34.

Schmidt, M. (2010). Learning from teaching experience: Dewey's theory and preservice teachers' learning. *Journal of research in music education, 58*(2), 131-146.

Sengupta, M., Das, J., & Maji, P. K. (2010). Environmental awareness and environment related behaviour of twelfth grade students in Kolkata: Effects of stream and gender. *Anwesa, 5*(1), 1-8.

Sethusha, M. J., & Lumadi, M. W. (2013). Grade six learners' perceptions of environmental awareness: A human ecological support programme. *Journal of Human Ecology, 42*(2), 113-123.

Shan, C., & Shixiu, B. (2022). Thematic unit teaching design and practice based on core literacy-taking the theme of steady, balanced and sustainable development of ecosystem as an example. *Biology Bulletin, 57*(07), 23-27. Retrieved from https://kns.cnki.net/kcms2/article/abstract?v=bnuN6dG7ilCoVGKQO9ccCNQOPWBvzt3mdnsbVgNjoINdeVEJeeRFR4Fh7v9wiHRFQOWg_CfEk3iOXwwoQiCUT0k4ZsLQsJgf6lbS42VMbRS_auFSeur5QIudvUROoLUIu6NJmVWxdS3TYNE-m_d6Hw==&uniplatform=NZKPT&language=CHS

She, L. (2021). Application Strategies of Digital Technology in the Teaching of Interior Design. *Journal of Contemporary Educational Research, 5*(10), 53-56.

Shelest, K. D., Ionov, V. V., & Tikhomirov, L. Y. (2017). Environmental awareness raising through universities–city authorities' cooperation. *International Journal of Sustainability in Higher Education, 18*(1), 39-49.

Shen, G., & An, Y. (2022). Influencing factors of psychological stress under the mixed teaching mode based on SPOC+ PBL. *Frontiers in Psychology, 13*, 979206.

Sivamoorthy, M., Nalini, R., & Kumar, C. (2013). Environmental awareness and practices among college students. *International Journal of Humanities and Social Science Invention, 2*(8), 11-15.

Solomon, U. U. (2010). A detailed look at the three disciplines, environmental ethics, law and education to determine which plays the most critical role in environmental enhancement and protection. *Environment, Development and Sustainability, 12*, 1069-1080.

Song, L. (2022). The problem-based learning mode for teaching English to college students. *International Journal of Continuing Engineering Education and Life Long Learning, 32*(5), 640-649.

Sonu, D., & Snaza, N. (2015). The fragility of ecological pedagogy: Elementary social studies standards and possibilities of new materialism. *Journal of Curriculum and Pedagogy, 12*(3), 258-277.

Sormunen, K., Juuti, K., & Lavonen, J. (2020). Maker-centered project-based learning in inclusive classes: Supporting students' active participation with teacher-directed

reflective discussions. *International Journal of Science and Mathematics Education, 18*, 691-712.

Sorrento, L. (2012). A natural balance: Interior design, humans, and sustainability. *Journal of Interior Design, 37*(2), 9-24.

Sparke, P. (2019). *An introduction to design and culture: 1900 to the present*: Routledge.

Sue, S., & Okazaki, S. (2022). Asian-American educational achievements: A phenomenon in search of an explanation. In *The New Immigrants and American Schools* (pp. 297-304): Routledge.

Sully, A. (2015). *Interior design: Conceptual basis*: Springer.

Sun, B. (2021). A brief discussion on the application and practice of sustainable design concept in environmental design majo. *Mass standardization*.

Sun, G., & Zhuang, Q. (2022). *The Application of the PBL Teaching Model in Chinese Primary School.* Paper presented at the 2022 8th International Conference on Humanities and Social Science Research (ICHSSR 2022).

Sunikka‐Blank, M., & Iwafune, Y. (2011). Sustainable building in Japan–observations on a market transformation policy. *Environmental Policy and Governance, 21*(5), 351-363.

Sunlin, & LAN, Q. (2008). The application of interactive inquiry teaching mode in physical education and health curriculum. *Sports World (Academic Edition)*(02), 43-45. doi:10.16730/j.cnki.61-1019/g8.2008.02.027

Supena, I., Darmuki, A., & Hariyadi, A. (2021). The Influence of 4C (Constructive, Critical, Creativity, Collaborative) Learning Model on Students' Learning Outcomes. *International journal of instruction, 14*(3), 873-892.

Szeberenyi, A., Lukacs, R., & Papp-Váry, Á. (2022). Examining environmental awareness of university students. *Eng. Rural Dev, 21*, 604-611.

Tadena, M. T. G., & Salic-Hairulla, M. A. (2021). *Raising environmental awareness through local-based environmental education in STEM lessons.* Paper presented at the Journal of Physics: Conference Series.

Tang, Q., Yu, Y., Jiang, Q., Zhang, L., Wang, Q., & Huang, M. (2008). The Feasibility of

Applying PBL Teaching Method to Surgery Teaching of Chinese Medicine. *International education studies, 1*(4), 110-113.

Taulien, A., Paulsen, A., Streland, T., Jessen, B., Wittke, S., & Teistler, M. (2019). A mixed reality environmental simulation to support learning about maritime habitats: An approach to convey educational knowledge with a novel user experience. In *Proceedings of Mensch und Computer 2019* (pp. 921-925).

Tedjokoesoemo, P. E. D., Nilasari, P. F., & Sari, S. M. (2022). Interior Design Students Perception on Interior Health and Comfort in Shop House Design for New Normal Era. *GATR Journal of Business and Economics Review (GATR-JBER), 6*(4), 1-9.

Theodorou, P., Kydonakis, P., Botzori, M., & Skanavis, C. (2018). Augmented reality proves to be a breakthrough in Environmental Education. *Protection and Restoration of the Environment, 7*, 219-228.

Toma, R. B., & Greca, I. M. (2018). The effect of integrative STEM instruction on elementary students' attitudes toward science. *Eurasia Journal of Mathematics, Science and Technology Education, 14*(4), 1383-1395.

Urban, W. J., Wagoner Jr, J. L., & Gaither, M. (2019). *American education: A history*: Routledge.

Usher, M., Hershkovitz, A., & Forkosh‐Baruch, A. (2021). From data to actions: Instructors' decision making based on learners' data in online emergency remote teaching. *British Journal of Educational Technology, 52*(4), 1338-1356.

Valderrama-Hernández, R., Alcántara, L., & Limón, D. (2017). The complexity of environmental education: teaching ideas and strategies from teachers. *Procedia-Social and Behavioral Sciences, 237*, 968-974.

Vallet, F., & Tyl, B. (2020). Implementation of an eco-innovation toolbox to stimulate design teams: a case of interior design. *Procedia CIRP, 90*, 334-338.

Vieira-Sbruzzi, R., Ferreira, C., Barbosa, T., & Borges, R. (2021). *Architecture and education:" project based learning" as a teaching strategy and learning of project in the interior design course of the federal institute of são paulo, brazil.* Paper presented at the EDULEARN21 Proceedings.

