

Strategies and Practices of Green Skills Development in EU Vocational Education Under the Orientation of Sustainable Development

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Abstracts: With the growing global demand for sustainable development, the training of green-skilled personnel has become a focus of attention for all countries. Vocational education plays an important role in cultivating green skill talents. The purpose of this paper is to explore the strategy and practice of green skill cultivation in vocational education of EU under the orientation of sustainable development and extract the inspiration for vocational and technical education in China. Through the methods of literature review and case study, the EU's practical experience in green skill cultivation in terms of framework, education curriculum design, teacher training and industry cooperation is analyzed. It is found that the vocational education system of the EU focuses on cultivating students' environmental awareness, technical skills and innovative thinking in the context of sustainable development, and has cultivated a large number of green-skilled talents through interdisciplinary cooperation and practice-oriented teaching methods. These experiences are of great significance for the cultivation of green skills in China's vocational and technical education.

Keywords: Sustainable Development; European Union; Vocational Education; Green Skills; Development Strategies

1. Introduction

In recent years, the concept of sustainable development has attracted much attention globally. The impacts of climate change and environmental degradation are increasingly visible, and society's need for individuals with the knowledge and skills needed to address these challenges is becoming more pressing. This has led to the rise of the green economy

as a key pathway towards sustainable development. In this context, the development of green skills in vocational education is particularly important as they will provide critical support for the development of a green economy and the realization of the SDGs [1]. There is an urgent need for sustainable development to find a balance between addressing environmental issues and promoting economic growth. Challenges such as climate change, resource scarcity and environmental degradation have had far-reaching social and economic impacts. A green economy is sustainability-oriented and aims to achieve the dual goals of economic growth and environmental protection by promoting the development of clean energy, environmentally friendly technologies and sustainable industries. Therefore, the cultivation of green skill talents in vocational education is the key to meet the needs of this green economy [2].

Vocational education plays a central role in the green economy transition. The development of a green economy requires people with green skills who can respond to changing market demands and drive innovation. By providing training and education related to the green economy, vocational education can meet the market demand for green economy talent by producing environmentally conscious and sustainable individuals.[3].

In addition, green skills development in vocational education contributes to social equity and inclusiveness. The development of a green economy should be a participatory process for all and not limited to the interests of a few. By providing green skills training to a wide range of people, vocational education can promote social inclusiveness, reduce poverty and inequality, and enable more people to share in the opportunities and benefits of a green economy [4].

In summary, it is essential to study the green skills development strategy of EU vocational education under the orientation of sustainable development. This not only meets the demand for talents in the green economy, but also promotes the realization of the Sustainable Development Goals (SDGs) and fosters social equity and inclusion. In the context of global climate change and environmental challenges, the cultivation of talents with green skills has become a crucial task.

As a global advocate of sustainable development, the European Union has an important responsibility to address climate change and environmental issues. Through research and development of advanced green skills development strategies, the EU can ensure that the vocational education system is aligned with the SDGs, and that it fosters environmentally aware and sustainable development skills [5]. This will facilitate the transition to a green economy, address skills shortages and unemployment, enhance innovation and sustainability, and improve the EU's international competitiveness and cooperation.

2. Success Stories in Green Skills Development in Vocational Education in the EU

2.1 The Dual Vocational Education Model in Germany

The German dual vocational education model is known for its successful practice-oriented approach, which combines theoretical learning with practical training to provide students with real-world skills training relevant to the green industry. Under this model, students have the opportunity to learn and apply what they have learned in a real work environment through apprenticeships and work placements, producing professionals with green skills [6-7]. The success of this model cannot be achieved without government policy support and industry collaboration.

The German government has given active policy support to the dual vocational education model. The government has set up a specialized agency to supervise and manage the vocational education system to ensure that it matches the market demand [7]. The government has formulated relevant regulations and standards to regulate the

operation of the apprenticeship system and internship programs, and to protect the rights and safety of students. In addition, the government has provided financial subsidies and incentives to encourage enterprises to actively participate in vocational education and provide practical opportunities for students. These policy supports provide a solid foundation for the smooth implementation of the dual vocational education model [6].

The German dual vocational education model relies on close cooperation between industry and educational institutions. Enterprises in Germany are actively involved in the apprenticeship system, establishing partnerships with educational institutions to provide practical training opportunities for students [7]. Enterprises take on the responsibility of training apprentices and provide students with practical work experience and skills training. By partnering with companies, students learn the latest industry knowledge and technology and understand the requirements and challenges of real work. This close industry collaboration ensures that the educational content matches actual needs and provides students with high quality practical training.

