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Application Research of Information Technology Teaching Model in “Green Building and Prefabricated Structure” Curriculum Reform

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Abstract: This study focuses on the application of information technology teaching models in the reform of the "Green Building and Prefabricated Structure" course, targeting issues such as the disconnection between theory and practice, low student participation, and outdated teaching content in traditional instruction. A reform plan based on information technology is proposed, which includes building an information technology teaching platform, developing multimedia resources, designing virtual simulation experiments, and establishing online interactive platforms. These measures aim to enhance teaching quality, stimulate students' learning interest, and improve their practical and innovative abilities. The paper systematically expounds the construction path, implementation strategies, and expected outcomes of the information technology teaching model, providing a theoretical basis and practical methods for curriculum reform in civil engineering education. This research has significant implications for cultivating high-quality talents that meet industry demands.

Keywords: Information Technology Teaching; Green Building; Prefabricated Structure; Curriculum Reform; Civil Engineering

1. Introduction

With the rapid development of information technology and the transformation and upgrading of the construction industry, the traditional teaching model has been difficult to meet the teaching requirements of the "Green Building and Prefabricated Structure" course. Some domestic scholars have achieved certain research results in the informatization teaching of civil engineering. For example, Wang Liang et al. [1] used information technology to guide students' autonomous learning and improve teaching effectiveness; Chen Peiyuan [2] reconstructed and organized the teaching content through the informatization teaching method of experimental courses, and gave some suggestions on informatization teaching; Li Changfeng et al. [3] put forward specific implementation measures and approaches to promote the informatization teaching reform of this course by using information technology; Huang Ruolin et al. [4] widely applied information technology to teaching, and promoted the development of educational digitalization by constructing co-built and shared information-based curriculum resources and curriculum systems; Wang Chong [5] adopted a variety of information technologies to guide students' autonomous learning; Ou Yong et al. [6] introduced virtual simulation technology into the course, which improved students' learning enthusiasm and exercised their comprehensive abilities. These curriculum teaching reforms can improve the teaching effectiveness of civil engineering professional courses to a certain extent, but the research is not in-depth. This study aims to explore the application of the informatization teaching model in this course to improve teaching quality and cultivate high-quality talents meeting industry needs. By analyzing the problems existing in the current curriculum teaching and combining the characteristics of information technology, a targeted reform plan is proposed to provide a reference for the teaching reform of civil engineering professional courses.

2. Theoretical Foundation and Current Situation Analysis of the Informatized Teaching Model

The informatized teaching model is an important product of the development of educational informatization. Its theoretical foundation mainly comes from constructivist learning theory, blended learning theory, and personalized learning theory. Constructivism emphasizes that learners actively construct knowledge in real-world situations, and informatized teaching provides rich virtual environments and interactive tools for this purpose. The blended learning theory advocates combining traditional face-to-face teaching with online learning to give full play to the advantages of both. The personalized learning theory emphasizes providing customized learning content and paths according to the individual differences of learners, and information technology makes it possible to achieve this goal.

In the field of civil engineering education, the application of the informatized teaching model has achieved remarkable results. For example, virtual simulation technology has been widely used in practical teaching such as structural analysis and construction simulation, enabling students to practice repeatedly in a safe and controllable environment. The rise of MOOCs (Massive Open Online Courses) has provided civil engineering students with more high-quality learning resources. In addition, the introduction of BIM (Building Information Modeling) technology has not only revolutionized the traditional engineering design teaching method but also provided a platform for interdisciplinary collaboration for students.

However, in the teaching of the emerging course "Green Building and Prefabricated Structure", the application of the informatized teaching model still faces many challenges. First, the problem of lagging teaching content update is particularly prominent. Prefabricated building technology is developing rapidly, but textbooks and teaching resources are difficult to update in a timely manner, resulting in students' difficulty in mastering the latest industry trends and technical standards. Second, the teaching method still mainly relies on traditional lectures, lacking practicality and interactivity. Prefabricated buildings involve multiple links such as design, production, and construction, and simple theoretical explanations make it difficult for students to form a systematic understanding.

The limited teaching resources restrict the improvement of teaching effectiveness. High-quality virtual simulation software is expensive, and many institutions can hardly afford it. The opportunities for on-site visits to prefabricated building projects are limited, making it difficult for students to obtain an intuitive engineering experience. In addition, the existing informatized teaching platforms have single functions and are difficult to meet the special needs of the course. For example, the lack of a virtual construction simulation system for the characteristics of prefabricated buildings makes it difficult for students to deeply understand the installation process and key technologies of prefabricated components.

These problems seriously affect the teaching quality of the course and the effect of talent cultivation. Students generally reflect that the existing teaching methods are difficult to stimulate their learning interest, and their understanding of prefabricated buildings remains at a superficial level, lacking practical operation ability and innovative thinking. This not only affects students' employment competitiveness but also restricts the healthy development of the prefabricated building industry. Therefore, exploring an informatized teaching model suitable for the characteristics of the "Green Building and Prefabricated Structure" course has become an important issue that needs to be solved urgently.

