

Application Research of Building Model in Teaching

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Abstract: This paper integrates the architectural model into the classroom theory teaching, optimizes the course teaching content, and transforms engineering practice into theoretical knowledge. Through the research, it is found that the architectural model has the advantages of being more intuitive, three-dimensional and real. The actual internal structure of various building component nodes can be exposed, and standardized nodes can be displayed against each other, so that students can master standardized processes, and a three-dimensional learning environment can be created for the cognition and observation of civil engineering students. Using it in civil engineering teaching can enhance students' learning interest. Improve students' theoretical knowledge application ability and practical operation ability, deepen students' understanding of teaching content, and cultivate students' innovative thinking and innovative consciousness.

Keywords: Architectural model; Three-dimensional; Innovative thinking.

1 Introduction

Civil engineering is different from architectural design, it needs to solve the fundamental problem is the safety of the project, so that the structure can resist a variety of natural or man-made forces, so the design and production of mechanical components in the civil engineering profession has become the top priority^[1]. After the beams, plates, columns and other components of ordinary building structures are poured, the steel bars are wrapped in concrete, forming a hidden project. Students have difficulties in understanding the internal steel bar structure, and it is difficult to convert the theoretical knowledge in textbooks to practical projects.

Based on the production of architectural models, through the five processes of preliminary design, material selection, space color matching, model making, and presentation, this paper organically combines professional knowledge and theory with labor ability training, realizing the goal of labor education of "cultivating virtue through labor, enhancing intelligence through labor, strengthening body through labor, cultivating beauty through labor, and innovating through labor"^[2], and deepening students' understanding of teaching content. Improve student learning effect^[3].

2 Application advantage of architectural model in teaching

In the traditional teaching process, courses are often completed in two-dimensional form, and students can hardly truly feel the relationship between various components of the building and its composition form^[4], and cannot convert from two-dimensional drawings to three-dimensional buildings. From the perspective of teaching effect, students lack spatial imagination in the process of reading pictures, and this teaching method is very boring, which will make students bored and lose their interest in course learning. Building model teaching can change the monotonous teaching of how to read building construction drawings in traditional teaching. Building model is more intuitive to help students understand building construction drawings and can strengthen students' spatial imagination ability. Now it has become one of the important means of practical teaching of Reinforced Concrete course.

Architectural model practice teaching is a kind of teaching activity designed around architectural model based on cognitive science theory and research results, comprehensive application of systematic scientific practice methods, taking architectural model as the main teaching means^[5]. The architectural model is made by scaling down the building entity, so the model can intuitively express the external characteristics, scale proportion, contour shape, spatial level and so on of the designed work. This kind of intuitive experiential learning is in line with the cognitive characteristics of beginners, and is conducive to beginners' grasp of architectural models, so as to link three-dimensional architectural models with two-dimensional architectural construction drawings. Students can gradually cultivate a sense of three-dimensional space by making models themselves, and can help beginners improve the shortcomings that are difficult to find in two-dimensional space. At the same time, students' ability to draw and recognize maps, as well as the efficiency and quality of model making can be improved.

3 Innovative teaching reform based on building models

3.1 The content of innovative teaching reform

First This paper takes the students majoring in civil engineering in Haidu College of Qingdao Agricultural University as the main research object. According to the students' learning situation and the characteristics of professional courses, in the course teaching process of civil engineering, the engineering practice is first transformed into theoretical knowledge for teaching, and then the students are asked to design and make architectural models, integrating "teaching, learning and doing". To realize the organic combination of labor education and theoretical knowledge.

