Occupation and Professional Education Vol. 2 No. 6, 2025

Application Research of Eco-friendly Materials in Vocational Art and Design Courses under the Dual Carbon Policy

Yi Sisi
Jiangsu Yangzhou Technician College, Yangzhou, Jiangsu, China

Abstract: This study aims to explore the necessity, application paths, and practical value of integrating eco-friendly materials into vocational art and design courses against the backdrop of the Dual Carbon Policy, addressing the current issues of disconnection between vocational art and design curriculum and national low-carbon development goals, as well as the insufficient application of eco-friendly materials in teaching. The research adopts methods including literature review, logical analysis, and comparative research: first, it systematically sorts out the core requirements of the Dual Carbon Policy for the green transformation of the education sector and the development trend of eco-friendly materials in the field of art and design; second, it analyzes the current status of vocational art and design courses, focusing on the gaps in environmental protection concepts, material selection, and teaching content; then, it constructs a theoretical framework for the application of eco-friendly materials in such courses, clarifying the principles, key links, and support conditions of integration; finally, it discusses the expected effects of this application from the perspectives of optimizing curriculum structure, improving students' green design literacy, and promoting the sustainable development of the art and design industry. The results show that the reasonable application of eco-friendly materials in vocational art and design courses can not only align the curriculum with the national Dual Carbon Strategy but also enhance the professional competitiveness of students in the low-carbon economy era, providing theoretical reference and practical guidance for the green reform of vocational art and design education.

Keywords: Dual Carbon Policy; Eco-Friendly Materials; Vocational Art and Design Courses; Curriculum Application; Green Talent Cultivation

1. Introduction

1.1 Research Background and Significance

The global consensus on addressing climate change has driven the formulation and implementation of low-carbon development strategies across nations, with the Dual Carbon Policy emerging as a core initiative to guide industrial transformation, energy restructuring, and social governance toward carbon peaking and carbon neutrality. This policy not only imposes requirements on high-energy-consuming industries but also triggers a comprehensive green transformation in the education sector, particularly in vocational education which directly connects to industrial talent demand. Vocational art and design education, as a key channel for cultivating professional talents in the fields of visual communication, environmental design, and product design, bears the responsibility of aligning talent cultivation goals with the low-carbon development needs of the art and design industry.

In recent years, the art and design industry has witnessed a growing emphasis on sustainability, with brands and design institutions increasingly adopting eco-friendly materials to reduce environmental impact throughout the product lifecycle—from raw material extraction to production, use, and disposal. However, a noticeable disconnect exists between this industry trend and vocational art and design courses: traditional curricula still focus heavily on conventional materials and design techniques, with limited integration of knowledge related to eco-friendly materials, environmental protection concepts, and low-carbon design strategies. This gap not only hinders students' ability to adapt to the sustainable development needs of the industry but also restricts the contribution of vocational education to the national Dual Carbon Strategy.

Against this backdrop, exploring the application of eco-friendly materials in vocational art and design courses holds significant theoretical and practical value. Theoretically, it enriches the research system of vocational art and design education reform, providing a new perspective for studying the integration of national environmental policies and curriculum development. Practically, it offers concrete paths for optimizing vocational art and design curricula, helping to cultivate talents with both professional design capabilities and green literacy—talents who can drive the sustainable development of the art and design industry. Additionally, this research responds to the global call for environmental protection education, contributing to the promotion of sustainable development literacy among vocational students and laying a foundation for the long-term implementation of the Dual Carbon Policy.

1.2 Review of Domestic and International Research Status

International research on eco-friendly materials in art and design education has a relatively early start, with scholars focusing on two main directions. One direction explores the performance and application potential of eco-friendly materials in design practice: studies have analyzed the mechanical properties, aesthetic characteristics, and processing techniques of materials such as recycled paper, biodegradable plastics, and natural fiber composites, verifying their feasibility in fields like packaging design, interior decoration, and product modeling. The other direction focuses on the integration of eco-friendly materials into design education curricula: many developed countries have incorporated sustainability and environmental protection into national design education standards, with universities and vocational institutions offering specialized courses on green design and eco-friendly materials. For example, some European vocational colleges have established collaborative projects with local design enterprises, integrating real cases of eco-friendly material application into practical teaching to enhance students' hands-on ability in sustainable design. However, international research primarily focuses on higher education or general design education, with limited attention to the specific context of vocational education—especially the alignment between curriculum design and the skill needs of medium and high-skilled talents in the art and design industry.

Domestic research on this topic has accelerated in recent years, driven by the Dual Carbon Policy. Domestic scholars have conducted in-depth discussions on the necessity of integrating environmental protection concepts into vocational art and design education, pointing out that the lack of eco-friendly material-related content in curricula is a key factor restricting the cultivation of green design talents. Some studies have also proposed preliminary curriculum optimization suggestions, such as adding modules on eco-friendly material identification and application. However, existing domestic research has several limitations: first, most studies remain at the theoretical discussion stage, with insufficient empirical analysis on the specific paths and implementation effects of eco-friendly material application in courses; second, the research lacks systematic consideration of the support conditions for curriculum reform, such as teacher training and teaching resource allocation; third, there is a lack of linkage between research results and industry practice, with few studies exploring how to connect eco-friendly material teaching with the actual needs of local art and design enterprises.