Volk, T. L., Hungerford, H. R., & Tomera, A. N. (1984). A national survey of curriculum needs as perceived by professional environmental educators. *The Journal of Environmental Education, 16*(1), 10-19.

Wang, N., Yu, C., & Wu, J. (2015). *Green design, low carbon environmental protection-the only way for sustainable development design.* Paper presented at the 2015 International Forum on Energy, Environment Science and Materials.

Wang, S. (2016). *Research on the Teaching of Display Design in Interior Design.* Paper presented at the 2016 International Conference on Economics, Social Science, Arts, Education and Management Engineering.

Wenjia, L. (2017). *Research on Constructing Internet Plus Teaching Resource Database of Interior Design of Higher Vocational Colleges and Design Proposal.* Paper presented at the 2017 International Conference on Smart Grid and Electrical Automation (ICSGEA).

Werner, S., & Long, P. (2002). *Cognition meets Le Corbusier—Cognitive principles of architectural design.* Paper presented at the International Conference on Spatial Cognition.

Widyastuti, F., Probosari, R. M., & Saputro, S. (2020). *Developing environmental awareness through experiential learning: A critical analysis of higher education students' practices.* Paper presented at the Journal of Physics: Conference Series.

Wilson, S. (2003). *Information arts: intersections of art, science, and technology*: MIT press.

Wirth, C. (2010). The Nexus between Traditional and Non-traditional Security Cooperation in Japan-China Relations: environmental security and the construction of a Northeast Asian region. *Asian Regional Integration Review, 2*, 69-86.

Xi, J., & Wang, X. (2022). Development of landscape architecture design students' pro-environmental awareness by project-based learning. *Sustainability, 14*(4), 2164.

Xiaoyu, G. (2016). Application and evaluation of operational research course teaching under PBL+LBL dual-track mode. *Science and Technology Vision*(11), 47+49. doi:10.19694/j.cnki.issn2095-2457.2016.11.025

Xiong, Y. (2021). *The Development of the Project-based-learning Teaching Method.* Paper presented at the 2021 5th International Seminar on Education, Management and Social Sciences (ISEMSS 2021).

Yadav, S. (2023). Cultivating Sustainable Behavior and Critical Consciousness Towards the Environment: Environmental Education for Sustainability. *The Impact of Climate Change and Sustainability Standards on the Insurance Market*, 333-348.

Yan, J., & Feng, C. (2014). Sustainable design-oriented product modularity combined with 6R concept: a case study of rotor laboratory bench. *Clean Technologies and Environmental Policy, 16*, 95-109.

Yan, Z. (2022). Research on three-dimensional art greening design. *Highlights in Art and Design, 1*(3), 1-4.

Yeler, G. M. (2015). Creating nature awareness in design education. *Procedia-Social and Behavioral Sciences, 174*, 406-413.

Yildiz, Y., & Budur, T. (2019). Introducing environmental awareness to college students with curricular and extracurricular activities. *International journal of Academic Research in business and Social Sciences, 9*(3), 667-675.

Ying, X. (2020). Strategies and ways to cultivate environmental awareness in preschool education-Comment on "The Crisis of Fresh Water Drying Up". *Water Resources and Hydropower Technology, 51*(04), 236-237. Retrieved from https://kns.cnki.net/kcms2/article/abstract?v=bnuN6dG7ilAwC4p7yrNMVwXyhgfPENfZd9xZgX5K82_DEkNmufnjmAXLww-_juswt3eJ2MwSORuVIPSVltXjOUxo7nrE2Zji2EjqPtAS1MlUyZdo1LC8malkKrIJrb3F610AxMHr5F7w1Os4d_rmRA==&uniplatform=NZKPT&language=CHS

Yingchao, L., Masahiko, F., & Peng, W. (2011). Study on comparison of citizens' environmental awareness among four cities in China and Japan. *Management Science and Engineering, 5*(3), 126.

Yinle, Y. (2023). The effect of TBL teaching method based on rain classroom in physiology teaching. *China Continuing Medical Education, 15*(04), 74-77. Retrieved from https://kns.cnki.net/kcms2/article/abstract?v=bnuN6dG7ilB5ckC-

QPubuoVT1iGTp9FFbDOGUnVRZBFEA8MHviBm1KHi24CgT00bq3YyMe5bl71EqMMdgafJwi-tqfsIUOLU7XliOMhRniw6hDV9Akx2Snrt-jtdSA3Ne4URqtHabAK9xmwYU7s2dg==&uniplatform=NZKPT&language=CHS

Yishao, Y. (2023). Effective application of sustainable design concept in interior design. *Jushe*(17), 27-29. Retrieved from https://kns.cnki.net/kcms2/article/abstract?v=bnuN6dG7iIDDwKMvrbdG1rEWJ6TYh4niyOiTMgBK305zrX-YK36MO5A8VM9oh5MJax1lt5LRrnWq-Yt44e2n4MasghfXLeAkjYVDgEGMwyl_R9bsDFFQPiYYSETE1Z_ZDEouoHUPE-CRe6E3NeOUuw==&uniplatform=NZKPT&language=CHS

Yu, Z. (2021). Focus on the context of the times —— Documentary of the roundtable forum on "New Design Trends and Green Material Selection" of China Building Decoration Industry High-quality Sustainable Development Conference. *China Building Decoration*(08), 16-20. Retrieved from https://kns.cnki.net/kcms2/article/abstract?v=bnuN6dG7iIC_zrH2Da2AAw90Pb7o8nBhflYfDNTNIuzwRR24oMI2Q3ztt48rGWKU2HTtO8kPE30SuGlOofcchk7ilkz9BPxH3AknOJpX4ju-p65gg8w1-Nl_t69VgzcsEFibvVXcCXCy9jYiiEHU3w==&uniplatform=NZKPT&language=CHS

Yudelson, J., & Meyer, U. (2013). *The world's greenest buildings: Promise versus performance in sustainable design*: Routledge.

Yunikawati, N. A., & Tuanani, M. A. M. (2022). TBL vs. PBL: Which is More Effective Model in Economics Learning? *Jurnal Pendidikan Ekonomi Dan Bisnis (JPEB), 10*(2), 181-192.

Yunqi, Z. (2022). Application of Sustainable Design Concept in Interior Design. *Architecture and Budget*(10), 46-48. doi:10.13993/j.cnki.jzyys.2022.10.016

Zhang, B., & Song, T. B. (2020). *Research on green design based on humanized design.* Paper presented at the 2020 3rd International Conference on Humanities Education and Social Sciences (ICHESS 2020).

Zhang, X.-Y. (2015). *Research on the application of ecological environment materials in interior design.* South China University of Technology,

Zhao, H.-h., Gao, Q., Wu, Y.-p., Wang, Y., & Zhu, X.-d. (2014). What affects green

consumer behavior in China? A case study from Qingdao. *Journal of Cleaner Production, 63*, 143-151.

Zhen, H. (2016). *Teaching Reform and the Method of Interior Design for The Higher College.* Paper presented at the 2016 International Conference on Education, Sports, Arts and Management Engineering.