Another key feature of the dual vocational education model is the apprenticeship system. The apprenticeship system is a training method that closely integrates students with enterprises, where students learn and work in real workplaces under the guidance of experienced mentors [6]. The advantage of an apprenticeship system is that students can learn and apply what they have learned in a real work environment, developing practical skills and professionalism. In the field of green industry, the apprenticeship system provides students with practical opportunities related to sustainable development and environmental protection. They can participate in environmental protection projects, renewable energy fields, learn and apply green skills and contribute to sustainable development. In addition to apprenticeships, work placements are an important part of the dual vocational education model. Students have the opportunity to undertake internships in companies or organizations in the course of their studies, working alongside professionals and experiencing first-hand the actual operations of the green industry [7]. Through

internships, students can translate theoretical knowledge into practical skills and learn about career opportunities and challenges. Internships also provide students with the opportunity to network with companies and build a solid foundation for future employment.

Overall, the German dual vocational education model successfully combines theoretical learning with practical training through government policy support and industry cooperation, providing students with practical skills training relevant to the green industry. Apprenticeships and work placements are the core elements of the model, helping students to apply what they have learned in practical work and training professionals with green skills.

2.2 The Swedish Model of Practice-Oriented Education

Sweden has always focused on environmental education and education for sustainable development by integrating green skills into school curricula and providing practice-oriented projects and internships to develop professionals with green skills. This practice-oriented education model not only helps students apply what they have learned to real-world scenarios, but also fosters innovative thinking and problem-solving skills, making an important contribution to Sweden's sustainable development [8].

Sweden integrates environmental education and education for sustainable development into the school curriculum. From elementary school to upper secondary school, pupils are taught about the environment and sustainable development. They study environmental science, natural resource management, clean energy technology and other courses to understand the importance of environmental protection and sustainable development [9]. Through these courses, students gain a deeper understanding of environmental issues and develop an interest in green skills.

Sweden focuses on a practice-oriented education model that helps students to apply what they have learned in real-world scenarios. Students are involved in a variety of practical projects, such as environmental protection activities and sustainable energy projects [10]. They have the opportunity to get hands-on experience in practical environmental protection and sustainable development work,

understanding the complexity of real problems and the process of implementing solutions. This practical experience not only deepens students' understanding of green skills, but also develops their teamwork and leadership skills.

Schools in Sweden also actively work with businesses and communities to provide internships for students. Students have the opportunity to apply what they have learned through internships in businesses or organizations related to green skills [11]. This internship experience not only provides students with the opportunity to work with and learn from professionals, but also prepares them for future employment. At the same time, businesses and communities gain fresh thinking and innovative ideas from the students, contributing to the practical promotion of sustainable development.

Sweden also promotes green skills education through government support and investment. The Government encourages schools to upgrade teaching facilities and materials to meet the training needs of green skills. In addition, the government provides financial support and scholarships to encourage students to choose green-skills related majors and provides them with financial assistance [12]. These government support measures have made green skills education more popular and sustainable.

In general, Sweden focuses on environmental education and education for sustainable development, producing professionals with green skills by integrating them into school curricula and providing practice-oriented projects and internships. This practice-oriented education model not only helps students apply what they learn to real-world scenarios, but also fosters innovative thinking and problem-solving skills. The practical promotion of green skills is also facilitated by the collaboration of Swedish schools with businesses and communities. Government support and investment have furthered the development of green skills education. Through these efforts, Sweden has built a solid talent base for sustainable development and has made a positive contribution to addressing environmental challenges and promoting a green economy.

However, Sweden does not stop there. They realize that knowledge and skills in the field of

environment and sustainable development are constantly developing and evolving. As a result, they continually update their curriculum content and teaching methods to keep up with new green technologies and innovations. The Swedish education system maintains close links with relevant industry and research organizations to ensure that students are exposed to the latest green skills and practices [10].

In addition, Sweden encourages students to participate in scientific research and innovation projects to promote green skills. Students have the opportunity to participate in research projects in environmental sciences and explore new solutions and technologies to contribute to sustainable development. This positive climate for research and innovation further stimulates students' interest and enthusiasm for green skills and prepares them to become future scientists, engineers and entrepreneurs.

