Research on the path to improve the quality of graduation projects of construction engineering majors based on digital background

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Abstract: In the digital age, the enhancement of graduation project quality within the field of architectural engineering is of paramount importance. This paper presents well-structured solutions to tackle the prevalent management challenges encountered in the digital execution of these projects. The goal is to notably improve the effectiveness of teaching methodologies. Employing a scientific approach to managing graduation projects enables students to not only comprehend and apply their theoretical knowledge more effectively but also to cultivate an in-depth understanding and proficient practical skills in digital technology.

1. Introduction

As the new round of scientific and technological revolution and industrial transformation deepens, my country's demand for high-end technical skills and application talents has shown a significant growth trend, especially in construction engineering[1]. In this field, the cross-integration of modern information technologies, such as mobile Internet, cloud computing, big data, etc., has brought unprecedented opportunities and challenges to the high-quality development of the housing and construction industry. In response to this change, our government and relevant departments attach great importance to developing vocational education. In 2019, the release of the "National Vocational Education Reform Implementation Plan" marked the deepening of my country's vocational education reform, and the 2021 "Measures for the Management of Undergraduate-level Vocational Education Major Settings (Trial)" set the primary setting and school running requirements for vocational undergraduates. Precise specifications are provided. In addition, the "Ministry of Education's Work Points for 2022" clearly points out the direction of "steady development of vocational, undergraduate education, " meaning that vigorously developing vocational, undergraduate education has become a general trend. Especially in the field of construction engineering, the "Guiding Opinions on Promoting the Coordinated Development of Intelligent Construction and Construction Industrialization" jointly issued by the Ministry of Housing and Urban-Rural Development and other departments in 2020 provides a clear path for technology application and talent cultivation in this field. This study focuses on technologies such as prefabricated buildings, Building Information Modeling (BIM), the Internet of Things, big data, and artificial intelligence.

A graduation project is essential for students to combine theoretical knowledge with practical problems and solve practical problems [2]. This helps students consolidate and apply the theoretical knowledge they have learned and cultivates their innovative consciousness and functional ability [3]. In this context, facing the dual pressures of technological revolution and industrial transformation, how to improve the quality of the graduation project of architectural engineering majors in the digital context and further strengthen its core position in students' learning careers has become a topic worthy of in-depth study.

2. Research status

Many studies have pointed out the vast potential of digital technology in the building design, construction, and maintenance process. Technologies such as BIM (Building Information Modeling), digital simulation, virtual reality (VR), and augmented reality (AR) are increasingly used in architectural design, enabling more accurate and efficient design and construction management. However, integrating these advanced technologies into the teaching of architectural engineering majors and students' graduation projects, ensuring the quality of the design, and combining digital technology with traditional methods effectively is still a challenge. Currently, there are mainly the following problems:

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2.1. The digital divide in graduation project guidance Graduation project is an essential stage in students' academic careers.

In the context of the rapid development of digital technology, there is still a certain lag in the guidance methods and content of graduation projects. Traditional instructors may lack knowledge and practical experience in digital technology, making it difficult to go deep into its specific application and operation level when guiding students [2]. Students may feel lost and confused in this situation, and their mastery of digital technology remains relatively shallow. In addition, because many schools still have limited investments in resources and equipment, students may not be able to take full advantage of the latest digital tools and technologies when conducting their graduation projects. This limits their design creativity and efficiency and may lead to a competitive disadvantage in the job market.

2.2. Popularization and application of digital technology

With the popularity of digitalization, modern graduates need a basic understanding and ability to apply digitalization. However, many students only retain theoretical knowledge of these technologies during the graduation project process and lack actual application practice. On the one hand, digital technology has been proven to improve design efficiency and accuracy significantly. On the other hand, compared with traditional 2D design, technologies such as BIM provide a more intuitive and interactive design environment. But despite this, the application of digital technology in architectural education still appears insufficient[3].

2.3. The gap between practical work and academic research

Students often experience a transition between school and the real world of work, especially in the context of digital technology. When many students enter the work environment after graduating

Students often feel a large gap between their knowledge ski, bills, and basic needs. In actual work, applying digital technology usually involves more complex collaboration and cross-department communication. School education is often more theoretical, resulting in students lacking the experience and ability to use practice in natural environments.

2.4. There is a mismatch between the evaluation standards for graduation projects and the digital era

With the further development of digital technology, profound changes have occurred in architectural design methods and tools. However, many schools still use the traditional evaluation system when evaluating graduation projects. This system may focus more on the form and style of the design and ignore the actual application value of digital technology in design.

3. Graduation thesis reform measures

Through an in-depth understanding of current construction engineering positions' actual needs and expectations in applying digital technology, we will clarify the digital capability requirements for graduates. Then, combined with the students' existing digital technology foundation, the difficulties and challenges they may encounter in job applications are identified. Based on this information, we will develop strategies and methods to improve the quality of graduation projects for vocational and undergraduate students while ensuring that they better adapt to the needs of digital construction engineering jobs.