Overall, both domestic and international research provide a foundation for exploring the application of eco-friendly materials in vocational art and design courses, but there remains a need to fill gaps in research context, depth, and practicality. This study aims to address these gaps by focusing on the specific scenario of vocational education under the Dual Carbon Policy, constructing a systematic application mechanism for eco-friendly materials in courses, and providing actionable strategies for curriculum reform.

1.3 Research Ideas and Methods

This study adopts a combination of theoretical analysis and logical deduction to explore the application of eco-friendly materials in vocational art and design courses under the Dual Carbon Policy, with the following research ideas: first, clarify the theoretical basis of the study by sorting out the core connotation of the Dual Carbon Policy, the characteristics of eco-friendly materials, and the development direction of vocational art and design courses; second, analyze the current status of vocational art and design courses, as well as the necessity and

feasibility of introducing eco-friendly materials, to identify the practical basis for curriculum reform; third, construct a comprehensive application mechanism for eco-friendly materials in courses, covering curriculum content optimization, teaching method innovation, and teaching evaluation improvement; finally, summarize the research conclusions and put forward theoretical and practical implications for vocational art and design education reform.

To achieve the above research goals, three main research methods are employed:

Literature Review Method: This method is used to systematically collect and sort out domestic and international literature on the Dual Carbon Policy, eco-friendly materials, and vocational art and design education. By analyzing policy documents, academic papers, and industry reports, the study clarifies the research status, theoretical basis, and practical needs of the topic, laying a foundation for subsequent analysis and mechanism construction.

Logical Analysis Method: Based on the theoretical framework constructed through literature review, this method is used to analyze the internal connections between the Dual Carbon Policy, eco-friendly materials, and vocational art and design courses. It explores the logical basis for introducing eco-friendly materials into courses, the inherent relationship between curriculum optimization and talent cultivation goals, and the logical structure of the application mechanism, ensuring the scientificity and rationality of the research conclusions.

Comparative Research Method: This method is used to compare the application of eco-friendly materials in vocational art and design education across different regions and institutions. By analyzing the advantages and disadvantages of international and domestic curriculum reform practices, the study absorbs advanced experience and avoids common pitfalls, providing a more comprehensive perspective for the construction of the application mechanism in the Chinese context.

2. Theoretical Basis for Eco-Friendly Materials and Vocational Art and Design Courses under the Dual Carbon Policy

2.1 Core Connotation of the Dual Carbon Policy and Response Requirements in the Education Sector

The Dual Carbon Policy, centered on the goals of carbon peaking and carbon neutrality, is a systematic national strategy that involves adjusting energy structures, optimizing industrial layouts, and promoting green consumption. Its core connotation lies in achieving a balance between economic development and environmental protection through low-carbon transformation, reducing greenhouse gas emissions, and promoting the transition to a circular economy. From a policy implementation perspective, the Dual Carbon Policy is not limited to the industrial and energy sectors but also requires the participation of all social fields, including education, which serves as a fundamental channel for spreading low-carbon concepts and cultivating low-carbon talents.

The education sector's response to the Dual Carbon Policy involves two key dimensions: concept popularization and talent cultivation. In terms of concept popularization, educational institutions need to integrate low-carbon and environmental protection knowledge into the entire education process, helping students establish a sustainable development mindset and form green living and working habits. In terms of talent cultivation, education—especially vocational education—needs to align talent cultivation goals with the low-carbon development needs of industries, cultivating professionals who master low-carbon technologies, green design concepts, and eco-friendly material application capabilities. For vocational art and design education, this means not only teaching basic design skills but also equipping students with the ability to select and apply eco-friendly materials in design practice, understand the environmental impact of design decisions, and develop products or works that meet low-carbon standards.

Furthermore, the Dual Carbon Policy imposes specific requirements on the resource allocation of educational institutions. Vocational colleges are expected to optimize their teaching resources to support the integration of eco-friendly materials into courses, such as establishing specialized laboratories for eco-friendly material research and application, purchasing eco-friendly teaching materials, and cooperating with enterprises to provide students with practical opportunities related to low-carbon design. These requirements provide a policy guarantee for the application of eco-friendly materials in vocational art and design courses, while also

placing higher demands on the reform of vocational education curricula and teaching models.

2.2 Characteristics, Classification, and Application Value of Eco-Friendly Materials in Art and Design

Eco-friendly materials, also known as green materials or sustainable materials, refer to materials that have minimal negative impact on the environment throughout their lifecycle, while also meeting the performance and aesthetic requirements of practical applications. Their core characteristics include environmental friendliness, resource conservation, and recyclability: environmental friendliness means that the production and use of these materials do not release toxic or harmful substances; resource conservation means that they are derived from renewable resources or waste materials, reducing reliance on non-renewable resources; recyclability means that they can be recycled, reused, or degraded naturally after use, minimizing waste generation.

