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Exploration and Practice of the "Building Structure" Course in Architecture Major Under the Context of School-Enterprise Cooperation

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Abstract

With the rapid development and growth of China's construction industry, the demand for architectural talent, as well as the methods and goals of training such professionals, has seen significant evolution. Recognizing this, the Ministry of Education and related departments issued directives encouraging collaboration between higher education institutions and enterprises to jointly cultivate talent in higher education. Architecture, as a highly practical discipline, was identified as a key area for such experimental collaboration.This paper examines the reform of the "Building Structure" course through a joint teaching approach between universities and enterprises. By integrating industry expertise and academic rigor, the current teaching model was transformed to foster innovation in educational practices. The goal is to cultivate professionals who not only meet the operational requirements of partner enterprises but also align with the broader needs of society. This approach emphasizes mutual benefit, on-demand collaboration, and shared support, establishing a foundation for enterprises and universities to jointly train exceptional talent that aligns with the dynamic demands of the construction industry.

Keywords

Higher education, school-enterprise cooperation, architecture, building structure.

1. Introduction

"Building Structure" is a fundamental course for architecture majors, serving as a critical link within the overall architectural training plan. It is a comprehensive technical subject that integrates both theoretical and practical aspects, emphasizing its importance in bridging academic knowledge and real-world application.

In response to the evolving demands of modern society and the growing emphasis on cultivating application-oriented talent, traditional teaching methods that rely heavily on teacher-centered instruction have become increasingly inadequate. To address this challenge, educators have re-evaluated the teaching approach for "Building Structure," focusing on the characteristics and learning preferences of post-2000s students.

Without disrupting the overarching course framework, teaching plan, or curriculum for architecture, reforms have been implemented to enhance students' active engagement and learning initiative. These reforms emphasize experiential learning by integrating engineering practices, fostering collaboration between universities and enterprises, aligning learning objectives with industry demands, and harmonizing structural reasoning with architectural design. This multi-faceted approach aims to create a more dynamic and effective learning environment [1].

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2. Disadvantages of Traditional Teaching Methods in Building Structure

Building Structure encapsulates the synthesis of design aesthetics and structural performance in architectural technology. However, the traditional teaching approach for this course often fails to meet the expectations of enterprises, resulting in a gap between academic outcomes and industry requirements. This disconnect not only limits students' understanding of the profession but also raises concerns among enterprises about the effectiveness of school-based talent training. Consequently, these shortcomings negatively affect students' professional competency when entering the workforce [2].

To address these challenges, this paper examines the root causes of the issues and, drawing on recent teaching practices, proposes targeted reform measures. These measures aim to strengthen practical teaching components and enhance the overall effectiveness of the Building Structure course.

One key strategy involves adopting a school-enterprise cooperation model. This collaborative framework bridges the gap between academic institutions and industry, fostering mutual benefit. Amid intense competition across industries, this approach allows universities to optimize their educational resources, improve student employability, and sustain steady development. For enterprises, it ensures a pipeline of well-trained, industry-specific talent tailored to their needs. By focusing on education quality, aligning with market demands, and enhancing institutional visibility, the school-enterprise partnership model creates a targeted, efficient system for cultivating skilled professionals.

Based on the characteristics of post-2000s college students, they tend to rely heavily on instructors for guidance. Traditional theoretical teaching methods, often delivered as "infusion teaching," present a singular perspective shaped by the teacher’s own design approach. This limits students' capacity for divergent and innovative thinking, which is crucial for the long-term development of the architecture profession.

In essence, Building Structure is the study of the construction methods and the principles governing the combination of a building's various components and their interactions [3]. Positioned before courses like Architectural Design, Building Structure is a compulsory subject that establishes students’ foundational understanding of the relationship between architecture and structure. Mastery of this course is critical, as it directly impacts their ability to execute in-depth architectural design work.