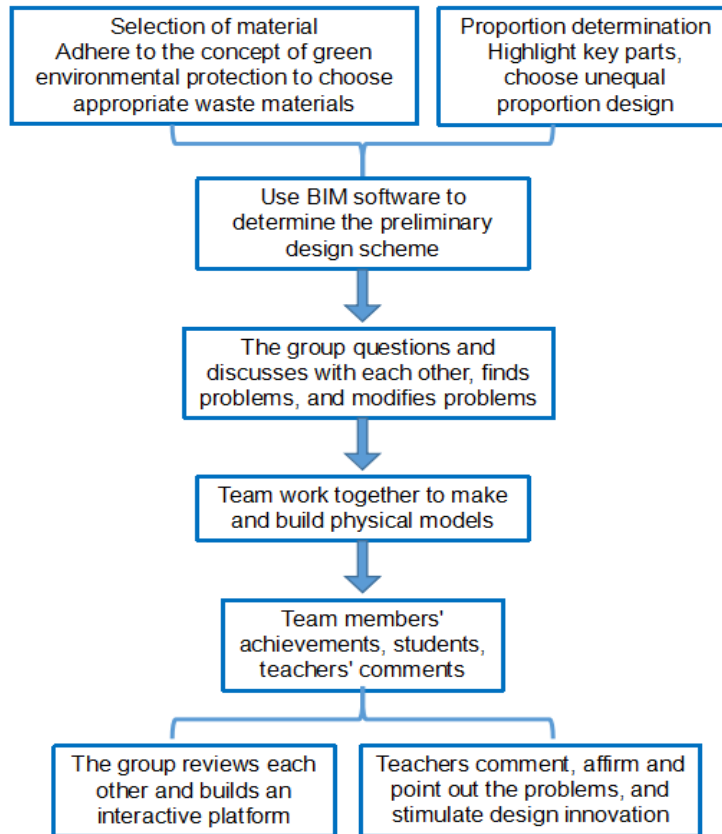


Fig. 1. Implementation plan of teaching reform

When making the architectural model, we adhere to the design concept of green environmental protection and choose the design and production of waste materials. Through mutual discussion and cooperation among students, students can master the standardized procedures and create a three-dimensional learning environment for students majoring in civil engineering to understand and observe. Design students to design with the thinking of engineers, after the completion of the production of the role of teachers to explain and comment on other group works, improve students' language skills. Through the whole process of model design and production, students' comprehensive literacy in science, technology, engineering and language has been improved, and students have been cultivated into "five" young students with solid theoretical knowledge, environmental awareness, innovative thinking, hands-on operation ability and language expression ability, laying a good foundation for future work. The implementation plan of teaching reform is shown in Figure 1.

3.2 Content of teaching reform

(1)Reconstruct the course teaching content.

The theory of college textbooks is too colorful and cannot keep up with the development of The Times and technology. Teachers use the holidays to obtain practical materials in actual engineering projects, consult the cutting-edge scientific and technological achievements of the specialty, combine the patented technology of the subject leader, and integrate them into the teaching of relevant professional courses to realize the conversion of practice and theory^[6].

(2)Build the model by combining BIM software and physical production.

Students use theoretical knowledge to design in the role of engineers, and build architectural models by hand to realize the conversion of 2D drawings and 3D models. Students participate in the life cycle of ideation-design-realization-operation, training students' ability to draw and read pictures, and cultivating students' ability to apply profound basic engineering knowledge. The model making process of students is shown in Figure 2.

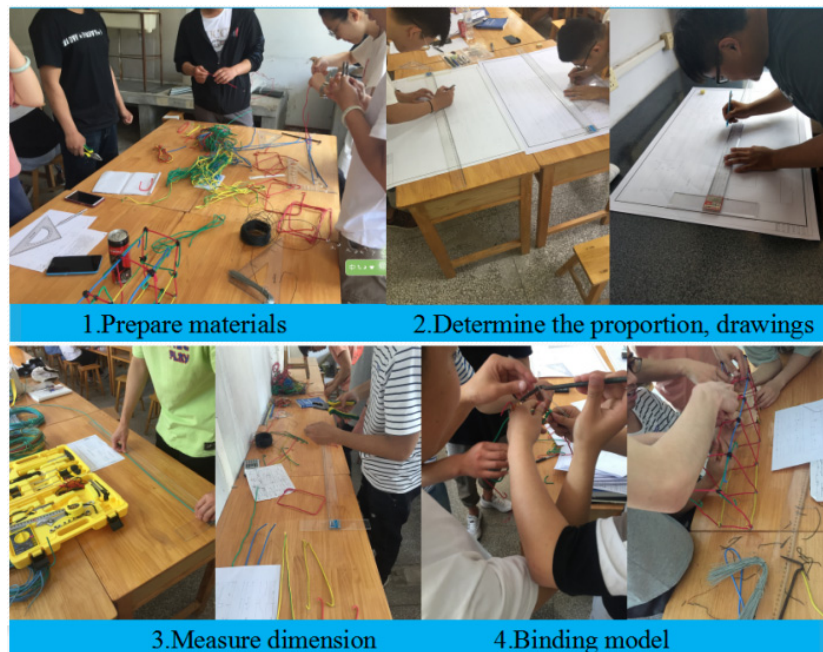


Fig. 2. The process of students making models

(3) Display results.

After the completion of the design, students explained the design as teachers and commented on the achievements of other groups. In the comments, the relationship between the teacher's "quotation" and the students' "comments" should be well handled, so as to fully mobilize students' enthusiasm for discussion, cultivate students' correct design thinking and stimulate design innovation. Through comments, students can judge themselves, find problems, and stimu-

late their design thinking and enthusiasm. Part of the building models made by students are shown in Figure 3.



Fig. 3. Some building models made by students

3.3 Teaching effect

In terms of theoretical knowledge level, teachers keep pace with The Times when teaching, combining current engineering practice, scientific and technological achievements and patented technology into theoretical knowledge for teaching. In terms of the level of environmental awareness, when making architectural models, adhering to the green concept of sustainable development and choosing waste materials that exist in large quantities but are not fully used in life, not only reduces the production cost of architectural models, but also improves students' sense of social responsibility. In terms of practical ability level, students start from practical engineering problems, use solid theoretical knowledge to build an architectural model, and use waste materials to make the real object of the model, and shape the craftsman spirit. In terms of innovative thinking, through the model concept to improve spatial thinking and theory with practice of scientific concepts, so that students' professional quality, labor ability to improve. In terms of language expression level, after the completion of the design, students will explain as teachers and comment on the achievements of other groups, which can improve students' language expression ability.

4 Conclusion

In this paper, the actual project as the guide, scientific research results as the incentive, patent technology as the guidance, to make the building model. The design concept of green environmental protection is upheld in the production, so that students can choose the design and production of waste materials, which not only saves resources but also improves students' environmental awareness. BIM software design is used to increase students' knowledge and understanding of building components and improve software operation ability. Through hands-on modeling, students' drawing reading ability and hands-on ability are trained, innovative thinking and awareness of students are cultivated, and craftsman spirit is shaped. Finally, after the design of the work is completed, students will explain the work in the role of teachers, which can improve students' language expression ability.

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