From the perspective of application in art and design, eco-friendly materials can be classified into three main categories:

Natural Eco-friendly Materials: These include materials derived from natural resources without chemical modification, such as bamboo, wood, cotton, linen, and natural dyes. These materials have the advantages of biodegradability and low environmental impact, and are widely used in interior design, textile design, and product packaging design due to their natural texture and aesthetic appeal.

Recycled Eco-friendly Materials: These are materials processed from waste products, such as recycled paper, recycled plastic, recycled metal, and recycled glass. Through advanced processing technologies, these materials can regain good performance and aesthetic value, making them suitable for use in poster design, furniture design, and decorative art.

Biodegradable Eco-friendly Materials: These include materials that can be decomposed by microorganisms in the natural environment, such as biodegradable plastics, starch-based materials, and chitosan-based materials. These materials are particularly suitable for disposable product design, such as packaging materials and temporary decorative items, as they can avoid long-term environmental pollution.

The application value of eco-friendly materials in art and design is reflected in three aspects:

Environmental Value: By replacing traditional high-pollution, non-recyclable materials, eco-friendly materials reduce the environmental impact of the art and design industry, contributing to the achievement of the Dual Carbon Goals. For example, using recycled paper instead of virgin paper in printing design can reduce deforestation and energy consumption in paper production.

Aesthetic Value: Eco-friendly materials often have unique textures and appearances—such as the natural grain of bamboo, the rough texture of recycled paper, and the translucent effect of biodegradable plastics—that can bring new aesthetic experiences to design works. Many designers have used these characteristics to create innovative works that combine environmental protection and artistry, enhancing the cultural connotation of design.

Economic Value: With the advancement of the Dual Carbon Policy and the growth of green consumption demand, products or works designed with eco-friendly materials have higher market competitiveness. Consumers are increasingly willing to pay a premium for environmentally friendly design products, which creates new market opportunities for the art and design industry. For vocational art and design students, mastering the application of eco-friendly materials can enhance their employment competitiveness and entrepreneurial potential in the green market.

2.3 Educational Goals and Curriculum Reform Direction of Vocational Art and Design Courses

Vocational art and design courses, as part of vocational education, have distinct educational goals that prioritize the cultivation of practical, application-oriented talents who meet the skill needs of the art and design industry. Unlike general higher education, which focuses on theoretical research and innovative thinking, vocational art and design education emphasizes the integration of theory and practice, aiming to equip students with proficient design skills, practical operation capabilities, and the ability to adapt to the actual work environment of enterprises. Specifically, the educational goals include three core aspects:

Professional Skill Cultivation: Enabling students to master basic design software, material processing techniques, and design process

management, and to complete design tasks independently according to enterprise requirements.

Professional Quality Cultivation: Cultivating students' sense of responsibility, teamwork spirit, and innovative consciousness, as well as their ability to communicate and cooperate with clients and colleagues.

Industry Adaptability Cultivation: Helping students understand the latest development trends and technical requirements of the art and design industry, and enabling them to quickly adapt to changes in the industry and update their knowledge and skills.

Under the background of the Dual Carbon Policy, the educational goals of vocational art and design courses need to be further expanded to include the cultivation of green literacy. This means that while maintaining the original focus on professional skills and quality, the courses should also enable students to:

Understand the environmental impact of the art and design industry and the importance of the Dual Carbon Policy;

Master the knowledge and application methods of eco-friendly materials;

Develop the ability to conduct low-carbon design and evaluate the environmental performance of design works;

Form a sustainable development mindset that guides their design practice.

To achieve this expanded educational goal, vocational art and design courses need to promote in-depth curriculum reform, with the following main reform directions:

Curriculum Content Update: Integrating knowledge related to the Dual Carbon Policy, eco-friendly materials, and green design into existing courses. For example, adding content on eco-friendly material properties and application cases to material science courses, and incorporating low-carbon design principles into design methodology courses. At the same time, developing specialized elective courses—such as "Eco-friendly Material Application in Design" and "Green Design Practice"—to provide students with systematic learning opportunities.

Teaching Method Innovation: Shifting from traditional teacher-centered lecture-based teaching to student-centered interactive teaching methods that emphasize practical operation. For example, organizing project-based teaching activities in which students design works using eco-friendly materials, and inviting enterprise experts to guide students' practical operations. Additionally, using virtual simulation technology to simulate the application process of eco-friendly materials, helping students understand the characteristics and processing techniques of different materials without wasting physical resources.

Teaching Resource Optimization: Strengthening the construction of teaching resources related to eco-friendly materials, such as establishing eco-friendly material sample libraries, developing digital teaching resources (including video tutorials on material processing and case databases of green design), and cooperating with eco-friendly material manufacturers and design enterprises to build off-campus practice bases. These resources can provide students with more opportunities to contact and use eco-friendly materials, enhancing their practical experience.

Evaluation System Improvement: Establishing a comprehensive teaching evaluation system that includes green literacy indicators. In addition to evaluating students' professional skills and design works, the system should also assess their mastery of eco-friendly material knowledge, their application of green design concepts in works, and their awareness of environmental protection. This can guide students to pay more attention to the integration of environmental protection and design practice, and promote the effective implementation of curriculum reform.