3. Informatized Teaching Reform Plan for the "Green Building and Prefabricated Structure" Course

In response to the problems existing in the current teaching of the "Green Building and Prefabricated Structure" course, this study proposes a systematic informatized teaching reform plan. The plan aims to improve teaching quality, cultivate students' practical ability and innovative thinking, and make full use of modern information technology to build an all-round and multi-level informatized teaching system. It is elaborated in five points as follows:

3.1 Building a Comprehensive Informatized Teaching Platform

This is the foundation of the reform. The platform should integrate various high-quality teaching resources, including online courses, virtual simulation experiments, case libraries, industry standard libraries, etc. The platform design should focus on user experience and adopt a modular structure, which is convenient for teachers to flexibly combine resources according to teaching needs. For example, modules such as "Basic Knowledge", "Design Principles", "Construction Technology", and

"Case Analysis" can be set up, and each module contains video explanations, interactive exercises, online tests, etc. At the same time, the platform should support mobile access, facilitating students to learn anytime and anywhere.

3.2 Developing High-Quality Multimedia Teaching Resources

This is the key to improving teaching effectiveness. In view of the characteristics of prefabricated buildings, resources such as 3D models, animation demonstrations, and virtual reality (VR) should be developed with emphasis. For example, 3D models of typical prefabricated building projects can be created, and students can deeply understand the building structure and node construction through operations such as rotation and zooming. For complex construction techniques, such as the hoisting and connection of prefabricated components, detailed animation demonstrations can be made to help students understand the key operation points. In addition, VR teaching scenarios can be developed to let students "immerse" in the whole process of prefabricated building construction, enhancing the sense of immersion and interest in learning.

3.3 Designing Virtual Simulation Experiments

This is an important means to cultivate students' practical ability. A virtual simulation experimental platform based on BIM technology can be developed to simulate the entire process of prefabricated building design, production, and construction. Students can carry out practical operations such as building scheme design, component disassembly, and construction organization in a virtual environment, and the system will automatically record the operation process and give evaluation feedback. For example, in the construction simulation link, students need to reasonably arrange the hoisting sequence of prefabricated components, and the system will give a score according to the correctness and efficiency of the operation. This kind of virtual experiment can not only make up for the lack of on-site visit opportunities but also allow students to practice repeatedly in a safe environment, improving their practical skills.

3.4 Establishing an Online Interactive Platform

This is an important way to promote teacher-student communication and collaborative learning. An online community based on the concept of social networking can be developed to support real-time communication, problem discussion, and resource sharing between teachers and students. For example, an "Expert Q&A" section can be set up to invite industry experts to answer students' questions online regularly; a "Project Collaboration" section can be set up to support students to form teams to complete virtual engineering projects; an "Achievement Display" section can be set up to encourage students to share their learning experiences and innovative ideas. This interactive learning environment helps to stimulate students' learning interest and cultivate their teamwork ability.

3.5 Introducing Big Data Analysis and Artificial Intelligence Technology

This is an important support for realizing personalized teaching. By collecting students' learning behavior data on the platform, such as video watching duration, exercise completion, test scores, etc., and using big data analysis technology, the learning progress and effect of each student can be accurately evaluated. Based on these analysis results, the system can automatically recommend suitable learning resources and provide personalized teaching suggestions for teachers. At the same time, an intelligent tutoring system can be developed, using natural language processing technology to provide students with 24-hour online intelligent answering services. For example, students can ask questions through voice or text, and the system will automatically search the relevant knowledge base and give accurate answers. For complex questions, the system can also guide students to study in-depth on relevant knowledge points.

The implementation of these informatized teaching reform measures will effectively improve the teaching effect of the "Green Building and Prefabricated Structure" course. Students can not only master solid theoretical knowledge but also cultivate practical ability and innovative thinking through virtual simulation and online collaboration. At the same time, teachers can use informatized tools to achieve accurate teaching and personalized guidance, improving teaching efficiency. In the long run, this reform will cultivate more high-quality talents for the prefabricated building industry and promote the innovative development of building industrialization.

4. Implementation Strategies and Expected Effects of the Informatized Teaching Model

With the deep integration of information technology and the education field, building a systematic and sustainable informatized teaching model has become an important direction of educational reform. This article analyzes from two aspects of implementation strategies and expected effects, aiming to provide a practical framework that can be implemented for educational institutions.

4.1 Implementation Strategies: Building a "Four-in-One" Support System

4.1.1.Strengthening Teacher Capacity Building and Creating a Digital Teaching Team

Teachers are the core driving force of informatized teaching. A three-dimensional training mechanism of "basic training + advanced research + practical incentive" needs to be established:

Popularization of basic skills: Through school-enterprise cooperation, carry out training on the operation of information tools, such as the application of virtual simulation software and smart classroom platforms, to solve the technical operation bottlenecks of teachers.

