Research on Teaching Method Based on "Hardware and Software" Way of Building Structure and Reading Engineering Drawings Course

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Abstract. The course of Building Structure and Reading Engineering Drawings is very important in Civil Engineering. The problems existed in traditional teaching methods affect the students'interest in learning and the quality of teachers' teaching. So it is very important to explore the teaching method. In the age of the Internet plus education, he improvement of teaching method should make full use of the advantages of Internet. Combining the traditional hardware conditions with the Internet+ to explore the "hardware and software" teaching method, the paper gives a comprehensive and reasonable teaching design idea.

With the progress of the times and the development of emerging information technology, lots of new teaching conditions and teaching models have been born, which has inspired new educational concepts and educational changes. [1][2] In the method of combining software and hardware, software refers to the teaching resources that can be integrated by using Internet conditions, the application of software technology related to the curriculum and the interactive interaction platform with the students. This part is mainly represented by online class. Hardware refers to the offline class, which mainly includes teaching venues and stencils, etc. We intend to explore teaching methods that combine software conditions with hardware conditions, so that students can prepare in advance, effectively integrate into the classroom and review the extended knowledge. They can improve their self-learning ability while making full use of time and space.

Existing Problems with Traditional Teaching Methods

The course *Architectural Structure and Mapping* is a core course for civil engineering. The teaching content of the course consists of two parts; one is the structure of the building, which requires students to have the ability to analyze the actual architectural structure. The other part is reading of the construction drawing of the building structure, which requires students to have a certain spatial imagination. The traditional teaching methods mainly have the following problems: Firstly, the students are presented with knowledge points through text and two-dimensional graphics, which lacks image and intuitiveness. It is difficult to understand when students have poor imagination. Secondly, the training program focuses on theoretical explanations, and the practical training is relatively little, so that students' practical operation ability and comprehensive application ability would be greatly affected. Thirdly, students' learning time and space are limited. They can only learn professional knowledge in a fixed space at fixed time. The consolidation of knowledge points under the class is only done through written assignments, which is not conducive to students' comprehensive review of knowledge points and to their extension of knowledge points. Based on the above problems, students' interest in learning and the teaching effect of teachers will be affected. Therefore, in the context of the information age, we need to actively change the teaching methods.

The Implementation Conditions of the Combination of Hardware and Software

The emergence of multimedia technology has made our teaching content out of boring text, and can convert abstract text information into intuitive pictures, videos and other multimedia information. [3] The emergence of the Internet, cloud computing, big data, and Internet of Things technologies has brought us to the Internet+ era. The combination of the Internet platform and information and communication technologies can bring breakthroughs in teaching methods. [4] Therefore, the first condition for the implementation of the software and hardware teaching method is Internet

technology, which allows us to obtain more educational resources. In addition, the implementation of this method also requires the assistance of multimedia classrooms, teaching molds and computers, etc. It can be said that the Internet provides software conditions for the implementation of the method, while multimedia classrooms, teaching molds, and computers provide hardware conditions for the implementation of this. No matter whether it is software conditions or hardware conditions, talents must be inseparable in the process of application. Talent is also a key condition for the implementation of this method. Because, if there is no talent to plan the application and management methods of designing hardware and software conditions, then it is very likely that the software and hardware conditions provided in the construction of university laboratories will become furnishings in teaching. In the process of students' learning and teachers' teaching, they cannot give full play to their due value. Therefore, colleges and universities should pay attention to cultivating excellent teachers' team while attaching importance to the construction of laboratory software and hardware conditions.

