

Exploration and practice of "Engineering drawing" teaching reform based on the improvement of students' innovative ability

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Abstract: "Engineering drawing" is an important tool used by engineers and technicians to express design ideas and carry out technical exchanges. It is the first basic technical course for engineering students to enter the university. How to stimulate students' interest in learning, guide students to take the initiative to practice, and improve students' innovation ability. According to the characteristics of "engineering drawing" course, the course teaching team elaborated the methods and approaches to cultivate and improve students' innovation ability through the exploration and practice of teaching reform including discipline competition, innovation training and open experiment.

1. Introduction

"Engineering drawing" is an important tool used by engineers and technicians to express design ideas and carry out technical exchanges, and it is the first basic technical course that engineering students come into contact with and take.^[1] The drawing is formulated in accordance with the unified provisions of relevant national or departmental standards and is the "technical language of the engineering community".

In today's China, "focusing on the cultivation of front-line innovative talents" is one of the important tasks of university education. However, compared with college students in developed countries, there is still a gap in the ability of our students to solve practical problems and innovate. There are many reasons for this gap, one of which is the lack of interest in learning and "passive practice". According to the characteristics of the "engineering drawing" course, in the course teaching, teachers create conditions for students through discipline competition, innovation training, open experiment and other teaching links, stimulate students' learning interest, mobilize students' learning potential, guide students to take the initiative to practice, and then improve students' innovation ability.

2. Discipline competition

2.1 Discipline competitions stimulate students' ability to combine theory with practice and work independently

Subject competition is a series of activities that are closely combined with classroom teaching to stimulate students' ability to combine theory with practice and work independently, to find and solve problems through practice, and to enhance students' confidence in study and work. Subject competition is exploratory, creative and scientific, without any shortcut, but also requires hard work. Therefore, to carry out discipline competition activities is helpful to cultivate students' rigorous and realistic learning attitude and the scientific spirit of daring to explore and proactive. Discipline competition plays an increasingly important role in promoting discipline construction and curriculum reform, guiding colleges and universities to pay attention to the cultivation of students' innovative ability, cooperative spirit, theory and practice, hands-on ability and engineering training in teaching

reform, advocating quality education, improving students' innovative ability and ability to design and make practical problems, and so on.

2.2 Competition Results

Combined with the discipline competition of "National College Students Advanced Mapping Technology and Product Information Modeling Innovation Competition", the course team carried out school-level fun drawing and excellent work evaluation and selection competition, organized students to participate in the "National College Students Advanced Mapping Technology and Product Information Modeling Innovation Competition Gansu Regional selection Competition", through two levels of selection. Finally determine the candidates to participate in the "National College Students Advanced Mapping Technology and Product Information Modeling Innovation Competition".^[2] The fun drawing competition uses divergent open questions, the answers are not unique, and the combination of traditional Chinese elements, such as Dougong and Zhaozhou Bridge, is easy for students to accept and can be fully participated. Excellent work evaluation is conducted in the mid-term and the end of the semester, and the outstanding work selected is displayed for students to watch and learn. The evaluation can have multiple criteria, such as beauty, accuracy, artisan spirit, etc. In the provincial and national competitions, teachers and students have improved their level year by year through unremitting efforts, especially in this year and two years, and achieved good results, which has improved the confidence of teachers and students, and cultivated the students' rigorous and realistic learning attitude and the courage to explore and positive spirit of hard work. Figure 1, 2, 3

