Application of 3D Modeling Technology in Teaching

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Abstract: Faced with the complex mechanical parts encountered in practical learning, teachers are difficult to explain complex machinery and students' imagination ability of three-dimensional space is weak. We apply three-dimensional modeling technology to teaching, give full play to the ability of the software itself to solve the above problems. The 3D modeling software is used to model the required objects in three dimensions, and the model is integrated into the classroom. In the software, the model is enlarged, flipped, and perspective for students to learn. It breaks the traditional single form of teaching, and makes logical learning in one-dimensional, two-dimensional and three-dimensional space complement each other, reducing learning resistance, improving classroom efficiency, saving teaching costs, and bringing benefits to teachers and students. The application of 3D modeling technology in teaching is convenient for teachers and students to learn.

1. Introduction

China's existing teaching mode is to learn from foreign countries, but traditional teaching is to impart knowledge to students by one-dimensional display of words and two-dimensional display of pictures and videos. When some knowledge is used, students and teachers are troubled because they can't see the real thing, and they can only learn theoretically but can't experience it personally. The new three-dimensional model of real scene can meet this requirement, and with the continuous improvement of computer graphics and other disciplines and the development of digital cameras and 3d scanner, etc. According to the actual situation, we integrate the solid 3D model into the teaching, collect the photos of the required real objects and simulate the real objects through the corresponding software, so as to show the real objects fully and vividly, thus solving the problems, making the classroom more lively and interesting, and saving the teaching cost.

2. Advantages of 3D Modeling Technology Applied in Teaching

2.1. Simple Operation and Strong Adaptability

The application of 3D solid modeling technology in geographic mapping and cultural heritage protection has been very mature, and it has a great influence on it. Since then, it has been inspired to apply 3D solid modeling in teaching. Different from geographic surveying and mapping, the machines, components, parts and etc. learned in engineering are relatively small and simple, so its

entity 3D modeling is relatively simple. Here, there are two ways. One is to use modeling software. [1] This method is aimed at rare or non-physical mechanisms, but it can also be used to model common mechanisms. The second is photo modeling. Here, the method of 3D modeling with photos is briefly described. This method is easy to operate, but a little complicated. It is photographed by mobile phone, and then 3D modeling is carried out by modeling software. It is important to ensure that the minimum 60% overlap and the maximum angle difference of 15 are continuous photos, and try to keep the camera at the same distance. If we want to get a finer three-dimensional model, then we need to shoot step by step, get closer to the object step by step, but try to keep the same shooting distance. We must pay attention to shooting in all directions, including the bottom. If the overall camera density is uneven, relative to clutter, and some angle photos are insufficient, then the built 3D model will be rough and even incomplete.

In the face of some machines and mechanisms with complex structures, we can use laser scanning system to carry out 3D modeling.

After modeling with modeling software, we can observe the model in all directions. When faced with some incomprehensible details, we can zoom the 3D model. In the course of study, we will encounter many machines and components that are hard to see, but we can easily solve this problem by using 3D modeling technology. The application of three-dimensional modeling in teaching is very flexible.

2.2. It can Reduce the Use of Solid Model, Save Cost and be Convenient to Carry

There are all kinds of components and parts in books. When teachers teach, they can't show them to students in class for various reasons, such as the high quality of the components. Application of solid 3D modeling technology in teaching [2, 3], teachers only need to build three-dimensional models of components and parts that need to be taught before class, and then they can use computers to show and explain to students in class, breaking the limitations of traditional teaching. It saves time, money and other teaching costs, and is also convenient for teachers to carry.

2.3. Reduce Learning Resistance and Stimulate Learning Interest

Through the 3D modeling technology, the teacher models the teaching needs, and shows the learned mechanical parts to the students through the computer screen in the classroom. When encountering machines with complex structures or difficult working principles, the teacher can combine the 3D models to explain them to the students in detail and demonstrate them. With the model, when students don't understand it or don't understand it thoroughly enough, they can ask questions to the teacher by referring to the three-dimensional model. In this way, the teacher can understand the students' doubts, make further explanations, and try to solve the students' doubts in plain language as much as possible. In this way, students not only improve their imagination ability in three-dimensional space [4, 5].You can also participate in class and teachers, create a good learning atmosphere, and at the same time communicate and discuss with teachers well, which can stimulate students' interest in learning.