Zhencheng, C. (2020). Evolution of System Design Concept for Sustainability: From Product System to Socio-technical System. *Decoration*(06), 113-115. doi:10.16272/j.cnki.cn11-1392/j.2020.06.068

Zheng, L., & Wen, Y. (2023). Research on PBL+ LBL Mixed Teaching Mode of Intermediate Econometrics. *Academic Journal of Management and Social Sciences, 5*(2), 152-155.

Zhiyu, L. (2012). Study on the cultivation of college students' science and technology innovative ability in electrotechnics teaching based on PBL mode. *ieri Procedia, 2*, 287-292.

Zhou, M. (2013). A multidimensional analysis of public environmental concern in Canada. *Canadian Review of Sociology/Revue canadienne de sociologie, 50*(4), 453-481.

Zhukov, D., Alayrac, J.-B., Cinbis, R. G., Fouhey, D., Laptev, I., & Sivic, J. (2019). *Cross-task weakly supervised learning from instructional videos.* Paper presented at the Proceedings of the IEEE/CVF Conference on Computer Vision and Pattern Recognition.

Zsóka, Á., Szerényi, Z. M., Széchy, A., & Kocsis, T. (2013). Greening due to environmental education? Environmental knowledge, attitudes, consumer behavior and everyday pro-environmental activities of Hungarian high school and university students. *Journal of Cleaner Production, 48*, 126-138.

Zwanch, K., Carter, H. C., & Davenport, J. (2023). Translating units coordination to units of length and area: a case study of undergraduate interior design students. *Research in Mathematics Education*, 1-18.

APPENDIX

Appendix A

List of Experts for Evaluating Research Tools and Competency Assessment

and List of Participating Schools

List of Experts in Research Tools and Capability Assessment

1 Dr.Atiyot Sankuranurak

Department of Art Education, Faculty of Fine Arts, SWU.

2 Dr.Suebsai Sangwachirapiban

Department of Visual Design , Faculty of Fine Arts, SWU.

3. Professor Shen Hongzhao

Expert in Sustainable Education Management

Position: Chief Architect and Professor at the Architecture Survey and Design Institute of Southwest Jiaotong University, China

4. Professor Rao Jianhua

Expert in Arts Education

Position: Director and Professor at the Graduate School of Sichuan Conservatory of Music, China

5. Professor Wei Daping

Expert in Educational Management

Position: Deputy Dean and Professor of the Department of Architecture at Sichuan University of Architecture and Technology

List of Experts for Evaluating the Applicability and Feasibility of Teaching Models

1. Experts in Environmental Design Curriculum Reform and Best Practice Educators

1.1. Professor Luo Xue

Position: Professor and Assistant Dean at Sichuan University of Commerce, Partner at Sichuan Qingjing Hall Decoration Design Co., Ltd.

1.2. Associate Professor Peng Huaji

Position: Associate Professor at Sichuan University of Commerce, Design Director at Sichuan Jiangan Environmental New Materials Co., Ltd.

2. Experts and Managers in Sustainable Design Practices

2.1. Dai Bo

Position: Director of the Architectural Design Institute at China Railway No. 2 Engineering Bureau

2.2. Zhao Shiguang

Position: Founder and Design Director of Chengdu Yize Architectural Design Co., Ltd., Lecturer at Sichuan Architecture Institute

3. Practitioners in the Field of Environmental Design

3.1. Huang Yalang

Position: Partner and Design Director at Chengdu Fanmu Decoration Design Co., Ltd.

3.2. Chen Fangfang

Position: Artistic Director at Chengdu Nengyan Art Design Co., Ltd.

List of schools participating in data collection

Undergraduate (Public)		Undergraduate (Private)	
1	Sichuan University	1	Geely University of China
2	Southwest Jiaotong University	2	Chengdu Vocational University of Art
3	Southwest Minzu University	3	Sichuan Technology and Business University
4	Xihua University	4	Sichuan University Jinjiang College
5	Sichuan Agricultural University	5	Chengdu Jincheng College
6	Sichuan Normal University	6	Sichuan University of Media and Communications
7	Sichuan Conservatory of Music	7	Gingko College of Hospitality Management
8	Chengdu University	8	Chengdu College of Arts and Sciences
9	Sichuan Tourism University		

Appendix B

Tools Used in the Research

Teaching model to enhance environmental awareness for interior design undergraduate students in Chengdu, China

Hello!

The purpose of this study is to develop a new teaching model to enhance environmental awareness among undergraduate students in the Interior Design program at Chengdu.

The questionnaire for this study targets undergraduate students majoring in Interior Design in Chengdu, including current students and those who graduated 1 to 5 years ago. The questionnaire is divided into two parts.

(1) The first part covers the respondents' basic information.

(2) The second part involves an analysis of the current status of environmental awareness among undergraduate students in the Interior Design program at Chengdu.

Please fill out the questionnaire truthfully to collect comprehensive data.

Before completing the questionnaire, please read the definitions to better understand the specific terms and facilitate your responses.

The information provided in this questionnaire will be used solely for research purposes. All data will be kept confidential and will only be used for statistical analysis, without affecting the respondents.

The researchers hope that by combining the questionnaire results with the findings of the study, an effective teaching model can be developed to foster environmental awareness among all undergraduate students in the Interior Design program at Chengdu, thereby benefiting all students and society as a whole. Please complete the questionnaire in full and submit it to the researchers. I sincerely appreciate your enthusiastic support and wish you success in your studies.

Tan Hongyan
Doctor of Arts Education
Sinakarinwirot University

Interior Design

Interior design is a multidisciplinary field that involves the planning, design, and decoration of spatial environments to enhance their functionality, safety, and aesthetics. Interior designers are typically responsible for creating the overall layout and appearance of indoor spaces, including color schemes, lighting design, furniture selection, the application of materials and finishes, and other decorative elements. Designers must also consider the practicality and comfort of the space while ensuring that the design complies with building codes and health standards.

Sustainable Design

Sustainable design, also known as "ecological design" or "green design," is a design philosophy aimed at reducing negative environmental impacts by using eco-friendly materials and technologies, as well as effective energy and resource management to create healthy, efficient, and long-lasting spatial environments. It makes a significant contribution to achieving Sustainable Development Goals (SDGs).

Teaching Model

A teaching model is a relatively stable instructional activity procedure designed to achieve specific educational objectives based on certain theoretical foundations, integrating practice with theory. It consists of a series of predetermined teaching strategies and methods used to guide and improve teaching practices. The structure of a teaching model includes teaching philosophy, educational objectives, curriculum structure, teaching strategies and methods, implementation conditions, and teaching evaluation.

Environmental Awareness

Environmental awareness refers to the theoretical knowledge, attitudes, values, and practical abilities related to sustainable design possessed by professionals in the field of interior design.

Part One: Basic Information of Respondents. Please check (√) the appropriate option.