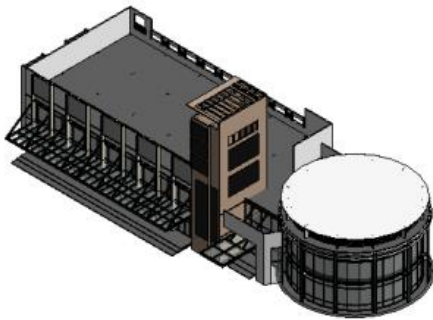


Figure 1 Revit 3D modeling



Figure 2 VR architectural design

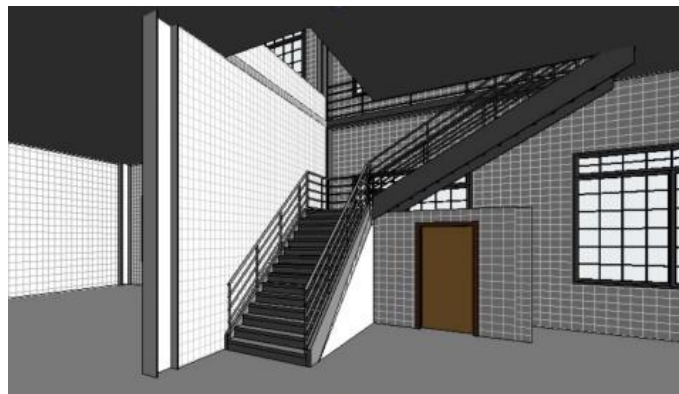


Figure 3 VR internal scenes

3. Innovation training

3.1 Innovative training guides students to take the initiative to practice

College students' innovation training aims to emphasize students' interest-oriented, cultivate students' ability to independently carry out scientific research as the goal, "encourage innovation, step by step, focus on process, and pay attention to results", stimulate students' interest in scientific research, and enhance college students' innovation ability. Guide students to participate in scientific research, in-depth practice, explore and establish a teaching model with problems and topics as the

core, advocate innovative experimental reform with students as the main body, and improve the comprehensive quality of college students.

Advocate teachers to guide students to carry out innovative training activities, carry out in-depth research teaching and heuristic teaching, and promote the combination of scientific research and teaching and the transformation of scientific research results.

3.2 Practical Results

The following examples are the practical results that take students as the main body and students' interests as the guidance, and stimulate students' interest in scientific research and enhance college students' innovative ability through the teaching model with problems and topics as the core. Example: "Data and simulation" innovative design of building based on 3D design method^[3]

Design elements such as the volume of a building, the relationship between space composition, form and line, the emptiness and reality of space and the sense of light are usually not directly displayed. In the process of traditional architectural practice, the expression of traditional architectural design is usually completed by the rendering company, and whether the expression of architectural scheme is appropriate and in line with the architect's idea depends on the ability and quality of the renderer's personnel and the communication with the designer^[4]. With the continuous updating and iteration of VR technology, the needs of architects and the industry can be met from the aspects of ease of operation, software compatibility and continuity of use, etc. The improvement of resource libraries such as plants, materials and furniture in VR technology will further promote the real texture of architectural scheme expression^[5].

In this stage, we choose a three-dimensional modeling of a memorial hall, which must be able to display the outdoor environment of the building, the exterior shape of the building, the interior space and various ancillary facilities in a visual, dynamic and all-round perspective, so that architects and users can experience the room, inside and outside space of the real building in the future in a virtual VR environment. We determine the selection of building materials and arrangement of plant configuration, and conduct real-time roaming in the VR virtual world.

4. Open experiment improves students' practical and innovative ability

The laboratory open experiment project is to further improve the students' practical and innovative ability, effectively use and tap the laboratory resources, give full play to the important role of the laboratory in the process of personnel training, and promote the combination of scientific research and teaching and the transformation of scientific research results.

The following example is one of the teaching results completed by such projects, which effectively promotes the combination of scientific research and teaching and the transformation of scientific research results, and enhances the innovative ability of students.

Example: Building information model construction under advanced mapping technology^[6]

The use of advanced mapping technology Revit for building 3D information modeling and design can effectively solve the problem of obscure and difficult to understand architectural drawings and poor communication between professions due to the flat building information established by 2D drawing. Taking the architectural design of a certain sports hall as a case study, this model is based on the high complexity of the building's body shape, and the plan and elevation cannot reflect the beauty of the building's body shape. It can only be designed as a three-dimensional model to better demonstrate its uniqueness. With the forward design process as the main line, the application of Revit software throughout the entire process from basic model creation to printing out the design drawings. Figures 4 and 5 are the models established by the 2D modeling software CAD, while Figures 6 and 7 are the graphics formed after Revit modeling.