Overall, the Swedish model of environmental education and education for sustainable development provides students with comprehensive green skills development. By integrating green skills into school curricula, providing practice-oriented projects and internships, and encouraging students to engage in scientific research and innovation, Sweden produces professionals with green skills. This provides strong support for sustainable development in Sweden and offers valuable lessons and inspiration for education in the field of environmental protection and sustainable development in other countries.

2.3 Policy Support and Economic Incentives in France

France has been committed to promoting green skills training and employment by encouraging the participation of businesses and individuals through policy support and economic incentives to advance the field of renewable energy and energy efficiency. This positive policy environment provides a wide range of training and employment opportunities for students, while contributing to the prosperity of the French green economy.

The Government of France encourages green skills training and employment through policy support and economic incentives. The Government has put in place a series of laws and regulations to support the development of

the renewable energy and energy efficiency sectors. For example, France has enacted a renewable energy development law aimed at accelerating the deployment and utilization of renewable energy sources, which provides opportunities for businesses and individuals to invest and grow. In addition, the Government provides economic incentives, such as financial subsidies and tax concessions, to encourage enterprises and individuals to participate in green skills training and employment. These policies and measures have effectively energized the green skills sector and attracted more talent and investors to the sector [13-14].

France actively promotes the field of renewable energy and energy efficiency, offering a wide range of training and employment opportunities for students. France has made remarkable achievements in the field of renewable energy, with particular strengths in wind and solar energy. In order to meet the industry's demand for green-skilled personnel, France has set up specialized training institutes and green-skills centers to provide training courses covering the design, installation and operation and maintenance of renewable energy systems. By participating in these training courses, students can acquire specialized skills and knowledge to prepare for future employment. At the same time, the French government has also partnered with businesses and industry organizations to provide internships and employment opportunities for students to help them apply the skills they have learned in the real world [15].

France focuses on developing students' innovative and practical abilities by providing them with comprehensive green skills training. Green skills training courses not only focus on the transfer of theoretical knowledge, but also emphasize hands-on practice and participation in real projects. Students will participate in a variety of practical activities and projects to hone their problem-solving skills and innovative thinking. They will work with companies to address real technical and environmental challenges, developing hands-on skills and teamwork. This comprehensive training makes France's green-skilled professionals highly practical and adaptable, able to quickly adapt to industry developments and changes [13-14].

France also focuses on international cooperation and exchanges on green skills training. France actively cooperates with other countries and international organizations to share experiences and best practices in green skills training. Through international exchanges, French students and practitioners have the opportunity to come into contact with international advanced green technologies and management concepts, broadening their horizons and ways of thinking. At the same time, France has attracted students and professions from all over the world to engage in green skills training and employment, promoting international mobility and exchange of talents.

Overall, France has actively promoted green skills training and employment through policy support and economic incentives. Such efforts not only provide opportunities for businesses and individuals to grow, but also offer a wide range of training and employment opportunities for students. Through government policy guidance and economic incentives, France has made remarkable progress in the field of green skills, making a significant contribution to the development of renewable energy and energy efficiency. At the same time, France has emphasized the development of students' innovative and practical abilities, and has strengthened the training of green-skilled personnel through international cooperation and exchanges. It is foreseeable that, with France's sustained efforts, green skills training and employment will continue to flourish and make a greater contribution to sustainable development and environmental protection.

2.4 Industry Cooperation and Green Skills Centers in the Netherlands

The Netherlands is a country with extensive experience in the development of green skills in vocational education. Through cooperation with industry and the establishment of green skills centers, the Netherlands has successfully provided green skills training and certification for students and practitioners [16]. This close linkage ensures that the training content is aligned with the needs of industry and provides a solid foundation for the development of green skills. Green skills training in the Netherlands is closely linked to industry cooperation. The Dutch government