1. Your gender:

☐ Male

☐ Female

2. Your age:

☐ 18-20

☐ 21-23

☐ 24-26

☐ 27 and above

3. Your current grade level:

☐ Freshman

☐ Sophomore

☐ Junior

☐ Senior

☐ Graduated 1-2 years ago

☐ Graduated 3-5 years ago

4. The institution you are attending: _____

The second part will analyze the current status of undergraduate students majoring in interior design in Chengdu regarding the cultivation of environmental awareness. Please mark the spaces (√) in the selected actual questionnaire answers. According to the questionnaire in the second part, the "assessment scale levels" are divided into five levels, with the meanings of each level as follows:

1 indicates strong disagreement
2 indicates disagreement
3 indicates uncertainty
4 indicates agreement
5 indicates strong agreement

Environmental awareness	Grade level				
	1	2	3	4	5
ESD sustainable education development is an important component of cultivating environmental awareness, encompassing knowledge, skills, and attitudes values.					
In terms of （knowledge）, the teaching situation in the school is as follows:					
1. In the course, I have learned systematic and comprehensive knowledge of environmental protection theories.					
2. My course includes content on sustainable design principles and methods.					
3. I have studied and understood the 3F and 5R principles in sustainable interior design.					
4 I have learned how to save energy, water, and materials in design.					
5 I understand the physical qualities of indoor environments (indoor air quality, indoor thermal comfort, indoor lighting, indoor sound environment).					
In terms of （skills）, the teaching situation at the school is as follows:					
6 I am able to effectively implement energy saving, water conservation, and material efficiency in interior design projects.					
7 I can apply the 3F principles (environmental harmony, human-centered design, and dynamic development) and the 5R principles (reassess, renew, reuse, recycle, and reduce) in project planning for sustainable interior design.					
8 I have acquired sufficient training in environmental protection skills during the course, and I am capable of communicating and addressing issues related to environmental protection.					
9 I can establish specific environmental goals for interior design projects and effectively operate and manage green initiatives.					
10.I am capable of evaluating and optimizing indoor design schemes for sustainability during the design process, taking into account various sustainable development strategies.					

In terms of （attitude values）, the teaching situation at the school is as follows:					
11.I believe environmental awareness is crucial in interior design.					
12.I believe interior designers carry significant responsibility in promoting environmental protection and sustainable development.					
13.I willing to explore and incorporate the concept of sustainable development into my designs.					
14.I hope that future designs can better balance environmental and economic benefits.					
15.I am willing to continuously learn more environmental design knowledge and skills.					
16.I believe that environmentally-friendly design can enhance the overall quality of design. It not only improves the environment but also boosts customer satisfaction and market competitiveness.					
17.I consciously consider environmental factors in the design process.					
18.I am willing to participate in environmental design research and development projects.					
19.I believe that sustainable design is one of the core values of interior design.					
20.I am willing to promote the importance of environmental protection through my own design works.					
PBL project-based teaching is divided into the following 6 parts of content:					
Correspond to the lesson standard					
21.The content of the environmental design course is highly consistent with national and local teaching standards, helping me clarify learning objectives.					
22.The connection between course content and teaching standards enables me to systematically grasp important concepts and skills in environmental design.					
Management teaching activities					
23.The school's arrangement of teaching activities for the environmental design course is reasonable and effectively stimulates my interest in learning.					
24.The teaching management activities provided by the school help me to learn and master environmental design skills more systematically.					
Assess student learning					
25.The evaluation of design outcomes assesses my theoretical knowledge of environmental design and my ability to practice sustainable design. Teacher evaluations of our design projects are fair, detailed, and constructive.					

26.The evaluation method of students' environmental design projects effectively motivates my learning and willingness to improve design proposals.					
Participation and guidance					
27.Throughout the learning and practice process, I receive timely, comprehensive, and personalized guidance and feedback from teachers.					
28.The specific guidance and feedback provided by teachers in projects have a positive impact on my learning.					
Build learning support					
29.The learning resources and tools provided by teachers in the course are very helpful for my understanding and application of environmental design concepts, helping me to better complete environmental design projects.					
review					
30.After each project, I reflect, summarize, and analyze the gains and losses in environmental design.					
31.I use the results of reflection to improve subsequent designs, which helps enhance my environmental awareness.					
The purpose of WIL is to apply the theoretical knowledge learned into practice					
Combining theory with practice					
32.I have the opportunity to participate in real work projects or internships in the course.					
33.Environmental design projects collaborated on by the school with companies or institutions allow me to apply theoretical knowledge to practice, gaining more operational experience and guidance.					
34.Participating in actual projects with companies or institutions significantly improves my environmental design capabilities and professional qualities.					

Teaching model to enhance environmental awareness for interior design undergraduate students in Chengdu, China

Hello!

The purpose of this study is to develop a new teaching model to enhance the environmental awareness of undergraduate students majoring in interior design in Chengdu.

The interview consists of a total of 15 questions:

(1) The first part covers the basic information of the respondents.

(2) The second part involves a needs analysis for cultivating environmental awareness among undergraduate interior design students in Chengdu.

Before the interview, please read the definitions of terms provided to better understand specific vocabulary and facilitate your responses.

The information provided in this interview will be used solely for research purposes. All data will be kept confidential and will only be used for statistical analysis, with no impact on the respondents.

The researchers hope that through the combination of interviews and research results, an effective teaching model can be established to foster environmental awareness among all undergraduate students in the interior design program in Chengdu, thereby benefiting all students and society at large. We sincerely thank you for your enthusiastic support and wish you great success in your career.

Hongyan Tan

Doctor of Arts Education

Sinakharinwirot University

Education Expert Semi-Structured Interview Questions

This study aims to explore a new teaching model to enhance environmental awareness among undergraduate interior design students in Chengdu. The goal is to strengthen students' environmental consciousness and improve teachers' teaching abilities.

Researcher:
Ms. Tan Hongyan, Doctor of Arts Education, , Srinakharinwirot University , Thailand.

Your school:

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Interview date:

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Interview sample:

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Interview question:

knowledge and skills

1. How would you evaluate the depth and breadth of environmental awareness theory in the current interior design curriculum? In the actual teaching process, what specific areas of environmental knowledge or skills do you believe students lack the most?

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2. To enhance students' awareness of environmental issues, do you think it is necessary to integrate knowledge from other disciplines (such as environmental science, sustainable

development, etc.) into the interior design curriculum? If so, what suggestions do you have? Could you provide examples of how to implement this interdisciplinary learning within the courses?

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3. Which theoretical knowledge about environmental issues do you consider most important for interior design students? What specific modules on environmental theories would be helpful in increasing students' awareness? For instance, the 3F principles (harmony with the environment, human-centered, dynamic development) and the 5R principles (Revalue, Renew, Reuse, Recycle, Reduce); understanding energy-saving, water-saving, and material-saving strategies in design; and comprehending the physical qualities of indoor environments (such as indoor air quality, thermal comfort, lighting, and acoustics).