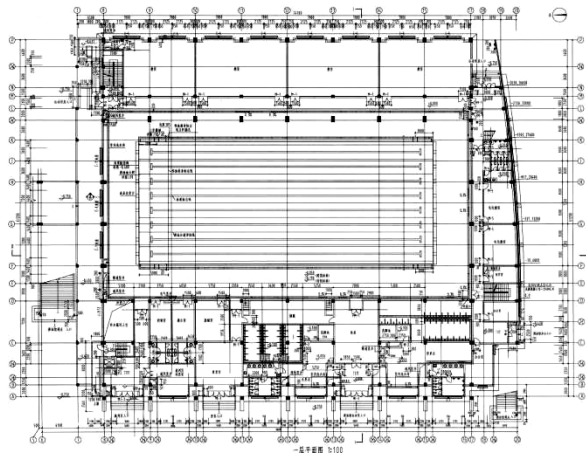


Figure 4 First floor plan

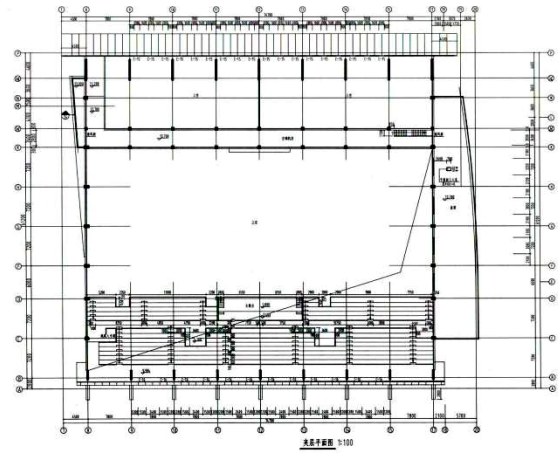


Figure 5 Mezzanine floor plan

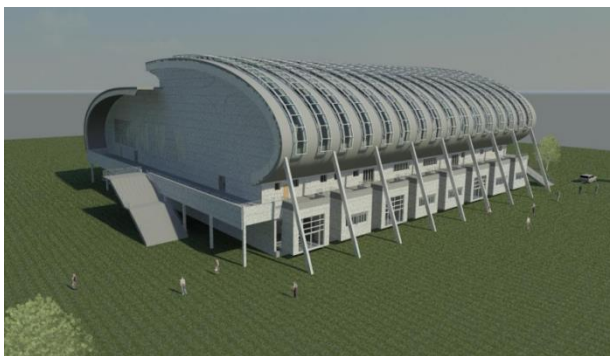


Figure 6 Southwest effect

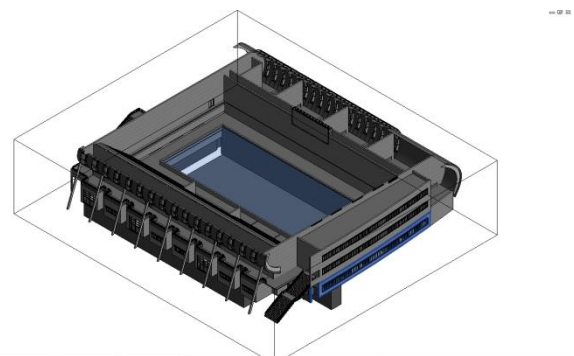


Figure 7 Slicing interlayer effect

5. Project- based learning

Project-based learning is a student-centered teaching model. Through a task, it promotes students to consult and empirically prove in the study of completing works and performing tasks, so as to acquire knowledge and skills. For example: In the part of house building drawing, after mastering the basic knowledge of house building drawing, the teacher presets a virtual project, requiring students to choose a building example (multi-layer reinforced concrete frame structure) in a group (3-4 people), compile a project plan, draw an architectural drawing and Establish a three-dimensional model (the learning and selection of software is self-study and self-selection). After the project is arranged, students should first make a simple plan for the project, select an example of a construction project, and complete the project arranged by the teacher through case research, data collection, construction drawing interpretation, software learning, teacher guidance and other methods. This teaching model organizes teaching activities through the joint implementation of a complete "project" between teachers and students. Because students participate in the planning, implementation and management of the whole project, it makes learning more purposeful, practical and interesting. It also trains students' analytical ability, innovation ability, cooperation ability, communication ability, etc.^[7]

6. Conclusion

If the teaching method of "engineering drawing" cannot fully reflect the student-centered teaching concept and guide students to take the initiative to practice, students will lack of interest in course learning and innovation ability. How to stimulate students' interest in learning and improve students' innovative ability is an effective method and approach to improve students' innovative ability through years of exploration and practice of teaching reform based on the characteristics of the course, from the aspects of discipline competition, innovative training, Open experiments and project-based learning and so on.

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