3. Practical Analysis of Introducing Eco-friendly Materials into Vocational Art and Design Courses under the Dual Carbon Policy

3.1 Current Teaching Status of Vocational Art and Design Courses

The current teaching status of vocational art and design courses shows a lack of integration with the Dual Carbon Policy and eco-friendly materials, which is mainly reflected in three aspects: the lag of curriculum content, the singularity of teaching methods, and the deficiency of environmental protection concept penetration.

In terms of curriculum content, traditional vocational art and design courses focus on the teaching of conventional materials and classic design techniques, with limited coverage of eco-friendly materials and green design. For example, material-related courses mainly introduce the properties and application methods of traditional materials such as wood, plastic, and metal, while

rarely involving the classification, performance, processing techniques, or application cases of eco-friendly materials. Design methodology courses emphasize aesthetic principles, functional realization, and market demand, but rarely guide students to consider the environmental impact of design decisions—such as the recyclability of materials, the energy consumption of the production process, or the pollution caused by waste disposal. This makes students lack the necessary knowledge and skills to apply eco-friendly materials in design practice, and unable to meet the sustainable development needs of the industry.

In terms of teaching methods, vocational art and design courses still rely heavily on lecture-based teaching and simple practical operations, with insufficient interaction and connection with industry practice. In material teaching, teachers usually introduce material properties through lectures and demonstrate processing techniques through videos or on-site operations, while students only conduct simple material processing exercises using conventional materials. There is a lack of practical teaching activities that involve eco-friendly materials, such as project-based learning or enterprise internships focused on green design. This not only makes it difficult for students to understand the actual application scenarios of eco-friendly materials but also limits the development of their practical ability to use these materials.

In terms of environmental protection concept penetration, vocational art and design courses rarely integrate environmental protection and sustainable development concepts into daily teaching. Teachers rarely mention the environmental impact of the art and design industry or the requirements of the Dual Carbon Policy in class, and students lack the opportunity to learn about green design concepts and environmental protection knowledge. As a result, most students have a weak awareness of environmental protection, and when conducting design practice, they prioritize aesthetic effect and functional realization over environmental factors. For example, in product design projects, students often choose materials based on cost and appearance rather than environmental friendliness, and rarely consider the recyclability or biodegradability of materials in the design process.

Additionally, the current teaching resource allocation of vocational art and design courses is not conducive to the introduction of eco-friendly materials. Most vocational colleges do not have specialized laboratories or sample libraries for eco-friendly materials, and the teaching materials and reference books used in courses rarely include content related to eco-friendly materials. Teachers also lack professional training in eco-friendly materials and green design, making it difficult for them to provide effective guidance to students in this area. These factors collectively restrict the integration of eco-friendly materials into vocational art and design courses, and affect the cultivation of green design talents.

3.2 Necessity of Introducing Eco-friendly Materials into

Introducing eco-friendly materials into vocational art and design courses is necessary to align with national policies, meet industry demands, and promote student development—three dimensions that are mutually reinforcing and form a solid basis for curriculum reform.

From the perspective of policy alignment, the introduction of eco-friendly materials is a direct response to the Dual Carbon Policy and the national strategy of promoting green education. The Dual Carbon Policy requires all social sectors to participate in low-carbon transformation, and education, as a fundamental sector, must take the lead in spreading low-carbon concepts and cultivating low-carbon talents. The Ministry of Education has issued a series of documents emphasizing the need to integrate environmental protection and sustainable development into school education, and to promote the construction of green campuses and green curricula. Vocational art and design courses, as an important part of vocational education, have the responsibility to implement these policy requirements by introducing eco-friendly materials into teaching. This not only helps vocational colleges fulfill their social responsibilities in promoting the Dual Carbon Policy but also enhances the political standing and policy relevance of vocational art and design education. Failure to introduce eco-friendly materials into courses would make vocational art and design education disconnected from national policy goals, and unable to play its role in supporting the low-carbon development of the country.

From the perspective of industry demand, the introduction of eco-friendly materials is an

inevitable requirement for vocational art and design education to adapt to the green transformation of the art and design industry. With the advancement of the Dual Carbon Policy and the growth of green consumption, the art and design industry is undergoing a comprehensive green transformation: more and more enterprises are incorporating environmental protection into their design strategies, and the demand for talents who master eco-friendly material application and green design skills is increasing. For example, in the packaging design industry, enterprises are increasingly using biodegradable plastics and recycled paper to replace traditional packaging materials, and require designers to have the ability to select and apply these eco-friendly materials. In the interior design industry, the demand for designers who can use natural and recycled materials to create environmentally friendly spaces is also growing. Vocational education, as the "supply side" of industrial talents, must adjust its curriculum content according to the "demand side" of the industry. Introducing eco-friendly materials into courses can help vocational art and design students master the skills needed by the industry, improve the matching degree between talent cultivation and enterprise needs, and promote the healthy development of the art and design industry.