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4. In the fast-evolving design industry, how do you think we can ensure that the environmental design knowledge students acquire is current and cutting-edge? What suggestions do you have to help faculty continuously update and enrich their knowledge of environmentally sustainable design?

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5. Could you provide examples of suitable practical activities or projects that could enhance students' skills in environmentally sustainable design?

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Attitude and Values

6. In your experience, what types of teaching methods can effectively help students establish environmental awareness and values? How do you think we can motivate students to spontaneously consider environmental issues during the design process?

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7. How do you believe we can guide students to transform their personal environmental protection awareness into a sense of responsibility towards society and the industry? What specific teaching strategies do you have that can help students understand and take on their social responsibilities?

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Correspond to the lesson standard

8. Do you think there is a gap between the current curriculum standards and the actual teaching content? How can this gap be addressed to ensure that students acquire the necessary environmental design skills?

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Management teaching activities

9. How do you manage and allocate time for learning and activities in practice, while ensuring the breadth and depth of the course content?

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Assess student learning

10. How do you design assessment criteria to ensure a comprehensive evaluation of students' overall abilities in theory, skills, attitudes, and values?

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Participation and guidance

11. During the project design process, how do you specifically guide students to identify and address environmental issues? How do you balance student autonomy with mentorship to maximize their creativity?

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Building Learning Supports

12. In the initial phase of teaching, how do you establish appropriate learning supports for students to help them comprehend the complex concepts of environmentally friendly design? As the course progresses, how do you adjust these supports to meet the gradually increasing learning needs of the students?

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Reflection and Review in Teaching

13. After completing the project, which specific reflection and summarization methods (such as personal journals, team discussions, etc.) are most effective in enhancing students' understanding of environmental design?

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Work Integrated with Learning

14. In your opinion, what specific challenges might students face when integrating work with learning (e.g., inadequate technical skills, limited resources, difficulties in applying problems from real projects, etc.)? What specific strategies and support mechanisms do you think teachers could adopt to help students overcome these challenges?

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15. Are there successful teaching models or methods that can assist students in applying and reinforcing their environmental knowledge and design skills learned in the classroom within real-world work settings? When students are engaged in project design, what specific real work scenarios and tasks do you believe would most effectively enhance their sustainable design practice skills? Could you share some successful cases of how real work environments have been utilized to improve students' environmental design skills?

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Note: " Through conducting relevant research and literature reviews, as well as collecting survey data from undergraduate interior design faculty members in Chengdu, we aim to gather all necessary data on the specified day.

Expert Semi-Structured Interview Questions for Enterprises

This study aims to explore a new teaching model to enhance environmental awareness among undergraduate interior design students in Chengdu.

Researcher:
Ms. Tan Hongyan, Doctor of Arts Education, , Srinakharinwirot University , Thailand.

Your company name:

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Interview date:

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Interview sample:

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Interview question:

1. What environmental capabilities and awareness do companies prioritize when recruiting recent graduates in interior design?

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2. In your company, how do you assess the performance of new interior design graduates in terms of their understanding of environmental design theories and skills? What core knowledge and skills do they generally possess, and what gaps remain?

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3. In practice, what type of internships or corporate partnership projects do you believe are most effective in enhancing students' environmental design skills?

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4. What attitudes and values regarding environmental design do you perceive among graduates? Are they willing and proactive in promoting the application of environmentally friendly design in real projects?

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5. Based on your experience, which specific corporate resources and platforms can help students better understand and practice environmental design?

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6. Could you share some challenges your company has faced during environmental design projects and the methods used to overcome these challenges?

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7. Do you think there is a gap between the environmental awareness and skills of current interior design graduates and the actual needs of companies? If so, what adjustments and improvements would you recommend?

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8. What key elements do you believe an effective educational model for cultivating environmental awareness and skills should include? For example, specific knowledge, practical experience, teaching quality, etc.

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9. From a corporate perspective, how do you view the future development trends in environmental sustainability within the interior design field?

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10. What suggestions and specific measures can you provide to facilitate deeper collaboration between universities and companies to enhance the environmental awareness of undergraduate interior design students in curriculum design and teaching methods, thereby better achieving the Sustainable Development Goals (SDGs)?

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Note: "Our goal is to collect all necessary data by the specified date through relevant research and literature reviews, as well as collecting survey data from Chengdu companies."

Interior Design Graduate Semistructured Interview Content

This study aims to explore a new teaching model to enhance environmental awareness among undergraduate interior design students in Chengdu.

Researcher:
Ms. Tan Hongyan, Doctor of Arts Education, , Srinakharinwirot University , Thailand.

Your company name:

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Interview date:

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Interview sample:

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Interview question:

Knowledge and Skills

1. In your practical work experience, which environmental protection knowledge and skills learned in university do you believe are essential for successfully implementing eco-friendly design?

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2. What shortcomings do you think currently exist in interior design education regarding the cultivation of students' environmental awareness and skills?

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3. What challenges related to eco-friendly design have you encountered in your practical work? How were those challenges overcome?

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Attitude and Values

4. In your long-term work experience, have there been instances where environmental design brought added value to clients? How have such experiences influenced your professional attitude and design decisions?

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5. Since your graduation, have your environmental awareness and attitudes changed? Please describe these changes in detail and the main driving forces behind them (such as industry trends, personal interests, etc.).

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6. To what extent do you believe that the work environment, market demand, and corporate culture influence your values regarding environmental design? What role has the educational phase played in this process?

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Theory Integrated with Practice

7. During your internship experiences in college, did you have the opportunity to participate in projects related to sustainable environmental design? How much have these experiences helped in your current work?

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8. In the process of learning through practical work, what do you think are the shortcomings of school-enterprise cooperation that have led to difficulties in real-world work? What suggestions do you have for improving collaboration models?

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Career Development

9.How do you perceive the future trends in the interior design industry concerning environmental design? What advice would you give to current students to better adapt to this trend?

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10.From education to professional practice, in which areas do you believe improvements are necessary to more effectively promote the achievement of the SDGs? Do you have specific action recommendations?

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Note: "Our goal is to collect all necessary data through relevant research and literature reviews, as well as surveys of Chengdu designers, by the specified deadline."

Feasibility and Applicability Assessment of the Model

Explanation of the evaluation model:

1. Content of the first part of the research: Teaching Model to Enhance Environmental Awareness Among Undergraduate Interior Design Students
2. Consider the applicability and feasibility of the model in the second part, and mark accordingly. Please mark the spaces in the selected answers (√). Based on the applicability and feasibility of the second part, the "evaluation scale levels" are divided into five levels, with the meanings as follows:

In terms of the applicability of the model:
5 indicates very suitable
4 indicates relatively suitable
3 indicates suitable
2 indicates not suitable
1 indicates very unsuitable

In terms of the feasibility of the model:
5 indicates very high likelihood of model implementation
4 indicates high likelihood of model implementation
3 indicates medium likelihood of model implementation
2 indicates low likelihood of model implementation
1 indicates very low likelihood of model implementation.