3.1. Improve the skills of construction professional teachers and promote student growth through multiple platforms

The key to meeting the challenges of digital transformation in construction engineering professional education is to systematically innovate course content to adapt to the development of the times. First of all, teacher professional development plans need to focus on key technical areas, such as building information modeling (BIM), measurement and pricing, PKPM, and other software applications, and ensure that teachers can effectively integrate these technologies into teaching and practice through the combination of theory and practice. Under guidance. Secondly, the course syllabus should be updated to keep up with the pace of the digital age, integrate the latest digital tools and technologies into the teaching system, and enhance students' ability to apply these tools in actual construction projects. In addition, colleges and universities need to invest resources in establishing modern laboratories and studios equipped with advanced technical facilities, such as high-performance computers, professional software, 3D printers, and virtual reality equipment, to simulate natural working environments and improve students' practical capabilities. At the same time, students are encouraged to combine classroom learning with actual construction projects and deepen their understanding of digital technologies through design studios, internship projects, and collaboration with industry experts. In addition, it is recommended to establish an interdisciplinary cooperation platform to promote exchanges and cooperation between architectural engineering students and students from other disciplines and broaden academic horizons. Finally, use online educational resources, such as online courses and professional forums, to provide students with a broader range of learning opportunities to further improve their digital skills in their extracurricular time. Through these comprehensive and innovative strategies, we can not only effectively respond to the challenges of the digital age but also promote the improvement of student's

professional skills and enhance their market competitiveness while promoting the continuous innovation and development of higher education in the field of construction engineering.

3.2. Strengthen the application and practice of digital technology

When dealing with the popularization and application of digital technologies in graduation projects, the college adopts a series of systematic strategies to ensure that students not only master the theoretical knowledge of digital technologies but also can effectively apply these technologies in actual projects. First, the course design should incorporate the application practice of digital technology and provide practical opportunities in natural project environments by integrating advanced technologies such as Building Information Modeling (BIM), thereby promoting the integration of students' theoretical and practical knowledge. Secondly, to further enhance students' practical experience, schools should actively establish cooperative relationships with industry enterprises to allow students to participate in actual construction projects through internships and project cooperation. This kind of practical project participation can enhance students' professional skills and deepen their understanding of the application of digital technology in the construction field. At the same time, regular seminars, technical workshops, and lectures by industry experts are critical to stimulating students' interest in learning and expanding their professional horizons. These activities allow students to understand the latest developments in digital technology and industry application cases, enhancing their academic exploration and practical application capabilities. Through these comprehensive education strategies, students can not only strengthen their theoretical understanding of digital technology but also effectively improve their practical skills, laying a solid foundation for cultivating high-quality professionals who adapt to the needs of the modern construction industry.

3.3. Use digitalization as a guide to optimize classroom content

To adapt to the challenges of the digital age, the course content and teaching methods of the construction engineering major have been optimized accordingly. By integrating actual construction engineering cases into teaching, students can have a deeper understanding of the role of digital technology in practical applications. There are case studies in the course on using BIM technology to improve efficiency in complex construction projects and applying 3D printing technology in architectural prototype production. Such case analysis helps students closely integrate theory with practice and enhances students' understanding and interest in technology applications. Virtual reality (VR) technology creates work scenarios, allowing students to practice and apply learned knowledge and skills in a simulated environment[4]. Provides students with a risk-free learning environment that helps students gain experience before facing real work challenges. At the same time, teaching methods should be more flexible and diverse, such as using flipped classrooms, group discussions, online seminars, etc., to promote students' active learning and in-depth thinking. In addition, the school can cooperate with the industry to organize regular field trips or internship projects to allow students to experience the practical application of digital technology in the construction field, such as visiting brilliant building construction sites or participating in actual projects of thoughtful city planning. These practical experiences deepen students' understanding of professional knowledge, help them establish industry connections, and lay the foundation for their future careers[5].

3.4. Strengthen industry connections and reconstruct the evaluation system

In the context of the digital age, the evaluation standards for construction engineering graduation projects still use the original standards. To address this issue, first of all, the college needs to restructure the evaluation system for graduation projects and use digital technology as one of the critical evaluation indicators. This includes evaluating students' ability to apply BIM technology, 3D modeling, and other advanced tools in design, focusing on examining the actual effects of these technologies in improving design efficiency and innovation. Secondly, the evaluation system should change from the traditional results-oriented model to a process- and thinking-oriented model. This shift means that assessments will focus more on students' design processes, innovative methodologies, and problem-solving strategies, especially their practical abilities in applying digital technologies. In addition, to ensure that the evaluation standards are consistent with the actual needs of the industry, industry experts need to be introduced to participate in the evaluation process. These experts can provide professional technical evaluation and connect educational content with the latest development trends in the industry. The school regularly holds career planning lectures and industry seminars, inviting professionals and business representatives from the construction industry to communicate with students. These events provide students with industry insights and help them understand the current market needs and expectations for construction engineering professionals. In addition, schools should actively establish cooperative relationships with industry companies to provide students with internship opportunities. These internships allow students to apply the knowledge they have learned in practical work and provide valuable inspiration and practical experience for their graduation projects. At the same time, it is recommended to adopt diversified assessment methods, including peer review, student self-assessment, and peer assessment, to enrich the assessment perspective and improve the comprehensiveness and fairness of the evaluation. This diversified assessment method helps promote

communication and mutual learning among students and provides comprehensive feedback.