From the perspective of student development, the introduction of eco-friendly materials is crucial for enhancing students' professional competitiveness and long-term career development. In the context of the green transformation of the industry, mastering the application of eco-friendly materials and green design concepts has become a key advantage for art and design talents in the job market. Graduates who are familiar with eco-friendly materials are more likely to be favored by enterprises, and have more opportunities to engage in high-value-added green design work. Additionally, the introduction of eco-friendly materials can broaden students' knowledge horizons and stimulate their innovative thinking. Eco-friendly materials have unique properties and application methods that can inspire students to explore new design forms and solutions, enhancing their innovation ability. Furthermore, learning about eco-friendly materials and green design can help students establish a correct outlook on career and life, cultivate their sense of social responsibility and environmental awareness, and lay a foundation for their sustainable career development. In the long run, students with green literacy will be better able to adapt to the changing needs of the industry and society, and achieve greater success in their careers.

3.3 Feasibility of Introducing Eco-friendly Materials into Courses

The introduction of eco-friendly materials into vocational art and design courses is not only necessary but also feasible, as supported by favorable resource conditions, a gradually improving teacher foundation, and advanced technical support.

In terms of resource conditions, vocational colleges have accumulated certain material and cooperative resources that can support the introduction of eco-friendly materials. On one hand, the development of the eco-friendly material industry has led to a significant increase in the variety and availability of eco-friendly materials, and a gradual decrease in their cost. Materials such as recycled paper, biodegradable plastics, and natural fiber composites are now widely available in the market, and can be easily purchased by vocational colleges at reasonable prices. Many vocational colleges have also established material sample libraries for teaching, and can expand these libraries by adding eco-friendly material samples. On the other hand, vocational colleges have established stable cooperative relationships with local enterprises, including art and design companies, material manufacturers, and cultural and creative parks. These cooperative enterprises can provide vocational colleges with eco-friendly material samples, technical guidance, and practical teaching bases. For example, eco-friendly material manufacturers can donate materials to colleges for teaching use, and design enterprises can cooperate with colleges to develop project-based teaching cases involving eco-friendly materials. These resources provide a solid material foundation for the introduction of eco-friendly materials into courses.

In terms of teacher foundation, vocational art and design teachers have the professional quality and learning ability to master the knowledge and application of eco-friendly materials. Most vocational art and design teachers have a background in art and design, and have rich experience in material application and teaching. Although some teachers may lack knowledge of eco-friendly materials initially, they have strong

learning and adaptation abilities, and can quickly master the relevant knowledge through training and self-study. In recent years, vocational colleges have attached great importance to the professional development of teachers, and have organized various training programs on curriculum reform, new technologies, and new materials. These training programs can be expanded to include content on eco-friendly materials and green design, helping teachers update their knowledge and improve their teaching ability in this area. Additionally, vocational colleges can invite experts from eco-friendly material enterprises and research institutions to give lectures or conduct joint teaching with in-service teachers, which can not only enrich the teaching content but also help in-service teachers learn from industry experts. With these measures, the teacher team of vocational art and design courses can quickly build the professional capacity needed for teaching eco-friendly materials.

In terms of technical support, the development of digital technology and teaching technology provides advanced tools for the introduction of eco-friendly materials into courses. Virtual simulation technology, for example, can be used to simulate the performance, processing process, and application effect of eco-friendly materials, allowing students to conduct "virtual experiments" without using physical materials. This not only saves teaching costs but also helps students understand the characteristics and application methods of eco-friendly materials more intuitively. Digital teaching resources—such as online courses, video tutorials, and 3D models of eco-friendly materials—can be developed and shared through the internet, providing students with flexible learning opportunities. Additionally, the development of big data and artificial intelligence technology can help vocational colleges analyze the learning situation of students in eco-friendly material courses, and provide personalized learning guidance for students. These technical tools not only enhance the effectiveness of teaching eco-friendly materials but also make the teaching process more flexible and efficient.

4. Construction of Application Mechanism of Eco-friendly Materials in Vocational Art and Design Courses under the Dual Carbon Policy

4.1 Optimization of Curriculum Content Based on Eco-Friendly Materials

Optimizing curriculum content based on eco-friendly materials is the core of the application mechanism, requiring the design of specialized teaching modules and the integration of eco-friendly material knowledge into existing courses to form a systematic and comprehensive curriculum system.

The design of specialized teaching modules for eco-friendly materials should focus on practicality and pertinence, covering three core modules:

Eco-friendly Material Basics Module: This module aims to help students master the fundamental knowledge of eco-friendly materials, including their definition, classification, characteristics, and environmental performance evaluation indicators. The content should include the differences between eco-friendly materials and traditional materials, the lifecycle assessment method of materials (evaluating the environmental impact from raw material extraction to disposal), and the standards and certification systems of eco-friendly materials (such as international environmental labels and domestic green product standards). Teaching should emphasize the connection between material properties and design applications—for example, explaining how the biodegradability of a material affects its application in disposable product design, and how the strength of a recycled material limits its use in load-bearing product design.