Model Evaluation Example

Content	Applicability					Feasibility				
	5	4	3	2	1	5	4	3	2	1
Model Name	√						√			
More suggestions: ..... (Suggestions)										

1. Applicability and Feasibility of the Model Name

"Development Model of Environmental Awareness for Undergraduate Students in Interior Design"

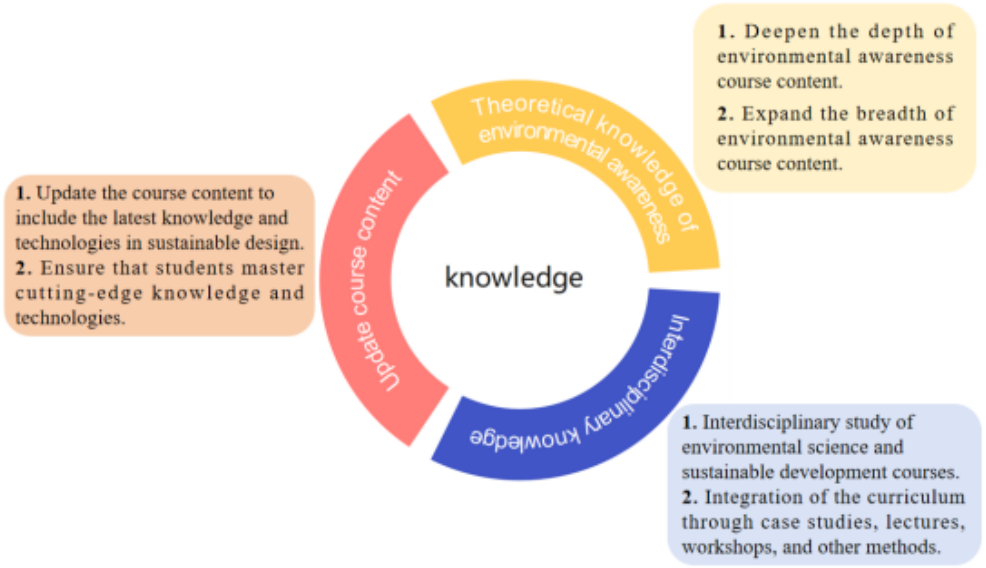
Content	Applicability					Feasibility				
	5	4	3	2	1	5	4	3	2	1
Model Name										
More suggestions: …… …… ……										

Optimize the feasibility of each model.

Content	Applicability					Feasibility				
	5	4	3	2	1	5	4	3	2	1
Development Model										
More suggestions: …… …… ……										

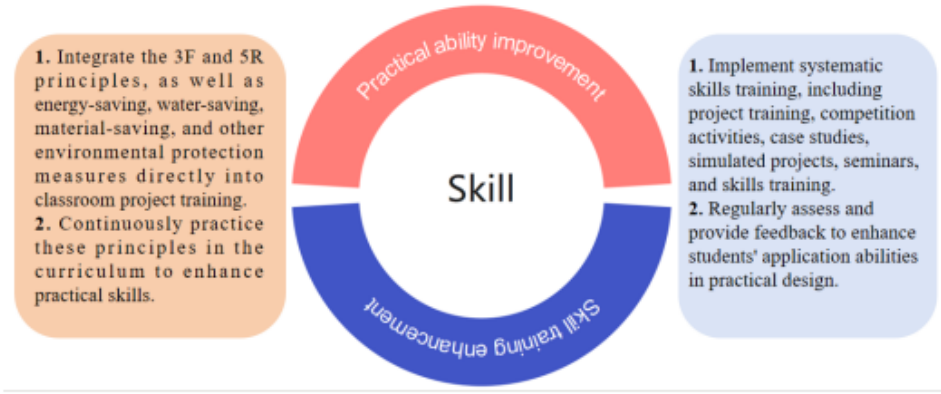
Applicability and Feasibility of Knowledge Dimensions

Applicability and Feasibility of Knowledge Dimensions



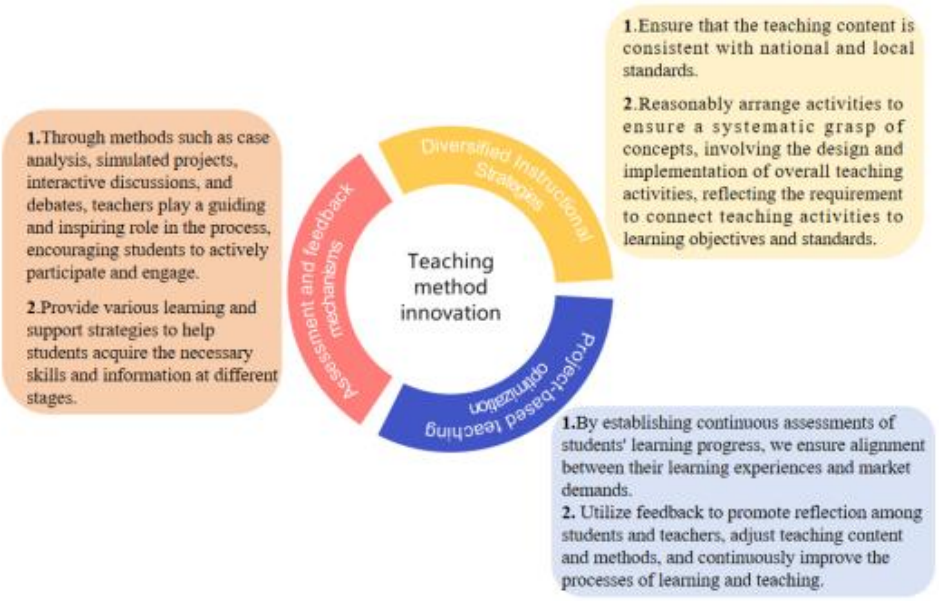
Content	Applicability					Feasibility				
	5	4	3	2	1	5	4	3	2	1
Knowledge										
More suggestions:										

Applicability and Feasibility of Skill Dimensions



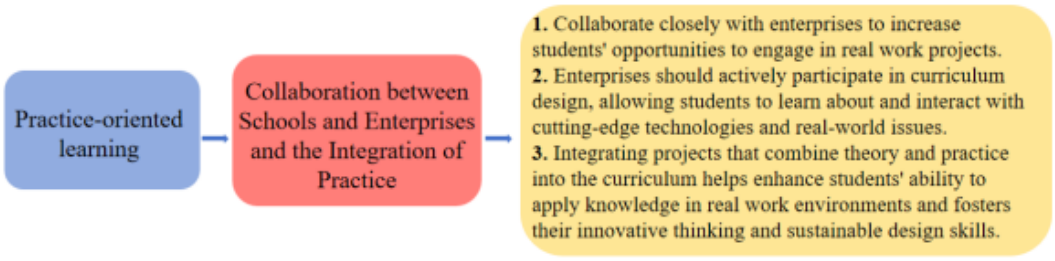
Content	Applicability					Feasibility				
	5	4	3	2	1	5	4	3	2	1
Skill										
More suggestions:										