has established a close partnership with various industries to jointly develop standards and curricula for green skills training [1,17]. This cooperative mechanism ensures that the training content is closely aligned with the actual needs of the workplace, and improves the relevance and practicality of the training [16]. The Dutch government has also set up a special organization responsible for communicating and coordinating with the industry to understand the needs and development trends of the industry and adjust the training contents in a timely manner so as to meet the ever-changing market needs [17]. Green Skills Centers in the Netherlands offer a wide range of training and certification opportunities for students and practitioners. These centers offer a variety of green skills training courses covering areas such as renewable energy, energy efficiency, and environmental management [18]. The training courses emphasize both theoretical knowledge transfer and hands-on practice and skills development. Students and practitioners can conduct hands-on training in laboratories and simulated environments to improve their practical skills. Upon completion of the training, they can also sit for the Green Skills Certification Examination to obtain appropriate certificates and qualifications, enhancing their competitiveness in the job market [17]. In addition, the Green Skills Centres in the Netherlands work closely with industry organizations to provide internships and employment opportunities. The center has established partnerships with major companies to [16] provide students and practitioners with opportunities for practical work experience. During their internships, students can get hands-on experience with Green Skills projects, learn about workflows and real-world problems in the industry, and improve their problem-solving skills in practice. At the same time, the center also connects with companies for employment and provides employment support and guidance to students and practitioners to help them find employment and develop their careers. The establishment of the Dutch Green Skills Center and its close cooperation with the industry not only provide students and practitioners with opportunities for green skills training and certification, but also provide strong support for the development of the green economy. By

ensuring that the training content matches the needs of industry, this model of cooperation helps to produce professionals who are well adapted to the needs of the green economy, contributes to the realization of sustainable development, and supports the Netherlands' leadership in the field of green technology and innovation [17].

3. Implications for the Cultivation of Green-Skilled Talents in Vocational Education in China

Through the study of Chinese government policy documents and guidance on the cultivation of green-skilled personnel, combined with the efforts of vocational education institutions in curriculum development, practical teaching, teacher training and cooperation and exchange, a number of important development trends and empirical practices can be seen. On these bases, insights into the cultivation of green skill talents are drawn, specifically including the following aspects: multidisciplinary integration: the cultivation of green skills needs to cross multiple disciplinary fields, including environmental science, renewable energy, energy-saving technologies, etc. When cultivating green skill talents, knowledge and skills from different disciplines should be integrated to provide comprehensive training and education so that students can have comprehensive green skills. Practice-oriented: Cultivating green skill talents should focus on the cultivation of practical ability. Students need to apply the theoretical knowledge they have learned to real-world situations through practical activities such as experiments, internships, and projects to develop problem-solving and innovation skills. Practical experience enhances students' practical skills and provides opportunities to work with the industry, enabling them to better adapt to the actual working environment. Teacher professionalization training: Teachers play an important role in green skills education, and they need to have appropriate professional knowledge and educational competence. In order to improve the professionalism of teachers, specialized training in green skills education should be provided so that they are aware of the latest technological developments and industry requirements, and are equipped with effective teaching methods and

assessment tools. Standards and certification: Establishing standards and certification systems for green skills can help ensure the quality and comparability of green-skilled personnel. Setting clear standards can help students understand the skills and knowledge required, and at the same time provide employers with a reliable reference. A certification mechanism can assess and certify the level of green skills of individuals and enhance their competitiveness in the job market. Cross-boundary cooperation: Cultivation of green skills requires cooperation among multiple parties, including the industry, educational institutions and the government. Establishing close links between the industry and educational institutions can ensure that the green skills developed match the actual needs and provide internship and employment opportunities. Government involvement in terms of policy, funding and support is also key to green skills development, facilitating the development and promotion of green skills education. Awareness of continuous learning and innovation: Knowledge and technology in the field of green skills are constantly evolving, and the green-skilled personnel to be trained need to be aware of continuous learning and innovation. Students should be encouraged to take the initiative to pursue new knowledge and skills, and develop their independent learning ability and adaptability. At the same time, educational institutions should keep their teaching content up to date and innovative, following the latest developments in the field of green skills.

These insights can help us to develop comprehensive educational programs in green skills training, focusing on practical skills, teacher training, standards certification and industry cooperation, in order to develop human resources with comprehensive green skills to contribute to sustainable development.

4. Conclusion

Vocational education has an important role to play in the training of green-skilled personnel. Drawing on the experience of European countries such as Germany, Sweden, France and the Netherlands, we can cultivate green-skilled talents that meet the needs of sustainable development through policy support, industry cooperation, practice-oriented education models and

docking with industry needs. These talents will play an important role in the green industry and promote the development of China's green economy and economic transformation and upgrading. The government, schools, enterprises and all parties in the society should work together to provide support and opportunities for the cultivation of green skill talents, and jointly build a talent cultivation system to contribute to sustainable development and environmental protection. At the same time, it is also necessary to pay continuous attention to the latest trends and needs of green skills development at home and abroad, and constantly adjust and optimize the training programs to meet the needs of the rapidly changing green economy and industrial development. Only by training more green skill talents can we realize the sustainable development of green economy and contribute to the sustainable development in the future.

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