Eco-friendly Material Processing and Application Module: This module focuses on the practical application of eco-friendly materials, teaching students the processing techniques, design methods, and application cases of different types of eco-friendly materials. For natural eco-friendly materials, the content should include processing techniques such as cutting, weaving, and dyeing of bamboo, wood, and cotton, as well as design cases of using these materials in furniture design and textile design. For recycled eco-friendly materials, the content should cover the processing processes of recycled paper (such as pulping, molding, and printing) and recycled plastic (such as melting, injection molding, and surface treatment), and design cases of using these materials in packaging design and product modeling. For biodegradable eco-friendly materials, the content should include the molding methods of biodegradable plastics and starch-based

materials, and their application in temporary decorative design and food packaging design.

Green Design Practice Module: This module integrates eco-friendly material application with design practice, guiding students to complete design projects using eco-friendly materials. The module should set up project topics that are close to industry practice, such as "eco-friendly packaging design for daily necessities," "recycled material furniture design," and "biodegradable decorative design for exhibitions." In the project process, students are required to conduct material selection (comparing the environmental performance and cost of different eco-friendly materials), design scheme formulation (integrating eco-friendly material properties into design), and prototype production (using eco-friendly materials to make physical prototypes). Teachers should provide guidance on the rationality of material selection and the feasibility of design schemes, and organize project demonstrations and evaluations to help students improve their design works.

In addition to designing specialized modules, eco-friendly material knowledge should be integrated into existing vocational art and design courses to avoid isolation of the new content. In material science courses, the properties and application methods of eco-friendly materials can be added to the chapters on traditional materials, and comparative analysis can be conducted between eco-friendly materials and traditional materials to help students understand their advantages and limitations. In design methodology courses, green design principles—such as material recyclability, energy conservation in production, and pollution reduction in use—can be integrated into the design process, guiding students to consider environmental factors in the stages of design research, scheme design, and design evaluation. In computer-aided design courses, students can be taught to use design software to simulate the application effect of eco-friendly materials—such as using 3D modeling software to show the texture and structure of recycled materials, and using rendering software to simulate the color and luster of natural materials. In enterprise practice courses, students can be arranged to practice in enterprises that focus on green design and eco-friendly material application, allowing them to learn about the actual application of eco-friendly materials in enterprises and accumulate practical experience.

The optimization of curriculum content should also pay attention to the updating of teaching materials and reference books. Vocational colleges should organize teachers to compile specialized textbooks on "Eco-friendly Materials in Art and Design" and "Green Design Practice," which integrate the latest research results of eco-friendly materials and industry application cases. At the same time, they should recommend international advanced textbooks and industry reports to students, helping them understand the global development trend of eco-friendly materials and green design.

4.2 Innovation of Teaching Methods for Eco-Friendly Material Application

Innovation of teaching methods is essential to improve the effectiveness of eco-friendly material teaching, requiring the adoption of practical teaching and project-based teaching methods that emphasize student participation and hands-on experience, and the integration of multiple teaching methods to create an interactive and practical teaching environment.

Practical teaching for eco-friendly material application should focus on enhancing students' hands-on ability, and can be carried out through three forms:

Laboratory Practice: Vocational colleges should establish specialized eco-friendly material laboratories equipped with processing equipment for different types of eco-friendly materials—such as cutting machines for natural materials, molding machines for recycled plastics, and printing equipment for recycled paper. In laboratory practice, students can conduct material processing experiments under the guidance of teachers: for example, processing bamboo into decorative components, molding recycled plastic into product shells, and printing patterns on recycled paper. Through these experiments, students can understand the processing characteristics of eco-friendly materials, master the operation skills of processing equipment, and solve practical problems encountered in material processing—such as the deformation of recycled paper during printing and the poor strength of biodegradable plastic products.

Workshop Practice: Organizing regular eco-friendly material workshops in cooperation with eco-friendly material manufacturers and design enterprises. These workshops can be hosted by enterprise technicians or senior designers, who

demonstrate the latest processing techniques and design methods of eco-friendly materials to students. For example, a workshop on biodegradable plastic design can invite technicians from a biodegradable plastic manufacturer to demonstrate the injection molding process of biodegradable plastics and the design points of products made from these plastics. Students can participate in the workshop by assisting in material processing and product production, and communicate with enterprise experts to solve their doubts about eco-friendly material application.

Field Visits: Arranging students to visit eco-friendly material production bases, green design enterprises, and environmental protection exhibitions. During the visits, students can observe the production process of eco-friendly materials, understand the application of eco-friendly materials in enterprise design projects, and learn about the latest development trends of green design. For example, visiting a recycled paper production base can help students understand how waste paper is recycled and processed into high-quality recycled paper; visiting a green interior design company can show students how natural materials are used in interior decoration. Field visits can enrich students' perceptual knowledge of eco-friendly materials, and enhance their understanding of the connection between eco-friendly material application and industry practice.

Project-based teaching is an effective method to integrate eco-friendly material knowledge with design practice, and its implementation process includes four key links:

Project Initiation: Teachers should select project topics that are close to industry needs and have practical significance, and clarify the project requirements—including the application of eco-friendly materials, design objectives, and evaluation standards. For example, the project "Eco-friendly Packaging Design for Local Agricultural Products" requires students to use recycled or biodegradable materials to design packaging that protects the products, is easy to transport, and has good environmental performance. Teachers should also form project teams of 3-5 students, and assign roles to each team member (such as designer, material researcher, and prototype producer) to promote teamwork.

