Construction and Application of Practical Teaching Platforms for the Cultivation of Green and Low-Carbon Talents in the Perspective of Industry-Education Integration

Longsheng Li

lys-08@163.com

Shandong Institute of Commerce and Technology , Jinan, Shandong , 250103, China

Abstract: This study, with the goal of cultivating green and low-carbon talents, aims to enhance students' practical skills by constructing an immersive practical teaching platform. This platform integrates theoretical learning, virtual simulation, hands-on training, and project showcases, creating an immersive learning environment for students to acquire knowledge and improve their skills. The results of its application demonstrate that compared to traditional teaching methods, this platform significantly stimulates students' interest in learning and enhances their comprehensive practical abilities. Although further improvements are needed in terms of resource development, application promotion, data analysis, and faculty training, the practice-oriented teaching reform based on the platform has shown initial positive effects. This study provides a new practical teaching model for the cultivation of applied talents in the field of green and low-carbon development. Further reforms and improvements are necessary to enhance teaching quality.

Keywords: green and low-carbon, talent cultivation, practical teaching platform

1 Introduction

With the increasing demand for green and low-carbon talents in China, it is imperative to enhance the practical skills of talent development. While previous research has proposed various teaching models, little attention has been paid to immersive practical teaching platforms. This study aims to construct a platform that seamlessly integrates theoretical learning with practical training. However, the application and effectiveness of immersive practical teaching platforms are not yet clear. Therefore, this study designs, implements, and evaluates an immersive teaching platform for the cultivation of green and low-carbon talents. The remaining sections of this paper are organized as follows. Section 2 outlines the design principles of the platform. Section 3 provides a detailed description of the platform's construction, including its framework, modules, and resources. Section 4 describes typical use cases, curriculum settings, and teaching outcomes. Section 5 discusses existing issues and solutions. Finally, Section 6 summarizes the entire paper.

ITEI 2023, November 24-26, Zhengzhou, People's Republic of China

DOI 10.4108/eai.24-11-2023.2343587

2 Design principles of the practical teaching platform

The design principles of the practical teaching platform should be student-centric, focusing on students' learning needs and aiming to cultivate their awareness of green and low-carbon practices and practical skills development [1]. The platform adopts an "integration of theory and practice" design philosophy, seamlessly combining theoretical learning with practical hands-on experiences, enabling students to master professional knowledge and skills through practical application. Specifically, the platform establishes a self-directed learning area for students, providing resources such as green and low-carbon-related videos and case analyses that students can autonomously select based on their learning progress [2]. Additionally, the platform creates an immersive virtual simulation environment, designing various simulated scenarios and situations for students to practice within a virtual environment. Furthermore, the platform establishes a platform for students to showcase their work, incorporating real projects from industry enterprises, guiding student teams in conducting project research, completing project development, and providing a platform for presentation and communication. Through these settings, students' interest in learning is stimulated, allowing them to acquire knowledge with enthusiasm and improve their abilities through practical experience. This is the design philosophy of the practical teaching platform [3].

3 Specific construction of the practical teaching platform

3.1 Overall framework of the platform

The overall framework of the practical teaching platform adopts an "integrated" design approach, organically integrating various components such as theoretical learning, virtual simulation, hands-on practice, and project showcases on a single platform to achieve resource sharing and interrelated applications [4], as shown in Table 1.

Table 1: Overall Framework of the Practical Teaching Platform

module	Description
Overall framework	Integrated design combines theoretical learning, virtual simulation, practical operation, work display and other links on one platform to achieve resource sharing and linkage application.
Module design	Modular design, including self-learning module, virtual simulation module, practical training module and work display module.
Students choose their own modules	Students can choose their own modules to study according to their personal learning plan, and each module can be connected to each other.
Background management	Background construction implements unified login, data collection and user management for all modules.
Technical architecture	Using B/S architecture, students can access learning through a browser. The platform supports access from multiple terminals, including PCS and pads.

