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Study on Teaching Reform in Applied Undergraduate Engineering Management

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Abstract: *With the rapid development of China's construction industry, the demand for engineering management talents with structural knowledge is increasingly growing. "Building Structures," as a core course in engineering management and cost estimation specialization, holds a pivotal position. It not only covers the principles of structural design and construction requirements of buildings but is also closely related to engineering costs, project management, and other aspects. However, traditional teaching methods of "Building Structures" often overemphasize theoretical teaching and neglect the cultivation of practical application abilities, diverging from the goals of applied undergraduate education. To better meet societal demands and cultivate engineering management and cost estimation professionals with practical abilities, this paper deeply explores the teaching reform of the "Building Structures" course. To ensure the successful implementation of these reforms, specific implementation plans and safeguard measures are proposed. By utilizing a variety of teaching methods, the practical application abilities, problem-solving abilities, and innovative thinking abilities of students are enhanced. After a prolonged period of exploration, more competitive talents in engineering management and cost estimation have been cultivated, contributing to the sustainable development of the construction industry.*

Keywords: *Engineering Management; Cost Estimation Specialization; Building Structures*

1. Training Goals for Talents in Engineering Management and Cost Estimation Specialization

1.1 Mastery of Basic Theories and Professional Knowledge

It is crucial to master the basic theories and professional knowledge in the field of civil and architectural engineering. Having a solid foundation in natural sciences is significant for students' future career development. The key to becoming an excellent civil engineer lies in a firm grasp of basic theories and professional knowledge. Students need to delve into the fundamental principles, design methods, construction techniques, and project management in civil engineering. They should also be aware of the latest technologies and developments in related fields to apply this knowledge in practice. Moreover, a strong foundation in natural sciences is vital. Civil engineers deal with complex natural environmental and engineering problems, necessitating a broad and solid foundation in sciences such as mathematics, physics, chemistry, and biology. This knowledge helps students understand the nature of engineering problems and provides them with ways and methods to solve them. Additionally, cultivating practical skills is essential. Civil engineers need extensive practical experience to effectively solve real engineering problems. Therefore, students should actively participate in various practical projects and internships to enhance their skills and abilities [1-2].

1.2 Strong Professional Qualities and Capabilities

In civil and architectural engineering, basic theories and professional knowledge form the cornerstone of an entire career. Whether it's structural design, selection of building materials, or optimizing construction processes, a deep understanding and mastery of relevant basic theories are needed. Professional knowledge covers all aspects of engineering projects, from planning, design, construction to maintenance, serving as a guide in practice. A solid foundation in natural sciences is also crucial for civil engineers. From the principles of mechanics in physics, material reactions in chemistry, to environmental protection in biology, these sciences provide a scientific basis for solving engineering problems. Basic training to become an engineer is essential for a qualified civil engineer. This includes not only the cultivation of professional skills like engineering drawing and structural design but also education and guidance in engineering ethics and quality control. Through this training, students can

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master the basic skills and thinking modes of engineers, preparing for their future careers. In civil engineering, facing a complex and changing environment and various challenges, having strong comprehensive professional qualities and capabilities is particularly important. This includes innovative thinking, problem-solving abilities, team spirit, and a continuous learning attitude. Only with these capabilities can civil engineers maintain competitiveness in the ever-changing engineering environment and contribute to social construction and development.

1.3 Good Physical Fitness and Adaptability

In the field of civil and architectural engineering, students need not only solid professional knowledge and skills but also good physical and mental qualities and adaptability, which directly affect their ability to handle complex engineering problems and career development. Due to the complexity and diversity of engineering projects, civil engineers often need to work in high-intensity environments, requiring sufficient physical strength and endurance. Whether it's long-term site surveys or continuous construction monitoring, engineers need robust health and enduring stamina. They also need mental qualities like calmness, decisiveness, and judgment to handle emergencies and unforeseen situations. When facing engineering accidents or natural disasters, engineers need to make quick decisions and take effective measures, requiring a calm mind and decisive decision-making ability. In practice, civil engineers may face various complex environments and challenges, such as climate change, geographical conditions, limitations of engineering materials and equipment. Therefore, they need the ability to flexibly respond and adapt to various environmental changes. For example, working in high-altitude areas may require adaptation to low-oxygen environments, while marine engineering may involve dealing with tides and waves. They also need to be capable of handling severe weather conditions like storms and hail. Only with these adaptive abilities can civil engineers successfully complete engineering projects.