Implementation Ideas of the Combination of Hardware and Software

General Idea of Teaching Method Implementation.
The implementation of the software and hardware combined teaching method is different from the general teaching method reform. Many conditions are required in the implementation process. Therefore, the overall idea of implementing the method is shown in Figure 1：
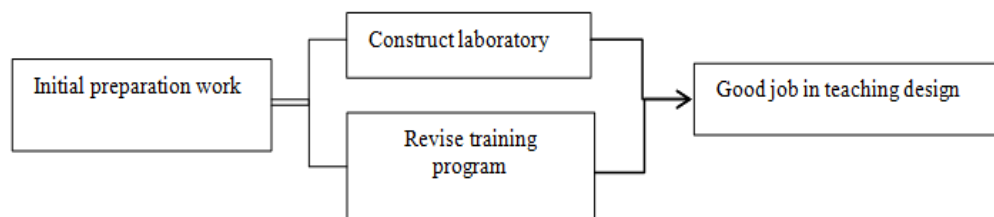

Figure. 1 The general idea of the combination of software and hardware

Firstly, we must do a good job in preparation, including building a laboratory and revising the training program. Meet the basic hardware and software conditions by laboratory construction. Set teaching molds, teaching whiteboards, computers, and other hardware conditions related to the course *Building Structure Construction and Mapping*. At the same time, set up a network in the laboratory, introduce an information-based teaching platform, teaching software, professional websites and forums, etc. in the network environment.

Revise the traditional training program, the proportion of the practice links in the traditional training program is relatively small, and the students spend less time practicing the theory. In this way, students have insufficient understanding of the knowledge points and cannot guarantee that they will achieve good learning results. Suggest that theory and practice interspersed with teaching to increase the proportion of practice.

The preparatory work for the revision of the laboratory construction and training program is a necessary condition. To do a good job in the teaching of *Building Structure Construction and Mapping*, a perfect teaching design system is essential, it is not only directly related to the degree of utilization of the previous creation conditions but also directly affects the teaching effect. When the instructional design is considered to be comprehensive and sufficient, the pre-creation condition will be used with a high degree of teaching effect. On the contrary, the best results cannot be achieved. This means that there should be excellent teachers in our teacher team should take responsibility for the overall planning; teachers should learn how to use software and hardware conditions as soon as possible. This part is easier to implement for young teachers today.

Specific Ideas of Teaching Design.
The specific ideas of teaching design in the combination of software and hardware are shown in Figure 2:
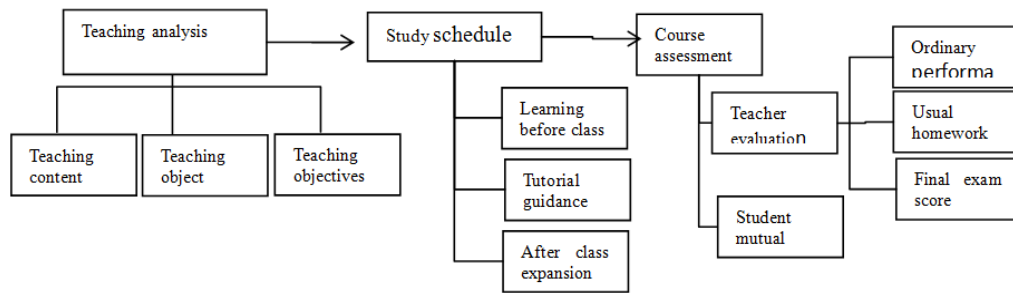
Figure. 2 Specific ideas of the teaching design of software and hardware

The factors that need to be considered in the development of the instructional design plan include teaching content, teaching objects, and teaching objectives. The teaching content of *Building Structure Construction and Identification* mainly includes two parts, which are the structure of building structure and the structure of building structure. The two parts are composed of building materials, such as beams, slabs, columns, walls, etc. The structure of knowledge points is relatively clear, and the teaching content can be arranged from the principle of division to total and from individual to system. But the theory of these contents is rather boring, and the pictures are more abstract. The teaching object of these contents is the third-year students of civil engineering. Although they already have certain professional basic knowledge, have certain hands-on ability, active thinking, and strong ability to accept new things, their abstract thinking is insufficient, their fascination with mobile phones is high, and serious low-headed phenomenon occurs，which has led to their enthusiasm for learning is not strong enough. So, the knowledge goal in the teaching goal is to master the key knowledge in the teaching content. The ability goal is to have the ability to read the construction plan. The goal of literacy is to be able to actively learn and have strong hands-on ability. Solve the problem of insufficient abstract thinking and less proactive learning by changing the presentation style of teaching content and achieve the knowledge goal, ability goal and literacy goal in the teaching goal.

