



Research on Online and Offline Mixed Teaching Mode Based on Rain Classroom-Taking the Course “Principles of Steel Structure Design” as an Example

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Abstract. The principle of steel structure design is a professional basic course in civil engineering, which has the characteristics of complicated knowledge, many calculations, strong practicality and so on. Under the traditional teaching mode, there are less class hours and more content, the important and difficult knowledge can not be explained in depth, and the students' ability to understand and apply the theoretical knowledge is weak. Based on the online platform of Rain classroom, this paper integrates and optimizes the teaching content, constructs a teaching model with deep integration online and offline, and reforms the traditional curriculum assessment methods, refines the process assessment links, and strengthens the process assessment efforts, so as to improve students' enthusiasm, cultivate students' self-learning consciousness and ability, and improve the teaching effect.

Keywords: Rain classroom · mixed teaching · course examination · steel structure

1 Introduction

The principle of steel structure design is a compulsory basic course for civil engineering majors, which involves a lot of calculation and strong practicality [1]. Under the traditional teaching mode, it often focuses on the learning of theoretical knowledge memory and understanding, the practical application link is relatively weak, and students' after-class learning is lack of effective follow-up feedback, so it is difficult to meet the needs of applied personnel training. Therefore, this paper carries on the exploration and practice of online and offline hybrid teaching mode based on the steel structure course, hoping to extend the classroom to the maximum extent, meet the individual needs of students, and improve the depth of students' participation and teaching effect.

2 Optimizing Teaching Content and Construction of Teaching Resources

The content of the steel structure course is complicated, but the teaching time is decreasing continuously in view of this problem, the teaching content should be adjusted accordingly, and the difficult knowledge should be emphasized in the classroom, while some

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R. B. B. M. Hussain et al. (Eds.): ICHSSR 2023, ASSEHR 765, pp. 1101–1105, 2023.

https://doi.org/10.2991/978-2-38476-092-3_137

minor, easy to understand and cross-repeat contents with the previous course should be published. Students are required to study by themselves in the rain class. Teachers can effectively track the students' learning progress and effect through the rain classroom, and answer students' questions online or offline at any time.

The construction of online teaching resources is the basis of mixed teaching. Using the online platform of rain classroom, we can build rich content and various forms of information-based teaching resources, help all aspects of teaching, and fully mobilize students' enthusiasm for learning, to meet the requirements of personalized learning [2].

- (1) Basic teaching resources: it mainly includes multimedia courseware of various chapters, teaching videos of important and difficult knowledge, construction of test questions database, etc., to meet the needs of online autonomous learning.
- (2) Extracurricular expansion resources: accumulate popular science articles and engineering examples related to steel structure knowledge, so that students can keep abreast of the latest developments in the industry at home and abroad, not only improve students' interest in learning, but also expand their knowledge in order to achieve classroom knowledge and extracurricular knowledge complement each other.
- (3) Knowledge solutions and exercises explanation: In view of the difficult problems of students online and offline, online micro-class videos are built to provide detailed guidance to students outside the classroom. At the same time, the class can not explain the key exercises or there are more mistakes in the homework, record a detailed video explanation of exercises, to solve the problem that students can not start to do homework.
- (4) Online flipping classroom: aiming at typical knowledge points, basic concepts or exercise assignments, students are encouraged to communicate with teachers, and then record an explanation video for other students to learn. Through personal presentation, students' self-confidence and enthusiasm in professional learning can be improved.

3 The Combination of Theory and Practice

Based on the needs of the training of applied high-quality talents, the practical teaching links of the organic integration of design and theoretical teaching can be started from the following aspects to cultivate students' ability to analyze and solve problems.

- (1) Classroom teaching: The pictures and videos of engineering examples are introduced into classroom teaching to strengthen students' intuitive feeling and understanding of steel structure, combined with engineering examples and current codes, focusing on difficulties.
- (2) Experimental teaching: with the help of the virtual simulation experimental platform, the experimental interface is clear, the operation process is smooth, the experimental phenomena and data are accurate and intuitive, and the problems in offline physical experiments are solved, such as few items to be implemented, mainly demonstration, less hands-on operation and so on. Students have high interest and can well meet the requirements of students' practical teaching.