2. Principles to Uphold in Teaching Reform

2.1 Respecting the Principal Status of Students

When students feel respected and valued, they become more confident and motivated to explore and learn. This enhancement in confidence and self-esteem helps them achieve better outcomes in academic, social, and emotional aspects. In the field of civil and architectural engineering education, a student-centered approach means placing students at the heart of the educational process, focusing on their needs, interests, and development. This involves thoroughly understanding students' characteristics, interests, and needs, and formulating personalized educational plans based on their actual situations. It also means emphasizing the cultivation of students' initiative and creativity, encouraging them to actively participate in the teaching process and utilize their subjective initiative. Additionally, acknowledging students' independence and autonomy during the educational process, respecting their opinions and choices, is crucial. In civil and architectural engineering education, this includes respecting students' individual viewpoints, innovative thinking, and practical achievements. Students should be encouraged to express their own ideas and solutions and be provided ample freedom for exploration. Moreover, it's important to focus on cultivating students' critical thinking and independent decision-making abilities, enabling them to judge and make decisions autonomously. This concept is instrumental in nurturing outstanding engineers with innovative thinking and practical skills, contributing to engineering construction and social development[3-4].

2.2 Emphasizing the Cultivation of Practical Skills

As society develops, more and more companies are focusing on applicants' practical experience and abilities. Thus, emphasizing the cultivation of practical skills can help students accumulate practical experience, enhance their operational capabilities, and thereby increase their competitiveness in the job market. Practical ability is one of the essential qualities of a civil engineer. In the field of civil engineering, the combination of theoretical knowledge and practical skills is crucial. Students need not only to master solid professional knowledge and theory but also the ability to apply this knowledge in real-world engineering. Through the cultivation of practical skills, students can better understand theoretical knowledge and learn how to apply it in actual work. Practical skills are beneficial in improving students' overall qualities. In the process of practice, students are required to collaborate and communicate with team members and solve real engineering problems. These experiences can cultivate comprehensive qualities such as teamwork, communication skills, and problem-solving abilities. These qualities are

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particularly important in modern professional development, helping students better adapt to the demands of social and industry development. Additionally, educators need to establish close cooperation with industry enterprises, providing students with more internship and practical training opportunities. Through collaboration with industry enterprises, students can gain in-depth understanding of problems and challenges in engineering practice and learn the latest technologies and management methods.

2.3 Continuous Updating and Adaptability

In applied undergraduate engineering management and cost majors, "Building Structures" is a core course that provides students with the basic principles, design, and analysis methods of building structures. However, with the advancement of technology and continuous development in engineering practice, traditional teaching content and methods may no longer meet current needs. Therefore, the principles of continuous updating and adaptability are particularly important in educational reform. As the construction industry is a field of constant innovation and development, new structural systems, materials, and technologies are emerging, making the existing teaching content quickly outdated. To enable students to keep pace with the rapid development of the industry, teaching content must be continuously updated. Different students have different learning needs and styles, and the principle of adaptability requires that teaching should cater to students' individual needs, providing diverse learning resources and teaching methods to enhance learning effectiveness. In engineering practice, various complex situations and problems are encountered, and educational reform should focus on developing students' practical operation and problem-solving abilities to adapt to the industry's variability. For this purpose, personalized teaching plans should be formulated according to students' learning needs and career plans. This can include the selection of elective courses, the arrangement of practical components, and extracurricular guidance. The implementation of personalized teaching plans can better meet the needs of students and improve teaching effectiveness. Furthermore, modern teaching methods and technologies such as blended learning, online education, and virtual simulations should be used to enhance teaching effectiveness and students' learning experience. These new teaching methods and technologies can better adapt to students' learning needs and industry trends.

3. Specific Measures for Teaching Reform

3.1 Curriculum Content Reform

The reform of teaching content in the field of civil and architectural engineering is increasingly focusing not just on the acquisition of knowledge by students, but also significantly on the development of their skills and overall quality enhancement. This reform involves a shift from the traditional emphasis on theoretical knowledge towards a greater incorporation of practical application. To achieve this, the curriculum is being redesigned to be more rational and practical. This includes integrating and updating course content to avoid redundancy and to encourage interdisciplinary learning, thereby broadening students' knowledge base and enhancing their comprehensive qualities. Additionally, there is a greater inclusion of practical elements in the curriculum, such as experiments, course designs, internships, and hands-on training, which are essential for cultivating practical operational abilities and problem-solving skills. Furthermore, by introducing real engineering cases into the courses, students are provided with opportunities to understand and apply theoretical knowledge in real-world scenarios, thereby improving their practical application skills. These changes are crucial in preparing students to better meet market demands and contribute more effectively to engineering construction and societal development.