The above is the teaching analysis work in the teaching design of the combination of software and hardware. The specific implementation process can be divided into three stages: pre-class study, in-class tutoring, and after-school development.

Before the first stage, the teaching platform provided by the software condition is used to allow students to pre-read the course content through online resources such as micro-courses, MOOCs, courseware, videos, etc., and complete self-learning. This part of the study lays the foundation for the second phase of learning.

In the second stage, the tutoring guides students to complete the learning tasks based on the content of the students' pre-reading. The Liang Ping method construction drawing in the course of *Architectural Structure Construction and Mapping* is taken as an example. The Liang Ping method construction drawing includes centralized labeling and in-situ annotation. First, prepare a set of drawings for students to understand the students' pre-study learning situation through questions. Then, focus on the places where students can't learn well, and then let the students further understand the meaning of the symbols in the construction drawing. After the students master the rules of the flat marking, they should draw out the cross-section bars of each beam in the drawing. The process is completed in a theoretical and practical manner. In the training, the teacher demonstrates the steel bar placement and performs the roaming animation for students to understand easily by BIM technology, sketch master software, Sketchup software, etc. Through the establishment of the software model, the information such as the longitudinal ribs, the stirrups, the negative ribs of the support, the position of the encryption zone and the non-encrypted zone of the stirrup are visually expressed.

The expansion of the third stage after class is to assign advanced tasks to the students after mastering the knowledge points. At the same time, let the students learn to master the operation of the software, visit the construction site, make models by action, and participate in the corresponding

skill competition. Teachers provide students with professional learning websites. With the help of the Internet, through the guidance of teachers and the study of students, students can expand their horizons, improve their skills and have a deeper understanding of the profession.

Surely, how effective the implementation of this teaching method must be measured by establishing a reasonable curriculum assessment system. The assessment of the course is mainly measured in terms of usual performance, usual homework and final exam results, but not only in the traditional proportion because traditional exams have the highest percentage of final exam scores. The combination of software and hardware teaching methods focuses on rationality and integration, and the proportion of practice is also high. In the meanwhile, this method also pays great attention to pre- and post-class study in addition to the emphasis on class teaching. Such a traditional assessment ratio is obviously not reasonable for this method. In addition, after the end of the course, besides the assessment of the students, the teachers can also allow students to self-assess and mutual evaluation between them, so that they can learn from each other. They can even allow students to evaluate the teaching situation of the teacher, so that the teachers can also understand the advantages of this teaching design, and also find the shortcomings to facilitate the later improvement. Diversified assessment methods and evaluation methods are also beneficial to improve teachers' teaching quality while cultivating students' teamwork, active learning, diligent thinking, and diligent ability.

Conclusion

The combination of software and hardware makes full use of Internet conditions while utilizing traditional hardware conditions. The use of Internet technology to integrate teaching resources, focusing on the combination of online and offline, allowing students to have pre-study conditions before class, with task-oriented learning in class and expand knowledge through hands-on and online platforms. In this way, students can overcome difficulties while mastering key knowledge. Except transforming boring theoretical study into a multi-modal teaching model, teachers can enhance students' interest and active classroom atmosphere, and cultivate students' teamwork spirit and change the role of teachers. In addition, based on the characteristics of this method, teachers must also change the traditional assessment methods to truly achieve a diversified, whole-process, all-round curriculum evaluation system.

With the development of Internet technology, the speed and platform for students and teachers to obtain information is almost equal. Students should not be passively crammed, but should be actively guided by teachers. This means that teachers should constantly change their teaching methods and teaching concepts in actual teaching. Combine the essence of traditional teaching methods with information technology to find ways and means that are more in line with student characteristics. The future education is informative, and information technology brings new opportunities and challenges to teachers, but also provides a platform for the reform of many courses. I believe that there will be more new methods in the new era.

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