Traditionally, the course relies on teacher-led instruction, supplemented by network resources such as multimedia videos and images, as well as limited practical teaching activities, such as site visits, allocated for 1 or a few credits. The primary teaching objective is to help students understand the significance, role, and integration of architecture and structure. Students are expected to grasp key principles, including the structural requirements of industrial and civil buildings, material selection (e.g., concrete, steel, wood, or hybrid materials), construction processes, and handling special structural details. However, many of these concepts remain abstract and difficult to fully comprehend within a conventional theoretical teaching framework.

Reforming and exploring innovative approaches for this course aim to address these gaps. The goal is to equip students with a thorough understanding of structural design principles and the ability to seamlessly apply them in real-world architectural projects. This involves moving beyond traditional methods to foster hands-on experience, creative thinking, and a deeper appreciation for the interplay between design and structure. Through these changes, students can better integrate theoretical knowledge with practical application, preparing them to excel in modern architectural practice.

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3. Necessity of Curriculum Reform in the Context of School-Enterprise Cooperation

3.1. Changes in Industry Demand

The rapid advancement of the modern construction industry, characterized by the continuous emergence of new technologies, materials, and processes, has raised the bar for professional competency in architectural design. The traditional teaching model of Building Structure, which predominantly relies on classroom-based instruction, struggles to keep pace with the dynamic nature of the industry. It falls short in preparing students to address the complexities and practical challenges of contemporary architectural projects.

3.2. Limitations of Course Positioning

Conventional curriculum designs often prioritize theoretical knowledge over practical application and interdisciplinary integration. This creates a disconnect between theory and practice, making it challenging for students to balance structural rationality with innovative design[4]. By leveraging the resources and expertise of industry partners through school-enterprise cooperation, the gaps in practical teaching can be effectively bridged, enhancing the course's relevance and applicability.

3.3. Need to Enhance Students' Comprehensive Abilities

In addition to mastering the fundamental principles of building construction, students must develop essential skills such as teamwork, problem-solving, and creative innovation to thrive in professional environments. School-enterprise cooperation provides valuable opportunities for students to engage with real-world projects, allowing them to apply their knowledge in practical scenarios. This hands-on experience significantly enhances their overall competencies, making them better equipped to meet the demands of the modern construction industry.

4. Teaching Reform of the Building Structure Course under School-Enterprise Cooperation

To deepen educational reform and enhance teaching research and practice, a new model for the Building Structure course has been developed by integrating insights from years of teaching practice and reform in architectural structure education. This model combines traditional teaching approaches with innovative methods to better engage students and address the practical requirements of the construction industry.

4.1. Classroom Teaching Enhancements

The classroom teaching primarily retains a teacher-led format but incorporates modern instructional tools to illustrate key concepts. These include visual aids, case studies, videos, and virtual reality (VR) simulations, which help explain complex topics more effectively. These methods are designed to capture students' attention, reducing distractions and promoting active engagement in the learning process.

4.2. Integration of Practical Assignments

For key chapters, students are assigned two homework tasks requiring manual drafting and analysis, based on textbook content. These assignments are reviewed and scored by professionals from partner enterprises. Students who produce outstanding work are given internship opportunities and additional chances for practical training. This approach not only provides a comprehensive explanation of knowledge points but also helps address the challenges students face in absorbing and applying theoretical concepts.

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4.3. Point-to-Point Problem Solving

The reform introduces targeted tutoring where students tackle real-world project problems faced by partner enterprises. This point-to-point approach enables students to develop practical problem-solving skills by working on actual industry challenges. The direct application of knowledge fosters a deeper understanding of structural principles, material characteristics, and construction practices.

4.4. Bridging Theory and Practice

While classroom teaching introduces theoretical concepts, practical applications are equally emphasized. For instance, students learn not just the theoretical properties of materials, such as size, weight, masonry methods, and panel types, but also their application in real projects. Similarly, concepts like how building height scales affect human perception and the mental impact of architectural forms are explored through practical experience.

4.5. Importance of On-Site Experience

Given that Building Structure is a highly practical subject, every concept taught in class has real-world implications. However, solely relying on textbook explanations leaves students with theoretical knowledge that lacks the depth needed for effective application. Practical, on-site experience is essential for understanding the nuances of materials, technology, and construction methods.

