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Exploration and Practice of "Construction Engineering Regulations" Course Reform

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Abstract: Based on the analysis of the existing teaching situation of the "Construction Engineering Regulations" course, this paper divides the course content into three parts according to the course characteristics and content, and explores three corresponding teaching modes. The proportion of student-led relationships in the three teaching modes is 80%, 60%, and 90%, respectively, realizing a teaching mechanism centered on students and stimulating students' interest in independent learning. Teaching methods such as problem-oriented learning, group discussion, student reporting, MOOC (massive open online course), case analysis, etc., have been used to establish a variety of comprehensive examination mechanisms such as quiz games, follow-up tests, and work displays. Practice has shown that after adopting these three teaching modes, classroom teaching efficiency has significantly improved, and students' abilities in exploration, expression, innovation, and team cooperation have also been enhanced.

Keywords: Construction Engineering Regulations; Problem-oriented learning; Independent learning

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1. Introduction

"Construction Engineering Regulations" is a compulsory course in civil engineering majors in undergraduate colleges and universities. The course is primarily based on legal provisions and is rigorously regulated. Through the study of the course, students master the basic content of laws and regulations in the field of construction engineering, understand the institutional environment of our country's engineering construction, and construct the corresponding legal system. It cultivates students' legal awareness of engineering construction and the ability to apply what they have learned to solve relevant legal problems in actual engineering construction, strengthens law-abiding consciousness, and improves the overall quality and moral cultivation.

According to the educational objectives of civil engineering majors, the theoretical course hours for "Construction Engineering Regulations" are generally 24. However, there are several problems in the teaching process:

(1) The numerous regulations are difficult to remember. Due to the large scale and wide scope of construction projects, as well as their significant social impact, there are numerous legal provisions

scattered throughout the entire process from project approval, bidding, contracting, surveying, designing, construction, supervision, acceptance, to post-maintenance. The dispersion and lack of coherence of these provisions make it challenging for students to study and master them proficiently.

(2) The text is complex and uninteresting, failing to capture students' attention. The textbook adopts lengthy and tedious text descriptions, and the traditional teaching method, where the teacher takes the lead and combines multimedia explanations, does not yield good teaching results in this course.

(3) The ability to analyze and solve problems is poor. Due to the strong logicality of legal regulations, some students may memorize the relevant legal provisions but struggle to extract the relevant knowledge when solving actual engineering problems, facing difficulty in identifying the root of the problems.

(4) There is a lack of innovation and creativity. In the teaching process, students passively receive information and lack active engagement, which will eventually lead to students lacking the ability for self-reflection and innovative thinking.

(5) There are poor communication skills. Construction engineering projects require collaboration among various stakeholders, and professionals in this field must possess good communication skills. Feedback from cooperative enterprises indicates that while students have good professional abilities, their communication skills are lacking. In the classroom, there is a lack of cultivation of students' communication and expression skills.

To improve the effectiveness of the course, many scholars have proposed teaching suggestions for this course. Dou and Li constructed a regulatory relationship diagram based on the content of construction regulations, created engineering cases based on project implementation procedures, and used problem-oriented learning methods to teach the course [1]. This approach has achieved good teaching results through practice. Wen *et al.* improved the teaching effectiveness by integrating actual engineering projects, introducing theoretical innovations, and strengthening connections with other course systems [2]. Lu and Qiao developed the "Construction Engineering Regulations" curriculum based on the core principles of "student-centeredness," "outcomes-oriented," and "continuous improvement," in accordance with the requirements of engineering education professional certification [3]. Wang proposed a teaching model based on the "unity of knowledge and action" educational concept, following the laws of ideological and moral development, and integrating professional knowledge, legal systems, and values into the curriculum [4]. This model includes four stages of teaching, covering value cognition in legal knowledge, value identification in legal topics, belief in values through legal cases, and value practice in legal situations. Zhang and Cao described the practice and effects of a blended teaching reform based on course ideology for "Construction Engineering Regulations" using Changsha College of Civil Engineering as an example [5]. Li and Yang discussed teaching reform from the construction of a pre-course resource library, flipped classroom design, and post-course achievement evaluation [6].

Based on the characteristics of the "Construction Engineering Regulations" course and the analysis of existing problems in teaching, this paper explores the teaching models for this course by combining current research status.

2. Discussion on teaching models

In view of practical issues encountered in the teaching process, while inheriting the traditional teaching model, it is necessary to absorb successful teaching reform achievements and actively explore a new teaching model that is suitable for the curriculum. Feedback from teaching practice should be promptly used to supplement and revise the teaching model. This new teaching model is based on the principle of "putting students at the center

of the classroom and stimulating their autonomous learning ability."

Based on the requirements of cultivating students in applied undergraduate institutions, the study of students' learning habits and psychological factors, combined with the characteristics of construction engineering regulations courses, the teaching reform ideas for this course can be summarized as follows.