The established three-dimensional model can also be used among teachers, sharing resources, improving students' learning efficiency, reducing teachers' burden, and making students happy to learn.

3. Illustrate

In mechanical drawing [6] The learning difficulty coefficient of intersecting lines is still large, because students rarely see this structure in their daily life, and their three-dimensional spatial

imagination ability is weak. Faced with this problem, we can use UG software for 3D modeling [7, 8].

First, let's take a look at UG software [9, 10]. UG is a product engineering solution produced by Siemens PLM Software Company, which provides digital modeling and verification means for users in product design and processing. The development of UG started in 1969, and it was developed and realized based on C language. UG NX is a flexible software tool for numerical solution of partial differential equations, which is developed by using adaptive multigrid method in 2D and 3D unstructured grids. This is an interactive CAD/CAM (Computer Aided Design and Computer Aided Manufacturing) system, which is powerful and can easily realize the construction of various complex entities and shapes.

Through this software, the teacher builds the 3D model of the entity related to the learning intersection line. UG modeling mainly includes the following steps: 1. Draw a sketch through sketching, and build the model through characteristic operations such as stretching and turning. 2. Direct modeling refers to the direct establishment of models, such as cuboids, cylinders, etc., by using entity feature operations. 3. Free-form modeling. In the modeling module, curves are directly used to generate curved surfaces and solid modeling. 4. There are also models established by importing external sketches or solid drawings. Modeling is to build a model, an abstraction of things in order to understand them, and an unambiguous written description of things. The process of building a system model is also called modeling. Any process that uses models to describe the causality or interrelation of systems belongs to modeling. Because of the different relationships described, there are various means and methods to realize this process. Through the analysis of the movement law of the system itself, the model can be built according to the mechanism of things; It can also be modeled by processing the experimental or statistical data of the system and according to the existing knowledge and experience about the system. After modeling, the teacher can rotate and scale the model for students to learn in class. In this way, students' imagination ability of three-dimensional space can be gradually improved, and students can really understand and master this knowledge. Cylindrical orthogonal as the Figure 1. Cylindrical deflection as the Figure 2. Special intersection lines as Figure 3. Cylindrical diagonal as the Figure 4.
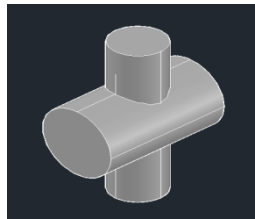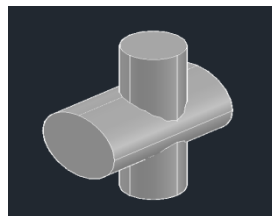

Figure 1: Cylindrical orthogonality

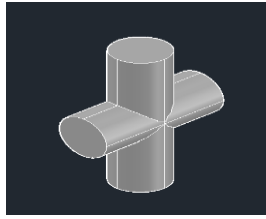Figure 2: Cylindrical deflection
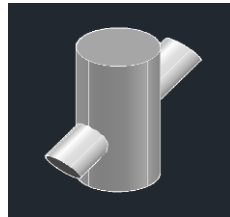
Figure 3: Special intersecting line

Figure 4: Oblique intersection of cylinders

4. Conclusions

In 2022, the state attached great importance to the application of solid 3D modeling in geographic mapping and cultural heritage protection. Facing this practical technology, we innovatively simplified it and applied it to teaching, especially in engineering disciplines. I think it will bring benefits to both students' learning and teachers' teaching. As a student, I know that it is not easy to study engineering, and I also understand the difficulties of teachers when they face the confusion of students. I think that the application of solid 3D modeling in teaching will be a beautiful landscape in the grand plan of education.

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