3.2 Main functional modules

The main functional modules of the practical teaching platform include three parts: the self-directed learning module, the virtual simulation module, and the project showcase module.The self-directed learning module offers a variety of teaching resources such as videos, electronic courseware, and case studies. Students can select and engage in learning activities based on their own interests and needs. The system also tracks the learning progress of each student to assess their performance. Students can choose relevant educational resources based on their interests, and the system tracks their progress and performance to evaluate their learning outcomes.The virtual simulation module creates three-dimensional virtual environments with various simulated devices and parameters. This allows students to complete practical tasks in virtual scenarios, enhancing their understanding of the subject matter. This module offers multiple three-dimensional virtual scenes to simulate real working environments, with various virtual simulation devices and adjustable parameters. Students can operate devices and adjust parameters in the virtual environment to complete assigned simulation tasks, thereby deepening their understanding of the subject and improving their practical skills.The project showcase module supports student teams in uploading and presenting their projects for evaluation. Student teams can upload project descriptions, images, and other materials for display and participate in project evaluation activities. It also enables discussion and communication among student teams, and teachers can provide feedback and assessments on student projects. These functional modules also provide features for discussion, communication, and teacher evaluations to promote interaction among students and between students and teachers[5-6].

3.3 Resource development

In the development and improvement of the practical teaching platform, resource development plays an indispensable role, and its importance can be summarized by the following formula:

$$R = A + B + C + D + E \tag{1}$$

Here, R represents the overall resource construction. To ensure the comprehensiveness and practicality of the resources, we have divided the resource construction into several key components: A is for self-learning resources, covering comprehensive content from basic knowledge to cutting-edge technology, aimed at fostering students' self-learning abilities; B is for virtual simulation resources, which enhance students' practical operation skills through highly simulated experimental environments; C is for hands-on training resources, emphasizing on-site operations to expose students to more realistic work scenarios; D is for works display resources, showcasing the achievements of students and teachers to promote school-enterprise cooperation and knowledge transfer; E is for green and low-carbon resource repositories, gathering various latest industry information related to green and low-carbon initiatives, keeping educational content in sync with industry development[7]. Through this approach, the diversity and practicality of teaching resources are ensured, strengthening the teaching function and practicality of the platform, making it closer to industry needs and forefront developments.

3.4 Platform implementation roadmap

To effectively advance the construction of the practical teaching platform, we have adopted a phased implementation strategy, which can be described using the following formula:

$$P(t) = P_0 + \alpha F_1(t) + \beta F_2(t) + \alpha F_3(t) \quad (2)$$

In this formula, P(t) represents the progress of platform construction at time t. P0 denotes the initial stage of the platform, primarily involving overall planning and basic framework construction. F1(t), F2(t), and F3(t) represent the progress of the first, second, and third implementation stages, respectively, as they change over time. Here, α, β, and γ are the weighting coefficients for each stage, emphasizing the importance of each stage in the overall platform construction. The first stage involves the planning of the platform's basic infrastructure and major functional modules. The second stage focuses on enhancing platform functionality and developing core educational resources. The third stage involves further enrichment of resources and the comprehensive promotion of the platform [8]. Throughout the entire process, continuous user feedback is collected, and necessary adjustments and optimizations are made based on the feedback to ensure that the platform better serves educational goals and student needs [9].

4 Application of the practical teaching platform

4.1 Typical cases

The practical teaching platform has successfully conducted several impressive typical teaching applications, which have not only enhanced students' practical abilities but also enriched their learning experiences. In the "Green Building Technology" course, the school utilizes the platform's virtual simulation module to provide students with a virtual construction site environment. In this virtual environment, students can design green building solutions, use various green building materials to achieve goals such as energy conservation, water resource conservation, and environmental protection in multiple aspects of green construction. Through this approach, students not only learn the theoretical principles of green building but also apply their knowledge in practical situations, fostering their practical skills[10].Another example is the "Solar Photovoltaic Power Generation" course, in which students complete the design of an entire solar power generation system through the platform and test the power generation performance in a virtual environment. This case allows students to experience the process of solar power generation firsthand, understand the working principles of photovoltaic cells, and also develop their innovation and problem-solving abilities. These typical cases break free from the constraints of traditional theoretical teaching by seamlessly integrating professional knowledge into real-world situations, providing students with more challenging and practical learning experiences. This not only enhances students' professional competence but also cultivates their teamwork, innovation, and practical skills, providing robust support for addressing future societal and career challenges.