The curriculum content is divided into three parts according to the importance and difficulty of the content and the requirements of actual construction engineering. Three teaching models are adopted:

(1) Model 1: Before the class, the teacher presents a problem, and students analyze and discuss it in groups, search for information, and solve the problem. During the class, students use new media such as video filming, hand drawing, animation production, courtroom simulation, process deduction, and PowerPoint presentations to express their understanding. The teacher provides feedback on their results, summarizes relevant knowledge points, and emphasizes key knowledge points; the teacher also integrates ideological and political education into the course, incorporates content from other courses, and tests related questions from the question bank to evaluate learning outcomes. The specific implementation process is shown in **Figure 1**. This model is aimed at the key content commonly used in actual engineering projects that students need to master. The teacher-student relationship accounts for 20% + 80%.

This model cultivates students' ability to learn independently, analyze problems, search for information, and solve problems. It also enhances students' expressive skills through the use of new media. At the same time, it provides students with a broad space for innovation and creative thinking from multiple perspectives. Through the experience of "practice leads to success," students' confidence in seeking knowledge and their sustainable learning ability are enhanced.

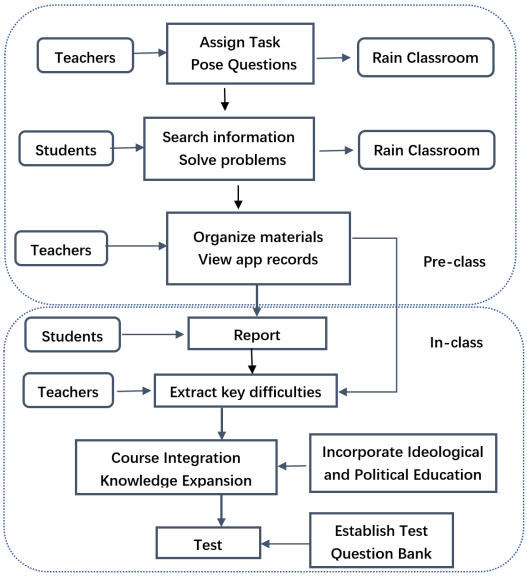

Figure 1. Implementation diagram of teaching model 1

(2) Model 2: In the classroom, the teacher provides case materials and questions related to the key and difficult content. The teacher guides students to analyze and discuss the cases. Based on the case analysis, the teacher introduces the knowledge points of the course. Students' questions and difficulties regarding the knowledge points are explained in detail, integrating ideological and political education into the course. Attention is also given to the construction of the legal system framework, cultivating students' analytical thinking and problem-solving skills. The specific implementation process is shown

in **Figure 2**. This model is aimed at constructing the legal system framework and addressing key and difficult content in the course. The teacher-student relationship accounts for 40% + 60%.

This model guides students to construct a knowledge system of regulations and enriches specific knowledge points within the framework. It strengthens students' memory of knowledge points, cultivates students' logical thinking, and helps them establish logical thinking and methods for problem-solving. The thinking process is guided by problem-oriented thinking.

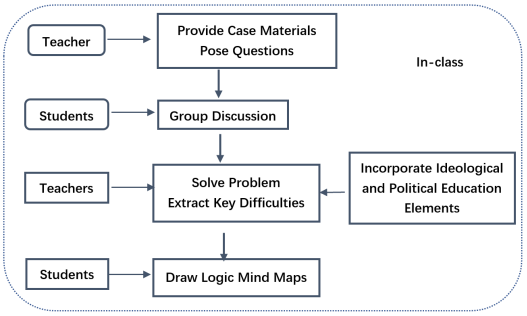

Figure 2. Implementation diagram of teaching model 2

(3) Model 3: The MOOC (Massive Open Online Course) approach is adopted, utilizing excellent online resources. Students study independently outside of class and their learning outcomes are assessed online using apps such as Rain Classroom. The specific implementation process is shown in **Figure 3**. This model is aimed at content that is not closely related to the major but that students need to understand. The teacher-student relationship accounts for 10% + 90%.

This model is based on the first two models and aims to develop students' sustainable self-learning ability by allowing them to apply the learning system and methods they have acquired to complete self-study outside of class, in order to prepare them for encountering new problems in future work. To ensure that students complete the learning outside of class, corresponding assessment questions are set on the Rain Classroom app, and the data is analyzed to identify problems faced by the students, which are then addressed in the class with the teacher's assistance.