3.2 Cultivation of Practical Abilities

The development of practical abilities helps transform theoretical knowledge from textbooks into actual operational skills. Understanding and mastering theory is the foundation of learning, but it is only through practice that this knowledge can be truly converted into personal capabilities. Practice makes knowledge vivid and concrete, deepening our understanding and memory of it. Cultivating practical abilities is one of the key objectives in the field of civil and architectural engineering education. Strengthening school-enterprise cooperation is an effective way to enhance students' practical abilities. Schools and enterprises can collaborate in various forms, such as co-developing courses, joint teaching, and conducting experiments and research projects together. Through school-enterprise cooperation, students gain more practical opportunities, deepen their understanding of problems and challenges in engineering practice, and master the latest technologies and management methods. Meanwhile,

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enterprises can also acquire excellent talent resources through cooperation, promoting technological innovation and industrial upgrading. Constructing practical teaching bases is another important measure to enhance students' practical abilities. Practical teaching bases are crucial venues for students to conduct experiments, internships, and practical training. By building practical teaching bases, students are provided with more comprehensive and systematic practical conditions, helping them better understand and master theoretical knowledge, and improving their practical and innovative abilities. This, in turn, enhances the overall quality and level of education in the field of civil and architectural engineering[5].

3.3 Reform of Teaching Methods

In traditional civil and architectural engineering education, teaching methods are often monotonous, predominantly involving teacher lectures and passive knowledge reception by students. This teaching approach can hardly stimulate students' interest in learning, and it limits their thinking and creative abilities. Therefore, reforming teaching methods is imperative, and adopting diversified teaching methods is an effective way to improve teaching quality and effectiveness. The specific methods are illustrated in Figure 1: (1) Case Teaching Method: This method is based on actual engineering cases, guiding students to analyze and solve real engineering problems, thus cultivating their practical abilities. Teachers can choose typical engineering cases for students to learn about case backgrounds, problem analysis, and solutions. (2) Project-Based Teaching Method: This student-centered approach involves students participating in actual or simulated engineering projects, fostering their practical abilities and teamwork spirit. Teachers can assign real or simulated engineering projects for students to complete in groups. (3)Practical Teaching Method: Focusing primarily on practical operations, this method includes experiments, internships, and practical training to cultivate students' practical abilities and operational skills. (4) Using Multimedia Teaching Tools: Tools like videos, animations, and simulation software make abstract theoretical knowledge vivid and accessible, aiding students' understanding and retention. Gradually, these methods can improve the overall quality and level of education in the field of civil and architectural engineering.

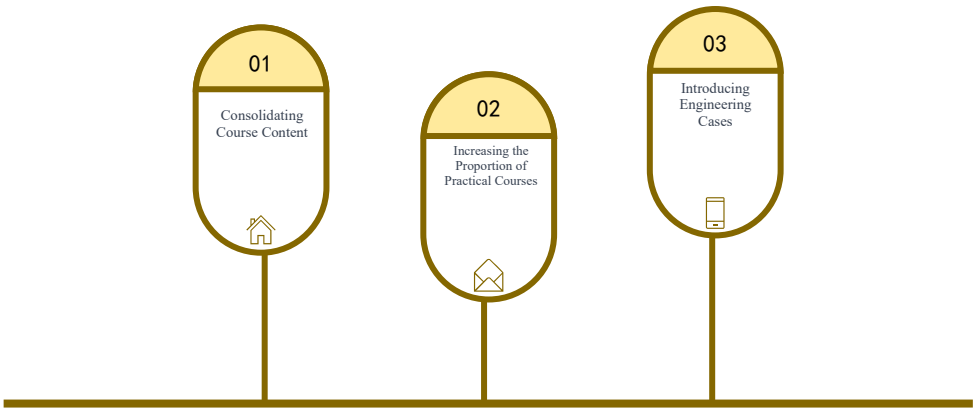

Figure 1: Measures for Optimizing the Course System

4. Conclusion

In summary, through the exploration of teaching reforms in the applied undergraduate courses of Engineering Management and Cost Estimation specialization, specifically in the "Building Structures" course, we have achieved certain results and gained valuable experience. The adoption of diversified teaching methods has significantly improved students' practical application abilities and deepened their understanding of building structures. However, teaching reform is an ongoing process that requires continuous summation of experiences and improvement of measures. In the future, we will continue to stay attuned to industry trends, promptly update teaching content, and strengthen collaboration with enterprises to provide more practical opportunities for students. At the same time, we will keep exploring new teaching methods and means to enhance the quality and effectiveness of teaching. With joint efforts from all parties, we aim to cultivate more engineering management and cost estimation professionals who possess practical abilities, innovative spirit, and teamwork skills, thereby contributing to the flourishing development of the construction industry.

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