4.2 Curriculum offerings

The school has leveraged the practical teaching platform extensively and actively introduced a series of distinctive green and low-carbon courses to meet the current societal demand for

knowledge in environmental protection and sustainable development. These courses include "Green Building Technology," "Ecological Design," "Circular Economy," and other specialized courses, as well as a series of project-based courses such as "Green Technology Project Research" and "Green and Low-Carbon Entrepreneurship."These courses not only fully integrate the resources and functional modules of the practical teaching platform but also support various educational scenarios, including traditional classroom teaching, project research, and practical applications. Through the practical teaching platform, students can interact better with educational resources, enhancing their learning experiences and capabilities.At the same time, the application scope of the practical teaching platform has expanded to include industry-academic-research projects in collaboration with enterprises. This provides students with valuable opportunities to participate in actual research and development projects in companies and complete various design tasks. This university-enterprise collaboration not only helps students apply their knowledge to real projects but also strengthens their professional competence and practical work experience.Through the organic integration and expansion of the practical teaching platform, the school has successfully created a series of courses and projects related to the field of green and low-carbon, offering students rich learning opportunities and practical experiences. This further promotes the development and application of green and low-carbon education.

4.3 Evaluation of Effectiveness

Since the implementation of the platform, students have shown a significant increase in their interest in course studies, and there has been a noticeable improvement in the quality of their design work.

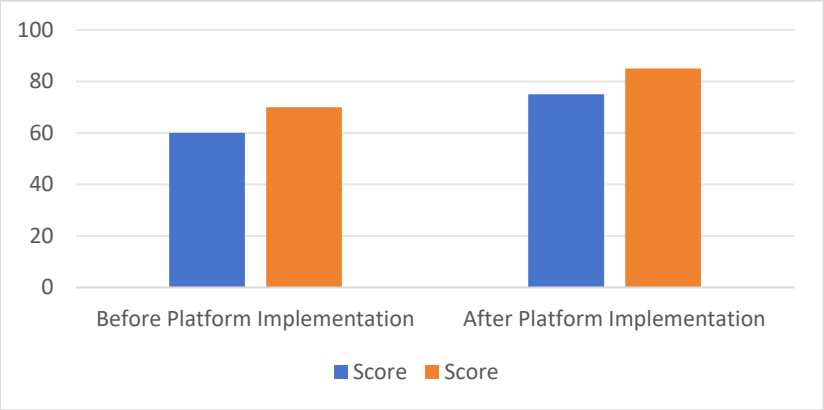

Figure 1: Evaluation of Effectiveness

The comprehensive assessment results of students' practical abilities indicate that students using the platform have significantly higher scores in all ability indicators compared to those following traditional teaching methods. Several teaching achievements submitted by our university and reliant on the platform have received provincial and national awards. Surveys show that over 90% of students have positively evaluated their learning experience with the platform. In conclusion, a comprehensive analysis demonstrates that the application of the

practical teaching platform has achieved significant teaching effectiveness.As shown in Figure 1.