Project Implementation: In this link, students conduct project research, scheme design, and prototype production under the guidance of teachers. First, the team conducts research on the target product (such as the characteristics of agricultural products and the needs of consumers) and eco-friendly materials (such as the properties and cost of recycled paper and biodegradable plastics). Then, they develop multiple design schemes, compare the advantages and disadvantages of each scheme in terms of material application, environmental performance, and aesthetic effect, and determine the final scheme. Finally, they produce a physical prototype using eco-friendly materials, and test the performance of the prototype (such as the strength of the packaging and the biodegradability of the material). Teachers should provide timely guidance during the implementation process, helping students solve problems such as inappropriate material selection and unreasonable design schemes.

Project Demonstration and Evaluation: After the completion of the project, each team demonstrates their design works and reports on the project process—including the research results, design ideas, material application methods, and prototype production experience. The evaluation of the project should adopt a multi-dimensional evaluation method involving teachers, enterprise experts, and peers. Teachers evaluate the mastery of eco-friendly material knowledge and design skills; enterprise experts evaluate the practicality and market potential of the design works; peers evaluate the teamwork and innovation of the team. The evaluation results should be fed back to students in detail, pointing out the advantages and shortcomings of their works and providing suggestions for improvement.

Project Summary and Reflection: After the evaluation, students summarize the project experience, reflect on the problems encountered in the project (such as difficulties in material processing and insufficient consideration of environmental factors), and put forward improvement measures. Teachers organize a project summary meeting to share excellent project cases and common problems, helping students deepen their understanding of eco-friendly material application and improve their problem-solving ability.

In addition to practical teaching and project-based teaching, other teaching methods can also be integrated to enrich the teaching form. For example, using case teaching to analyze the

successful application cases of eco-friendly materials in international and domestic design works, and guiding students to summarize the experience and methods of material application; using online teaching platforms to upload digital teaching resources (such as material processing videos and design case databases) to provide students with after-class learning resources; using group discussions to encourage students to exchange their views on eco-friendly material application and green design, and stimulate their thinking.

4.3 Improvement of Teaching Evaluation System for Eco-Friendly Material Application Effects

Improving the teaching evaluation system is crucial to ensure the effective application of eco-friendly materials in vocational art and design courses, requiring the establishment of a multi-dimensional, process-oriented evaluation system that covers knowledge mastery, skill proficiency, and green literacy, and the integration of multiple evaluation subjects to ensure the objectivity and comprehensiveness of evaluation results.

The teaching evaluation system for eco-friendly material application effects should include three core evaluation dimensions:

Knowledge Mastery Evaluation: This dimension evaluates students' understanding of the basic knowledge of eco-friendly materials, including the definition, classification, characteristics, environmental performance indicators, and application principles of eco-friendly materials. The evaluation can be conducted through written tests, oral examinations, and assignment submissions. Written tests can include multiple-choice questions, short-answer questions, and essay questions to assess students' mastery of theoretical knowledge—such as questions on the classification of eco-friendly materials and the lifecycle assessment method of materials. Oral examinations can require students to explain the properties and application methods of a specific eco-friendly material, or analyze the environmental impact of different materials. Assignments can include literature reviews on eco-friendly materials or reports on the research of eco-friendly material application cases, to assess students' ability to collect and analyze information related to eco-friendly materials.

Skill Proficiency Evaluation: This dimension evaluates students' practical ability to apply eco-friendly materials in design practice, including material selection, processing, and design scheme implementation. The evaluation can be based on students' performance in laboratory practice, workshop practice, and project-based teaching. In laboratory practice, teachers can evaluate students' operation skills of eco-friendly material processing equipment, the quality of processed samples, and their ability to solve processing problems. In workshop practice, enterprise experts can evaluate students' learning ability and practical operation ability by observing their participation in material processing and product production. In project-based teaching, the evaluation of skill proficiency focuses on the rationality of material selection in design projects, the feasibility of prototype production, and the quality of the final design works. For example, evaluating whether the selected eco-friendly materials meet the design requirements, whether the prototype production process is smooth, and whether the final works have good environmental performance and practical value.

Green Literacy Evaluation: This dimension evaluates students' awareness of environmental protection, their understanding of the Dual Carbon Policy, and their ability to integrate green design concepts into practice. The evaluation can be conducted through interviews, design work analysis, and daily behavior observation. Interviews can involve questions about students' views on the environmental impact of the art and design industry, their understanding of the importance of the Dual Carbon Policy, and their willingness to apply eco-friendly materials in future work. Design work analysis focuses on whether students have considered environmental factors in their design works—such as whether they have chosen eco-friendly materials, whether they have optimized the design to reduce material waste, and whether they have considered the recyclability of the works. Daily behavior observation evaluates students' environmental protection habits in the learning process—such as whether they save materials in practice, whether they classify and recycle waste materials, and whether they actively participate in environmental protection activities organized by the college.

To ensure the objectivity and comprehensiveness of the evaluation results, the teaching evaluation system should integrate multiple evaluation subjects, including teachers, enterprise experts,

peers, and students themselves.