A successful architect must combine theoretical knowledge with hands-on experience to design structures that are not only creative but also technologically sound and feasible. By engaging directly with projects, students gain the expertise needed to bridge the gap between academic concepts and real-world practice, enabling them to excel in their future careers. This reform ensures that students are better prepared to design buildings that meet technical, material, and practical demands while fostering innovation[5].

Based on the identified challenges, the teaching reform of the Building Structure course for architecture majors has introduced the following initiatives:

Integrating Real-World Projects into Teaching

For the legends and cases presented in the textbook's key chapters, actual design projects are incorporated to illustrate theoretical concepts. These are complemented by evaluations and insights from enterprise lecturers. Students are required to engage with the material by manually drafting, practicing, and replicating drawings. This hands-on approach bridges the gap between theoretical knowledge and practical application[6].

a. On-Site Investigations and Practical Learning

Building on theoretical studies, students participate in site visits to construction projects undertaken by school-enterprise cooperation partners. These visits focus on the knowledge points and content addressed in hand-drawing exercises, allowing students to observe and analyze the real-world application of what they've learned. By engaging in this experiential learning, students gain a deeper understanding of the interplay between theory and practice, enhancing their professional awareness and competencies.

5. Effectiveness and Feedback of the School-Enterprise Cooperation Model

5.1. Comprehensive Improvement of Students' Abilities

Upon completion of the course, students not only acquire solid theoretical knowledge of building construction but also develop practical problem-solving skills. Graduates have demonstrated significant improvements in their practical abilities and project execution when entering the workforce, showing how the integration of real-world applications enhances their readiness for professional challenges.

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5.2. Improvement of Teaching Quality

Through school-enterprise cooperation, the course content has been aligned more closely with industry needs, leading to a noticeable improvement in teaching outcomes. Feedback from students indicates that the incorporation of case studies and hands-on practice has provided them with a deeper understanding of building structure, bridging the gap between theoretical concepts and practical application[7].

5.3. Deepening of School-Enterprise Cooperation

The collaboration between the school and enterprises has strengthened, with both parties working together to develop valuable teaching resources, such as building construction animations and an engineering case library. This partnership has fostered a virtuous cycle of continuous cooperation, enhancing the quality and relevance of the educational experience for students while meeting industry demands.

6. Future Development Directions

As technology in the construction industry evolves rapidly, the Building Construction course must continuously integrate new knowledge, particularly in emerging areas such as smart construction and carbon-neutral building practices[8]. Regular updates to the curriculum will ensure that students are well-prepared to address the latest industry trends and challenges.

The scope of school-enterprise cooperation should be expanded further by establishing partnerships with a broader range of industries. This includes building connections with new material research and development companies, as well as BIM technology firms. By diversifying collaborations, the course can incorporate additional resources and expertise to enrich students' learning experiences.

Practical activities within the course should be linked to scientific research projects, encouraging students to tackle real-world engineering challenges through active participation in research. This approach will facilitate a seamless integration of "study, research, and application," enhancing students' problem-solving abilities and reinforcing the connection between academic knowledge and industry practice[9].

Strengthening collaboration with international construction enterprises and universities is essential for broadening students' global outlook. Inviting international experts to lecture or hosting global building construction workshops will provide students with diverse learning opportunities, preparing them to work in a globalized and increasingly interconnected industry.

7. Conclusion

The pilot reform of the Building Structure course for architecture majors has proven to be highly effective in providing students with valuable professional training and hands-on experience. The reform has sparked greater enthusiasm among students, while also enhancing their engineering practice and scientific research skills. Additionally, students have gained an early understanding of the critical role that "design" plays in practical engineering projects.

Enterprise partners involved in the school-enterprise cooperation have also benefited from the reform, recognizing the increased enthusiasm and dedication of students. These companies enjoy priority access to students for internships and offer top candidates employment opportunities after graduation.

For the school, this reform has helped alleviate some of the challenges related to student employment, while simultaneously boosting its reputation and standing. The needs of both the enterprises and students have been addressed, resulting in a mutually beneficial outcome. This

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collaborative approach has not only aligned with industry demands but has also significantly heightened students' professional interest and engagement.

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