5 Challenges and countermeasures

Currently, the practical teaching platform still faces several issues in various aspects that require a series of measures to continuously improve and enhance it. One of the key issues is the insufficient development of platform resources. In order to provide more opportunities for practical education, there should be an active search for and integration of additional resources, including laboratory equipment, practical courses, and real-world projects to enrich the educational content of the platform.Another critical challenge is the need to promote platform adoption. Effective promotion strategies need to be devised to encourage more students and teachers to use the practical teaching platform. This could include promotional activities, training courses, and incentive programs to expand the user base and ensure that more people benefit from practical education.Additionally, there is a need for stronger data collection and analysis. By collecting and analyzing performance data of students and teachers on the platform, a better understanding of their needs and progress can be obtained. This can help in adjusting educational content and providing personalized support to better meet user requirements.Teacher proficiency in using the platform is also a crucial issue. Training and support should be provided to help teachers make better use of the practical teaching platform, improving the quality and effectiveness of their education.Strengthening university-enterprise collaboration and societal applications is also essential. Collaborations with businesses and society can offer students more practical opportunities and integrate classroom knowledge with real-world applications. This can be achieved through establishing partnerships with companies, organizing field visits, and practical projects.Establishing a standardized iterative upgrade mechanism is crucial to ensure the continuous improvement and development of the platform. Regular reviews and updates of platform content and functionality should be conducted to keep up with developments in educational technology and changes in user needs.By addressing issues related to resource development, platform promotion, data analytics, teacher proficiency, and actively engaging in university-enterprise collaboration and societal applications, we can continuously enhance the quality and impact of the practical teaching platform. This will better cultivate students' green and low-carbon practical skills and enable the platform to play a more significant role in talent development.

6 Conclusion

Through the construction of the practical teaching platform, effective integration of theoretical learning, virtual simulation, project-based training, and design projects has been achieved, significantly enhancing the practicality of cultivating green and low-carbon professionals. The platform's application has not only strengthened students' mastery of professional knowledge but, more importantly, markedly improved their ability to apply knowledge to solve real-world problems. It can be said that the practical teaching platform has created an immersive professional learning environment, allowing students to acquire knowledge and develop skills in an atmosphere closely resembling real work scenarios. While there are areas for ongoing improvement in platform development, the reform of practical teaching based on the platform

has already shown initial success. We are confident and committed to further advancing this reform to improve the quality of talent development and contribute to society by nurturing a greater number of highly skilled applied professionals.

References

[1] Zhong Z .Construction and Application of Computer Network Experimental Teaching Platform Based on Big Data[J]. 2023.

[2] Yang H .Construction and Application of Smart Education Teaching Platform[J].Journal of Physics: Conference Series, 2021, 1744(4):042147 (6pp).

[3] Xiao X , Liu X , Xiao Z .Construction and Application of Computer Virtual Simulation Teaching Platform for Medical Testing[J].Journal of Physics: Conference Series, 2021, 1915(4):042074-.

[4] Han L , Liu X , Cheng Z ,et al.Construction and Application of a High-Throughput In Vivo Screening Platform for the Evolution of Nitrile Metabolism-Related Enzymes Based on a Desensitized Repressive Biosensor[J].ACS Synthetic Biology, 2022(4):11.

[5] Li N , Jiang P , Li C ,et al.College Teaching Innovation from the Perspective of Sustainable Development: The Construction and Twelve-Year Practice of the 2P3E4R System[J].Sustainability, 2022, 14.

[6] Jing X , Maia D .The Construction and Development of App Application Platform for Public Information Products of Urban Grand Media in the Context of Artificial Intelligence[J].Hindawi Limited, 2021.

[7] Gusev A , Kupryshkin V F , Ulanov A S ,et al.Substantiation of the Design Parameters of the Working Elements of the Drive of a Mounted Soil-cultivating Module with Combined Rotation of Active Working Bodies[J].Machinery and Equipment for Rural Area, 2022.

[8] Huang X , Yang J , Jin W ,et al.Design and Application of a Practical Decision-Making and Commanding Platform for Emergency Rescue[C]//IEEE International Conference on Software Engineering and Service Science.IEEE, 2021.

[9] Alifu X , Wusuyin N , Yasen M .Construction and Application of Virtual Simulation Platform for Medical Education Based on Big Data[J]. 2022.

[10] Zhang P .Construction and Application of Employment Platform for Intelligent Poor College Students Under Information-Based Education[J].Springer, Cham, 2021.