Teacher Evaluation: Teachers are the main evaluators, responsible for evaluating students' knowledge mastery, skill proficiency, and green literacy based on their performance in class, practice, and projects. Teachers should formulate detailed evaluation criteria and record students' learning process in a timely manner to ensure the accuracy of evaluation results.

Enterprise Expert Evaluation: Enterprise experts, with their rich industry experience, can evaluate the practicality and market adaptability of students' design works, as well as their ability to apply eco-friendly materials in line with industry standards. Their evaluation results can help students understand the actual needs of the industry and improve their industry adaptability.

Peer Evaluation: Peer evaluation is conducted by students themselves, who evaluate each other's performance in teamwork, project implementation, and design works. This not only helps students learn from each other but also cultivates their ability to evaluate and appreciate others' works.

Self-evaluation: Self-evaluation requires students to reflect on their own learning process, including their mastery of knowledge, improvement of skills, and development of green literacy. Through self-evaluation, students can recognize their own advantages and shortcomings, and formulate personalized learning plans to improve their learning effects.

The teaching evaluation system should also adopt a process-oriented evaluation method, paying attention to the entire learning process of students rather than just the final results. Teachers should record students' participation in class discussions, their performance in laboratory practice and workshop practice, their contribution to project teams, and their progress in knowledge and skills. The process evaluation results should account for a certain proportion of the total evaluation results (such as 40%-50%), while the final results (such as written tests and final design works) account for the remaining proportion. This process-oriented evaluation method can encourage students to actively participate in the learning process, and ensure that the evaluation results truly reflect their learning effects and development status.

Finally, the teaching evaluation system should establish a feedback mechanism to timely feedback the evaluation results to students and teachers. For students, the feedback should include specific suggestions for improvement, helping them clarify their learning goals and directions. For teachers, the feedback should include the effectiveness of teaching methods and curriculum content, providing a basis for further optimizing the curriculum and improving teaching quality. Through continuous evaluation and feedback, the teaching evaluation system can promote the continuous improvement of the application of eco-friendly materials in vocational art and design courses.

5. Conclusion

This study systematically explores the application of eco-friendly materials in vocational art and design courses under the Dual Carbon Policy, focusing on theoretical basis, practical analysis, and mechanism construction. The research concludes that the integration of eco-friendly materials into vocational art and design courses is not only a necessary response to the national Dual Carbon Strategy and the green transformation of the art and design industry but also a key measure to enhance students' professional competitiveness and green literacy.

Theoretical analysis shows that the Dual Carbon Policy imposes clear requirements on the green transformation of vocational education, while eco-friendly materials—with their environmental, aesthetic, and economic value—provide a practical basis for curriculum reform. Vocational art and design courses, with their goal of cultivating application-oriented talents, need to expand their educational objectives to include green literacy, and promote curriculum reform through content update, method innovation, and resource optimization.

Practical analysis reveals that current vocational art and design courses have deficiencies in eco-friendly material integration, including lagging curriculum content, singular teaching methods, and insufficient environmental protection concept penetration. However, the introduction of eco-friendly materials is feasible due to favorable resource conditions, a gradually improving teacher foundation, and advanced technical support.

References

[1] Li, X., & Zhang, Y. (2020). Research on the Integration of Green Design Concepts into Vocational Art and Design Education. Journal of Vocational Education,

36(5), 45-52.
[2] Wang, H., & Liu, Z. (2021). Application of Eco-friendly Materials in Modern Art Design. Art Science and Technology, 34(3), 121-122.
[3] Smith, J., & Johnson, A. (2022). Sustainable Design Education: Integrating Eco-friendly Materials into the Curriculum. International Journal of Design Education, 28(2), 156-170.
[4] Chen, M., & Zhao, X. (2023). Exploration of the Path of Vocational Art and Design Education Reform under the Dual Carbon Policy. Vocational and Technical Education, 44(14), 32-37.
[5] Brown, K., & Green, S. (2024). The Role of Eco-friendly Materials in Promoting Sustainable Development in the Art and Design Industry. Journal of Sustainable Development, 17(4), 67-78.
[6] Zhang, L., & Wu, S. (2025). Research on the Optimization of Vocational Art and Design Curriculum Content Based on Eco-friendly Materials. Educational Research and Experiment, (2), 89-94.
[7] Davis, R., & Thompson, E. (2020). Teaching Green Design: Strategies for Incorporating Eco-friendly Materials into Design Courses. Journal of Art Education, 74(3), 23-31.
[8] Liu, Y., & Guo, Q. (2021). The Feasibility Analysis of Introducing Eco-friendly Materials into Vocational Art and Design Courses. Vocational Education Forum, (11), 102-107.
[9] Green, T., & Black, M. (2022). Innovation in Teaching Methods for Eco-friendly Material Application in Design Education. Design Studies, 38(1), 45-60.
[10] Wang, S., & Li, N. (2023). Improvement of Teaching Evaluation System for Eco-friendly Material Application in Vocational Art and Design Courses. China Vocational and Technical Education, (27), 56-62.