Research on the Course Reform of "Engineering Drawing" Based on 3D Modeling Technology

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Abstract： The engineering drawing course reform based on 3D modeling technology can not only help students to quickly establish spatial thinking ability, but also stimulate students' interest in learning. Compared with the traditional engineering drawing course teaching mode, the teaching quality is significantly improved.

Keywords: 3D Modeling Technology; Engineering Drawing; Course Reform

1. The background of teaching reform

1.1 Existing problems

As a basic professional course, "Engineering Drawing" is offered in all engineering majors in our school, which shows that it plays a pivotal role. However, in recent years, with the continuous updating of our school's training program, the class hours have been gradually compressed, initially 96 class hours, later 72 class hours, and now 48 class hours. Although the class hours are compressed, the teaching content has not been deleted. Instead, with the advancement of technology, computer graphics content has also been added. Therefore for the students, the difficulty of learning increases and the quality of learning shows obvious decline.

1.2 Advantages of 3D modeling software

By the course of engineering drawing   students are trained to be able to use the basic theory of projection and have the ability to read and draw engineering drawings.The drawing course teaching in our school mainly contains two parts,   manual drawing and computer drawing. Previously, our school used AutoCAD as computer graphics software. In order to adapt the market demand for talented employers and to improve the quality of teaching, our school now uses SolidWorks 3D modeling software.

AutoCAD is more used for drawing two-dimensional sketch. Although it has a three - dimensional drawing function of three-dimensional drawing, it is less intuitive and cannot show the internal effect after cutting. The 3D modeling software technology SolidWorks is easy to learn and use, has a strong sense of   3D，and has the function of replacing 3D models with 2D engineering drawings. More importantly, the learning and use of SolidWorks can be fed back to the teaching and learning of drawing courses, helping students to quickly establish the concept of space, effectively solving the problem of declining teaching quality due to the deletion of class hours.

2. The teaching reform practice based on 3D modeling

2.1 The methods of improving teaching

In the teaching process, we can use 3D modeling technology to realize the advantages of 360º visualization of the interior, exterior, and rotation of 3D shapes, which breaks the mode of traditional teaching   of theoretical teaching in the teaching of drawing, and using SolidWorks 3D drawing as the mainline instead. In teaching practice, the combination of theoretical teaching and computer graphics can fully mobilize students' subjective initiative and improve their learning enthusiasm. The specific implementation is as follows:

During classroom teaching, we abandon the aids of traditional teaching , and establish a unified two-dimensional image and three-dimensional shape required in teaching by establishing a library of teaching resource . Through animation simulation display in the course, students can clearly judge the visibility and positional relationship of "points", "lines" or "surfaces" at a glance, which is helpful for students' understanding, and then effectively relieve the difficulties in teaching.

When students complete their homework after class, for example: two views are given and the third view should be drawn. Since students have learned the use of SolidWorks software, for students with weak spatial imagination, they can observe the two views given in the question and modeling with SolidWorks at the same time. It will be helpful for the thinking based on the three-dimensional model they had drawn, from which you can feel the intuitive and vivid model structure step by step. The answer will be complete by the third view they eventually finished. Practice has proved that students can not only improve the quality of homework completion but also find self-confidence and a sense of achievement in learning by responding questions and doubts by themselves.

2.2 Optimize the teaching content

Based on the advantages of 3D modeling technology and the actual needs of future work, we have made partial adjustments to the content of original teaching . By simply the principles of geometric drawing and weaken the knowledge of point, line, surface projection and so on, the position of "body" will be a highlight in it. After teaching practice, it is shown that the selective deletion of teaching content based on 3D modeling technology does not reduce the learning effect of students.

In terms of the arrangement of teaching content , we have also made a major adjustment, the interspersed explanations of SolidWorks and manual drawing.   For example: in the lecture, the component models of SolidWorks are firstly explained, so that students will have the ability to model simple components in 3D; then the knowledge of manual drawing will be explained, such as projection basics, combinations, etc. If students encounter difficulties at this part, they can solve the problems with the help of 3D models. After that, these areas of knowledge will be gradually introduced to the students: the surface design of SolidWorks, the notation and detail drawing of manual drawing, the assembly drawing of SolidWorks and manual drawing, and the engineering drawing of SolidWorks. This kind of interspersed teaching arrangement can effectively integrate manual drawing and computer drawing, and improve the teaching efficiency.

2.3 Using 3D modeling technology to help the extracurricular activities

In the concept of traditional teaching, extracurricular learning is mainly based on homework. But in the course reformation of "Engineering Drawing" based on 3D modeling technology, we will further extend from extracurricular learning to the second class, that encourages students to participate in subject competitions and scientific research projects, such as: Engineering Design Expression Contest----3D Modeling, "Qimingxing" College Students' Science and Technology Innovation and Entrepreneurship Project, etc. In addition, our school has also carried out in-depth cooperation with

enterprises and design institutes. Students can directly participate in real engineering projects of enterprises, using the 3D drawing skills they have learned to carry out cooperative projects such as drawing and design with enterprises, enable students to increase their knowledge and apply what they have learned in practice. Then, through the practical application, they can constantly comprehend the content they have learned and achieve integration with other course related knowledge systems, which will promote the improvement of their application and thinking ability, laying a good foundation for entering the workplace in the future.

3. Summary

In summary, through exploration and practice, the teaching reform of the course of engineering drawing   based on 3D modeling technology has changed the teaching mode and teaching method of the course of traditional engineering drawing ; the thought of students during the process of learning engineering drawing is being changed, from 3D to 2D and then back to 3D, to the present way, switching between the current 3D and 2D at any time. After that, the engineering drawing class returns to the design itself, which not only improves the students' interest in studying engineering drawing class, but also stimulates their innovative vitality. In this way, it improves students' practical ability and cultivates their ability to solve problems with innovative thinking, and also improves their employment ability at the same time.

Of course, the teaching reform of engineering drawing class has not reached the end. In the next step, we will focus on further selection and optimization of 3D modeling software for different majors to meet the different requirements of students' skills in different professional positions. For example, for the course of engineering drawing in industrial design majors, we can analyze and compare from SolidWorks, MAYA, PRO/E and other software, and select the top ones for it. The Revit software is a more compatible choice for building environment and energy application engineering majors, which can be more effectively integrated with courses of subsequent professional .

Overall, there is still a lot to be explored in the reform of courses of engineering drawing   based on 3D modeling technology. With the continuous emergence of new technologies, teaching concepts and teaching methods will also continue to innovate.

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