The applicability and feasibility of innovative teaching methods



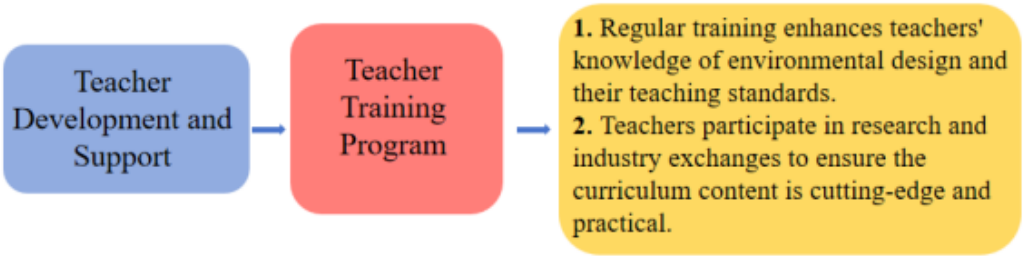
Content	Applicability					Feasibility				
	5	4	3	2	1	5	4	3	2	1
Innovative Teaching Methods										
More suggestions:										

The applicability and feasibility of practice-oriented learning



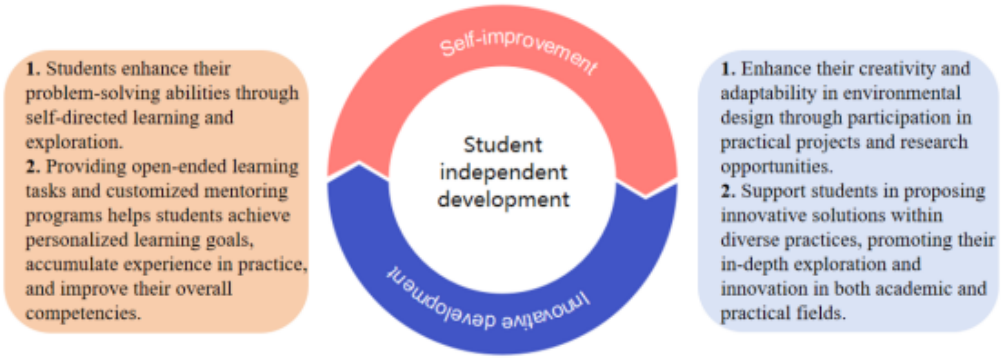
Content	Applicability					Feasibility				
	5	4	3	2	1	5	4	3	2	1
Practice-oriented learning										
More suggestions:										

The applicability and feasibility of teacher development and support

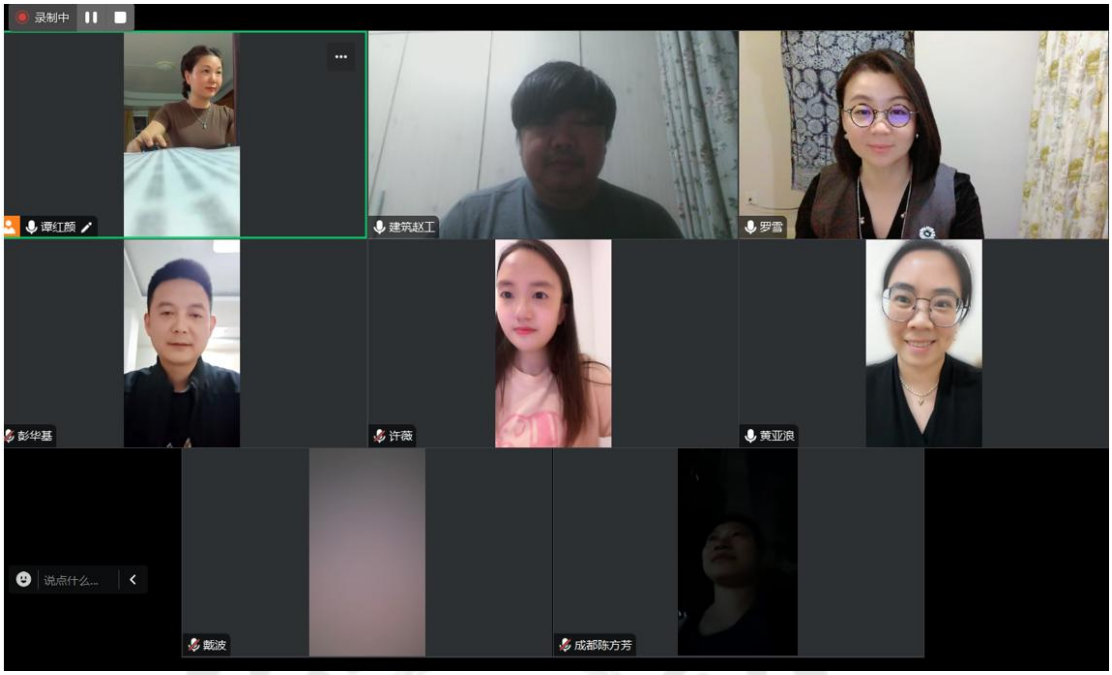


Content	Applicability					Feasibility				
	5	4	3	2	1	5	4	3	2	1
Teacher Development and Support										
More suggestions:										

The applicability and feasibility of student autonomous development



Content	Applicability					Feasibility				
	5	4	3	2	1	5	4	3	2	1
Student Autonomous Development										
More suggestions:										


录制中
谭红颜
建筑赵工
罗雪
彭华基
许薇
黄亚浪
说点什么...
戴波
成都陈方芳

Project Record for Enhancing Environmental Awareness Teaching Model for Undergraduate Interior Design Students

Date / Time	Details
Name	
Conference Theme	
Meeting Content	
Meeting Format	
Q&A Content	
Characteristics/Atmosphere of Participants	

HESI. 8718/1532

Graduate School
Srinakharinwirot University
114 Sukhumvit 23, Bangkok 10110

31 October 2024

Subject: Invitation to Serve as an Expert Evaluator

Dear Professor Luo Xue,

I hope this message finds you well.

I am writing on behalf of the Graduate School at Srinakharinwirot University to formally invite you to serve as an expert evaluator for the thesis of Ms.Hongyan Tan, a doctoral candidate in Art Education. Her thesis, entitled "The develop interior design teaching model for undergraduate students in Chengdu to cultivate their environmental awareness," has been approved, and she is being advised by Assistant Professors Dr.Natthida Phujib and Dr.Athiphat Wijitsathirattan.

Ms.Tan has initiated preliminary communications with you regarding this project and will coordinate further details as needed.

We sincerely request your esteemed assistance in this matter and express our gratitude for your consideration of this invitation.

Yours sincerely,

C Ekpanyaskul.

(Associate Professor Dr.Chatchai Ekpanyaskul, MD)
Dean of the Graduate School

Note: If you require any further information, please feel free to contact Ms.Tan at 13183855288.

HESI. 8718/1532

Graduate School
Srinakharinwirot University
114 Sukhumvit 23, Bangkok 10110

31 October 2024

Subject: Invitation to Serve as an Expert Evaluator

Dear Associate Professor Peng Huaji,

I hope this message finds you well.