Upgrading of teaching concepts: Organize educational technology experts to carry out special research, guide teachers to understand new teaching models such as blended teaching and project-based learning, and promote the transformation from "knowledge imparting" to "ability cultivation".

Practical incentive mechanism: Set up innovation awards for informatized teaching, encourage teachers to develop digital curriculum resources, and incorporate the achievements into the professional title evaluation system.

4.1.2 Consolidating the Hardware Foundation and Building an Intelligent Teaching Environment

Hardware facilities are the "high-speed road" of informatized teaching, and a "three-level" support system needs to be constructed:

Basic level: Achieve full-coverage of gigabit campus network, and build cloud servers to ensure the storage and sharing of teaching data.

Application level: Build a cluster of smart classrooms, equipped with interactive electronic whiteboards, VR/AR devices, and Internet of Things control systems. For example, the architecture major can introduce a BIM virtual construction laboratory.

Expansion level: Connect to industry resource platforms, such as jointly building the "Intelligent Construction Teaching Resource Library" with the Architectural Society of China to obtain the latest industry cases and standard specifications.

4.1.3 Reconstructing the Curriculum System and Realizing Innovation in Teaching Methods

Reconstruct the curriculum system based on "ability-orientation" to form the characteristics of "three integrations":

Time-space integration: Adopt the flipped classroom model of "online micro-lesson preview + offline in-depth discussion". For example, through this model, the classroom interaction rate of the "Architectural Structure Design" course in a certain university has increased by 40%.

Virtual-real integration: Use virtual simulation technology to carry out teaching in high-risk scenarios. For example, in building safety training, VR is used to simulate high-altitude operation accidents to reduce the risk of practical operations.

Industry-education integration: Introduce real enterprise projects as teaching cases, and jointly develop practical courses such as "Intelligent Construction Project Management" to narrow the gap between talent cultivation and job requirements.

4.1.4 Improving the Evaluation Mechanism and Forming a Quality Improvement Loop

Establish a "three-dimensional" dynamic evaluation system:

Student dimension: Use the AI learning analysis system to track the degree of knowledge mastery, and combine the e-portfolio to record the growth track.

Teacher dimension: Implement a 360-degree evaluation of "student evaluation of teaching+peer evaluation+enterprise feedback", with a focus on examining the innovative ability of informatized teaching.

Course dimension: Analyze indicators such as the click-through rate of course resources and the frequency of interaction through big data, and dynamically optimize the teaching content. For example, according to the data feedback, a certain vocational college has increased the class hour proportion of BIM technology from 15% to 30%.

4.2 Expected Effects: Multidimensional Empowerment for the Upgrade of the Educational Ecology

4.2.1 Significant Improvement in Teaching Quality

Student side: The learning participation rate has increased by more than 50% (as shown by the practical data of a certain vocational education group). Through virtual simulation training, the error rate of drawing reading of architecture majors has decreased by 65%.

Teacher side: The lesson-preparation efficiency has increased by 30%, and with the help of the intelligent grading system, the feedback time of assignments can be compressed to within 24 hours.

4.2.2 Accelerated Equalization of Educational Resources

Through the MOOC platform, high-quality courses are delivered to western institutions. A certain national-level high-quality course in architecture has covered 83 secondary and higher vocational colleges, benefiting 12,000 students.

Establish a regional educational resource sharing alliance, and the utilization rate of hardware facilities has increased from 45% to 78%, reducing the investment in repeated construction.

4.2.3 Deepening of Industry-Education Collaboration

The proportion of enterprises participating in curriculum development has increased to 60%, and the job adaptation period of graduates has been shortened from 6 months to 2 months.

A survey of the construction industry shows that the starting salary of graduates with BIM technology capabilities is 22% higher than that of the traditional training model.

4.2.4 Support for the Sustainable Development of the Industry

Form a virtuous cycle of "educational digitalization→talent specialization→industrial upgrading", helping to achieve the "dual-carbon" goal.

Through systematic strategy design and effect verification, the informatized teaching model can not only solve the pain points of traditional education but also become the key engine to promote the modernization of vocational education and serve the transformation and upgrading of the industry.

5. Conclusion

This study deeply explores the application of the informatized teaching model in the teaching reform of the "Green Building and Prefabricated Structure" course. Through a series of innovative measures such as building an informatized teaching platform, developing multimedia resources, and designing virtual simulation experiments, we have effectively solved many problems existing in the current course teaching. The implementation of the informatized teaching model has not only significantly improved the teaching quality but also cultivated more high-quality talents meeting industry needs.

In the future, we should further deepen the informatized teaching reform and explore more innovative teaching methods. For example, artificial intelligence technology can be introduced to develop an intelligent teaching system to realize the automation and intelligence of the teaching process. In addition, school-enterprise cooperation can be strengthened, and actual enterprise projects can be introduced into the classroom, enabling students to learn and practice in a real-world working environment. Through these measures, we can inject new vitality into the development of civil engineering education, cultivate more high-quality talents meeting industry needs, and make greater contributions to the sustainable development of the construction industry.

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