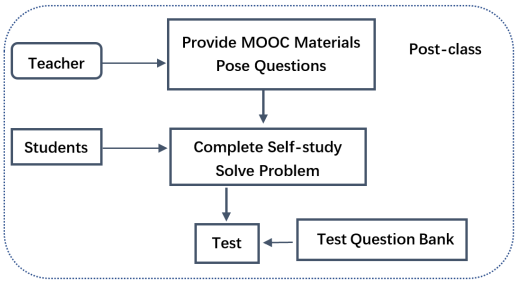

Figure 3. Implementation diagram of teaching model 3

3. Practice and achievements

Based on the course content, the three teaching models mentioned above were applied in the teaching of the 2021 civil engineering major. It was found in practice that the overall teaching effect was good. These three models stimulated students' interest in the course, resulting in active participation and intense discussions in class. Through the use of an app, students actively engaged in self-learning outside of class, which proved to be

effective. Furthermore, students demonstrated strong abilities in creating videos, animations, and PowerPoint presentations, indicating that some students excel in using new media. The specific findings are as follows.

Diverse classroom forms were employed to stimulate students' active learning interests. Taking "Analysis of Construction Engineering Safety Accidents" as an example, the first teaching model was applied. In the 9th week, students were assigned a task to discuss relevant knowledge points related to construction engineering safety accidents in groups, search for case materials related to safety accidents, analyze the cases, extract knowledge points, and solve problems. Subsequently, in the classroom, the groups presented the content in novel and proficient ways. In the 13th week, during the group presentations in class, it was found that students selected relevant knowledge points individually or in groups, found appropriate case materials, and presented them in various forms. The main manifestations were as follows:

(1) The content was comprehensive, as the selected knowledge points by the 10 groups covered almost all aspects of construction engineering safety accidents.

(2) The forms of presentation were diverse, including filming live-action videos to elaborate on the post-accident handling process, creating animations with students' voice-overs summarizing actual engineering cases and emphasizing safety knowledge, using formats such as news broadcasts and legal programs to showcase the severe consequences of safety accidents and emphasize the importance of safe construction, shooting videos to reconstruct the process of holding responsible parties accountable in court after safety accidents, and hand-drawing videos to simulate the consequences of choosing correct and incorrect practices. These presentation forms strongly attracted students' attention and helped them grasp the relevant knowledge points in a relaxed and enjoyable environment. Additionally, it was found that students preferred expressing themselves through new media.

(3) The referenced materials were accurate and up-to-date. Students accessed the latest information through the Internet, effectively solving the problem of outdated case materials in the textbook and making the course more closely aligned with actual engineering practices.

High-quality online teaching resources were maximized, and comprehensive assessments were conducted using an app. Taking "Legal System of Construction Engineering Survey and Design" as an example, due to the limited and relatively easy content of this part, as well as its less direct relevance to professional work and the establishment of a basic framework of the legal system, the third teaching model was adopted. In the 14th week, the teacher assigned a task for students to study through MOOC platforms such as China University MOOC and Xuexi Tong, and then issued a test on the Rain Classroom app. Students completed the test after self-studying. The test results showed that students were proactive and had high accuracy. Through the test, knowledge points where students had more questions were emphasized in class.

Logic thinking diagrams facilitated students' understanding and memory of relevant knowledge points. A comprehensive construction legal system was constructed from a holistic perspective, linking the knowledge points together. Taking the "Legal System of Construction Engineering Contracts" as an example, the second teaching model was adopted. Firstly, a general framework of the formation, validity, performance, modification, transfer and termination, and liability for breach of contracts was established. Then, focusing on construction engineering contracts, students were guided to fill in the formation, validity, performance, modification, transfer and termination, and liability for breach of contracts for survey, design, construction, and other contracts by comparison. This helped students memorize the relevant knowledge points.

Realistic engineering scenarios were created in the classroom, and students were immersed in roles to complete designated tasks. For example, when explaining the knowledge point of "Engineering Quality Warranty Responsibility," students were directly given an engineering quality warranty form to fill out. By

guiding students through the process of filling the form out, this knowledge point was effectively explained. Similar methods can be used for many other knowledge points, such as the preparation of engineering claims notices and the drafting of construction contracts. Through these methods, students' initiative and enthusiasm for learning can be better mobilized, and the expected teaching effect can be achieved.

4. Conclusions

The teaching reform of this course is student-centered, with teachers playing the roles of organizing, directing, guiding, assisting, promoting, and supervising. It emphasizes the enhancement of rich and multidirectional communication, discussion, and collaborative problem-solving among teachers and students, as well as among students themselves. This enriches the classroom experience and enables students to complete the course learning in a relaxed environment, master the relevant knowledge points, cultivate sustainable self-learning abilities, and improve their overall quality.

Currently, the new teaching model explored in the course is only used in the "Construction Engineering Regulations" class of the civil engineering major. It will be further promoted to the "Construction Engineering Regulations" course in the entire Civil Engineering College, dynamically adjusted and gradually improved through practice, establishing a curriculum system, and then extending to other courses. The ultimate goal is to establish a teaching system where "students are the main focus in the classroom, and their autonomous learning abilities are stimulated."

Disclosure statement

The author declares no conflict of interest.

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