- (3) Practical teaching after class: Guide students to pay attention to observe the existing steel structure buildings in the school, train students to consciously accumulate learning materials and form an effective link with what they have learned; Increase the in-class training link, take the engineering example as the carrier, require students to complete the design and calculation of stressed members and joints, and make the model according to the design results [3]. At the same time, students are encouraged to actively participate in the structural design competition to cultivate their innovative design and practical ability.

4 The Implementation Process of Online and Offline Mixed Teaching

Centering on the comprehensive training goal of students' knowledge, ability and literacy, relying on diversified teaching resources and taking the rain classroom platform as the carrier, carry out the advanced teaching process of autonomous learning before class, internalization of knowledge in class, and application and consolidation after class.

- (1) Before class: teachers clearly define the contents of autonomous learning before class, set up a list of learning tasks under the guidance of problems, publish teaching videos, courseware and other learning materials, students carry out learning and testing online, and communicate with teachers in time for problems existing in learning; teachers timely grasp students' learning dynamics through the platform, analyze the situation of students' self-study, so as to adjust the content of classroom interaction.
- (2) In class: Classroom teaching should focus on cultivating students' ability to analyze the application of knowledge and pay attention to the diversification of teaching methods and means. Taking the engineering example as the background, combined with the code provisions to emphasize the difficult knowledge, guide the students to carry out classroom discussion according to the train of thought of "raising problems, analyzing problems, solving problems and drawing conclusions", so as to improve students' ability to analyze and solve problems [4]. In addition, rain classroom is used to carry out in-class tests, contributions, on-screen comments and other activities to improve students' participation and obtain students' mastery of the teaching content in a timely manner.
- (3) After class: After-class application consolidation includes three aspects: regular learning, phased learning and practical learning. Regular learning focuses on homework and exercise consolidation, which strengthens students' understanding and application of basic knowledge. In addition, it also publishes high-quality development resources to improve students' cognitive depth; phased learning guides students to sort out and review knowledge through chapter tests and mind maps, and uses online flipping classes to enhance students' understanding of theoretical knowledge; On the other hand, practical learning strengthens students' comprehensive application ability of theoretical knowledge through practical links. The specific learning arrangements are shown in Fig. 1.

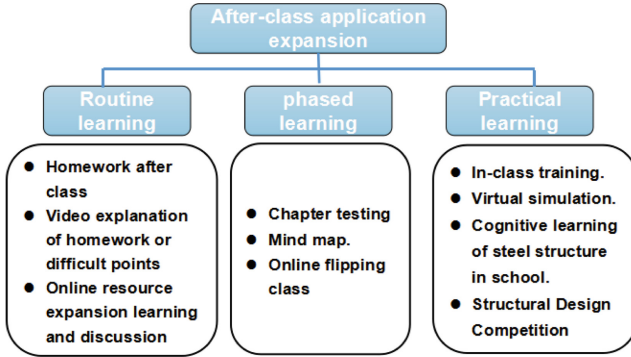


Fig. 1. After-class application expansion

5 Reform the Way of Curriculum Assessment

According to the data recording and analysis of the rain classroom platform, grasp the dynamic process of students’ learning, increase the proportion of process assessment, the assessment content includes online learning, in-class training, experiments, final examination four aspects [5], the detailed assessment links and proportion are shown in Table 1.

Table 1. Curriculum examination and evaluation

Assessment mode	Check point	Proportion	Evaluation method
Rain class	Video of knowledge points Work Mind map Chapter testing Online flipping class Check-in, test	35%	Rain classroom assessment Teacher evaluation
In-class training	The design content is complete, the calculation method is feasible and the train of thought is correct. Fine model making	10%	Teacher evaluation
Experiment	Virtual simulation experiment operation and experiment report	5%	Evaluation of virtual simulation system. Teacher evaluation
Final examination	Understanding and application of theoretical knowledge	50%	Teacher evaluation

6 Conclusion

With the vigorous development of national and provincial first-class curriculum construction, undergraduate course teaching requires us to constantly carry out new teaching methods reform and innovation. Under the current background of “Internet+” education, we should make full use of online platforms such as rain classroom, carefully design online and offline teaching activities, realize the close connection of the three stages of autonomous learning before class, intensive lecture in class and consolidation after class, and strengthen the process assessment. In order to cultivate applied talents with autonomous learning ability and problem analysis and problem solving.

Acknowledgement. This article is in the Teaching research project 2021 Xijing College School-level Teaching Reform Project (Project No.: JGYB2106).

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