4. Construction of teaching and management system for vocational undergraduate thesis

4.1. Set up "split" topic selection

Topic selection is the first link in the graduation thesis teaching and management system. Topic selection should be based on cultivating students' abilities, complying with the requirements of the professional undergraduate talent training program, and being in line with the development direction of new professional technologies, new business formats, and new models. At the same time, it should have practical, solid significance so that students can implement their graduation projects.

Taking Guangzhou Vocational and Technical University of Science and Technology as an example, first, research student employment and set students' topic selections according to their positions. The employment directions of construction engineering majors mainly include relevant design institutes, construction, supervision, and testing units. Cost units, teachers, and students jointly communicate and select topics for employment. Students can do construction organization design, structural design, project bidding, and budget estimates or research reports according to their employment direction. The topic selection is set based on the position and students' interests, and the general rule of the construction project is controlled. The graduation project is more flexible and relevant to the work so students can use their learning.

4.2. Strengthen the standardization and normalization construction of graduation projects

To strengthen the management of graduation projects, Guangzhou Vocational and Technical University of Science and Technology has formulated the "Graduation Project (Thesis) Management Regulations for Undergraduate Students." The School of Architectural Engineering has developed graduation project management regulations suitable for undergraduate majors in architectural engineering by school regulations and systematically regulates graduation projects. Design normalization and standardization. During the implementation process, from topic selection, proposal, first draft, second draft, third draft, public defense, group defense, selection of outstanding graduation projects, and random inspection of graduation projects, corresponding managers will be set up to review, supervise and manage the graduation projects, and set rewards and punishments system to ensure the quality of graduation projects. Regarding teacher management, selecting graduation project instructors requires at least an intermediate professional title or above to ensure the instructor can execute the project smoothly. Regarding student management, since applied undergraduates and vocational undergraduates require on-the-job internships in the seventh semester, students are already working in the corresponding positions when the graduation project is arranged in the seventh semester, and it is impossible to communicate at any time like students on campus. Therefore, during the graduation project process, it is necessary to communicate remotely and promptly using communication software. In this process, try to arrange for a teacher to guide both the graduation project and the internship simultaneously. The teacher will combine the student's internship work with the graduation project. This can improve communication between students and teachers and avoid information asymmetry, causing poor communication and excessive efficiency. Low.

4.3. Strengthen the development, promotion, and application of the graduation thesis management system

The school has independently developed a graduation project management system. With the help of the management system, the Academic Affairs Office, secondary college leaders, and graduation project management teachers can monitor the teachers' management of the graduation project at any time to supervise and manage promptly. Especially at the time node, set up a corresponding approval system to urge teachers and students to complete the related work promptly according to the time node. In addition, the graduation project and its process documents are essential materials for students' learning outcomes, and the school has unified regulations on the format. Teachers have made a lot of requirements on the formatting issues in the graduation project so that students can adapt to the document writing standards of relevant jobs after graduation.

4.4. Use digitalization as a guide to optimize the content of graduation projects

By taking the lead in digitalization in the early stage and optimizing the teaching of classroom content, students are required to apply advanced management technology in the graduation project to design, organize, and manage engineering projects. For example, in structural design, students must use PKPM software for computer calculations. In construction organization design, a separate chapter is necessary to connect new technologies and processes. For example, case studies that require BIM technology to improve efficiency in complex construction projects or the application of 3D printing technology in architectural prototyping. These graduation project requirements deepen students' understanding of professional knowledge, help them establish industry connections, and lay the foundation for their future careers.

5. Conclusion

This article proposes comprehensive reform measures to address the educational challenges faced by the construction engineering profession in the digital era. These measures include improving teachers' mastery of digital technology and teaching capabilities, innovating course content, strengthening practical teaching, restructuring the evaluation system, and strengthening ties with the industry. These strategies can effectively address current educational challenges and provide students with a more comprehensive learning experience. By improving teachers' skills and updating course content, students can achieve balanced theoretical learning and technical application development. Participation in real projects and close collaboration with industry provides students valuable hands-on opportunities and enhances their professional skills and problem-solving abilities. In addition, the reformed assessment system and diversified teaching methods help comprehensively evaluate students' comprehensive qualities while stimulating their potential for innovative thinking and independent learning. These reform measures are expected to cultivate high-quality professionals who are more adaptable to the needs of the digital construction engineering industry and provide reliable support and practical guidance for the sustainable development and educational innovation of the construction engineering profession.

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