I am writing on behalf of the Graduate School at Srinakharinwirot University to formally invite you to serve as an expert evaluator for the thesis of Ms.Hongyan Tan, a doctoral candidate in Art Education. Her thesis, entitled "The develop interior design teaching model for undergraduate students in Chengdu to cultivate their environmental awareness," has been approved, and she is being advised by Assistant Professors Dr.Natthida Phujib and Dr.Athiphat Wijitsathirattan.

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C Ekpanyaskul.

(Associate Professor Dr.Chatchai Ekpanyaskul, MD)

Dean of the Graduate School

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HESI. 8718/1532

Graduate School
Srinakharinwirot University
114 Sukhumvit 23, Bangkok 10110

31 October 2024

Subject: Invitation to Serve as an Expert Evaluator

Dear Professor Dai Bo,

I hope this message finds you well.

I am writing on behalf of the Graduate School at Srinakharinwirot University to formally invite you to serve as an expert evaluator for the thesis of Ms.Hongyan Tan, a doctoral candidate in Art Education. Her thesis, entitled "The develop interior design teaching model for undergraduate students in Chengdu to cultivate their environmental awareness," has been approved, and she is being advised by Assistant Professors Dr.Natthida Phujib and Dr.Athiphat Wijitsathirattan.

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(Associate Professor Dr.Chatchai Ekpanyaskul, MD)
Dean of the Graduate School

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HESI. 8718/1532

Graduate School
Srinakharinwirot University
114 Sukhumvit 23, Bangkok 10110

31 October 2024

Subject: Invitation to Serve as an Expert Evaluator

Dear Professor Zhao Shiguang,

I hope this message finds you well.

I am writing on behalf of the Graduate School at Srinakharinwirot University to formally invite you to serve as an expert evaluator for the thesis of Ms.Hongyan Tan, a doctoral candidate in Art Education. Her thesis, entitled "The develop interior design teaching model for undergraduate students in Chengdu to cultivate their environmental awareness," has been approved, and she is being advised by Assistant Professors Dr.Natthida Phujib and Dr.Athiphat Wijitsathirattan.

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(Associate Professor Dr.Chatchai Ekpanyaskul, MD)

Dean of the Graduate School

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HESI. 8718/1532

Graduate School
Srinakharinwirot University
114 Sukhumvit 23, Bangkok 10110

31 October 2024

Subject: Invitation to Serve as an Expert Evaluator

Dear Professor Huang Yalang,

I hope this message finds you well.

I am writing on behalf of the Graduate School at Srinakharinwirot University to formally invite you to serve as an expert evaluator for the thesis of Ms.Hongyan Tan, a doctoral candidate in Art Education. Her thesis, entitled "The develop interior design teaching model for undergraduate students in Chengdu to cultivate their environmental awareness," has been approved, and she is being advised by Assistant Professors Dr.Natthida Phujib and Dr.Athiphat Wijitsathirattan.

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(Associate Professor Dr.Chatchai Ekpanyaskul, MD)

Dean of the Graduate School

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HESI. 8718/1532

Graduate School
Srinakharinwirot University
114 Sukhumvit 23, Bangkok 10110

31 October 2024

Subject: Invitation to Serve as an Expert Evaluator

Dear Professor Chen Fangfang,

I hope this message finds you well.

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(Associate Professor Dr.Chatchai Ekpanyaskul, MD)

Dean of the Graduate School

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HESI. 8718/1532

Graduate School
Srinakharinwirot University
114 Sukhumvit 23, Bangkok 10110

31 October 2024

Subject: Invitation to Serve as an Expert Evaluator

Dear Assistant Professors Dr. Atiyot Sankuranurak,

I hope this message finds you well.

I am writing on behalf of the Graduate School at Srinakharinwirot University to formally invite you to serve as an expert evaluator for the thesis of Ms.Hongyan Tan, a doctoral candidate in Art Education. Her thesis, entitled "The develop interior design teaching model for undergraduate students in Chengdu to cultivate their environmental awareness," has been approved, and she is being advised by Assistant Professors Dr.Natthida Phujib and Dr.Athiphat Wijitsathirattan.

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Dean of the Graduate School

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HESI. 8718/1532

Graduate School
Srinakharinwirot University
114 Sukhumvit 23, Bangkok 10110

31 October 2024

Subject: Invitation to Serve as an Expert Evaluator

Dear Assistant Professors Dr.Suebsai Sangwachirapiban,

I hope this message finds you well.

I am writing on behalf of the Graduate School at Srinakharinwirot University to formally invite you to serve as an expert evaluator for the thesis of Ms.Hongyan Tan, a doctoral candidate in Art Education. Her thesis, entitled "The develop interior design teaching model for undergraduate students in Chengdu to cultivate their environmental awareness," has been approved, and she is being advised by Assistant Professors Dr.Natthida Phujib and Dr.Athiphat Wijitsathirattan.

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Dean of the Graduate School

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HESI. 8718/1532

Graduate School
Srinakharinwirot University
114 Sukhumvit 23, Bangkok 10110

31 October 2024

Subject: Invitation to Serve as an Expert Evaluator

Dear Professor Shen Hongzha,

I hope this message finds you well.

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(Associate Professor Dr.Chatchai Ekpanyaskul, MD)

Dean of the Graduate School

Note: If you require any further information, please feel free to contact Ms.Tan at 13183855288.

HESI. 8718/1532

Graduate School
Srinakharinwirot University
114 Sukhumvit 23, Bangkok 10110

31 October 2024

Subject: Invitation to Serve as an Expert Evaluator

Dear Professor Rao Jianhua,

I hope this message finds you well.

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(Associate Professor Dr.Chatchai Ekpanyaskul, MD)
Dean of the Graduate School

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HESI. 8718/1532

Graduate School
Srinakharinwirot University
114 Sukhumvit 23, Bangkok 10110

31 October 2024

Subject: Invitation to Serve as an Expert Evaluator

Dear Professor Wei Daping,

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(Associate Professor Dr.Chatchai Ekpanyaskul, MD)
Dean of the Graduate School

Note: If you require any further information, please feel free to contact Ms.Tan at 13183855288.

VITA

NAME	Hongyan Tan
DATE OF BIRTH	November 23, 1982
PLACE OF BIRTH	Chengdu, Sichuan, China
INSTITUTIONS ATTENDED	Second Semester of the 2021 Academic Year, Doctor of Education (Ed.D.) in the School of Fine Arts, Major in Art Education at Srinakharinwirot University
HOME ADDRESS	235 Shuhui Road, Jinsha, Chengdu, Sichuan, China
PUBLICATION	EVOLUTIONARY STUDIES IN IMAGINATIVE CULTURE (ISSN: 2472- 9884)
AWARD RECEIVED	Ginkgo Golden Bird Award Silver Medal W A D 2020 Outstanding Designer at the World Youth Designers Conference 2023 Platinum Award at the U.S. Nius International Design Awards, among others