Exploring the Teaching Mode of "Mechanical Design" Based on 3D Printing

Jie Liu, Yufan Hou, Lingfeng Xiao, Shiyu He, Jiaqi Li
Guangzhou Huali Science and Technology Vocational College, Guangzhou 511325, China.

Abstract: The emergence of modern new technology, 3D printing technology, has attracted the attention of various sectors of society and gradually has a widespread impact on the education industry. In the current teaching of "mechanical design", on the basis of understanding 3D printing technology, university teachers urgently need to think about how to reasonably introduce this technology to innovate the teaching mode of "mechanical design". In this regard, this article analyzes the current situation of the "Mechanical Design" major through the initial introduction of 3D printing, elaborates on the advantages of applying 3D printing technology in the "Mechanical Design" teaching mode, and puts forward application suggestions. It is hoped that this can promote the exploration of the educational philosophy of 3D printing in the "Mechanical Design" teaching mode.

Keywords: 3D Printing; Mechanical Design; Teaching Model

1.Introduction

In the current teaching mode of "mechanical design", when teachers explain complex principles and diverse shapes of component structures to students, simply combining oral explanations with floor plans cannot visually present and help students understand, which is very detrimental to the promotion of "mechanical design" teaching and the cultivation of talents in the mechanical industry. In response to this practical teaching problem, university teachers are exploring the rational application of 3D printing technology in the "mechanical design" teaching mode, which is not only convenient for teachers' classroom teaching, but also beneficial for students to master the basic theory and innovative operational ability of "mechanical design".

2.Introduction and development overview of 3D printing technology

3D printing technology is a three-dimensional printing technology that uses digital technology to realize rapid prototyping. His design process involves first using modeling software on a computer to establish a three-dimensional model, then dividing the model into layer by layer cross-sectional areas. Materials such as powder or liquid are loaded into the printer, and controlled by the computer to read the cross-sectional information and print it layer by layer, thus forming a three-dimensional physical object by stacking and bonding. At present, desktop level 3D printers are the most common in the application education industry. The production of such desktop level printers requires low accuracy, convenient operation, and easy maintenance, so many manufacturers produce them, and the price is not very high. The materials used for 3D printing are mostly PLA and ABS new materials used in universities, priced at tens of yuan per kilogram, which is fully within the acceptable range of daily teaching in schools. Overall, considering only the prices of 3D printing equipment and consumables, it is feasible for universities specializing in "mechanical design" to introduce 3D printing technology, which is also in line with the current situation of modern education progress.

3.Analysis of the current situation of the teaching mode of "mechanical design"

“Mechanical Design” i s a professional course in design principles with diversity, designability, complexity, and practicality. It involves multiple types of knowledge points and is difficult to learn. It requires students to have a high professional foundation in drawing, computational logic, spatial imagination thinking, and hands-on practical skills. With the rapid development of industrial

technology in China, the types and internal structures of mechanical products are becoming increasingly complex, posing more practical challenges for teachers to teach this professional course.

In the current teaching mode of "mechanical design", most teachers use traditional teaching methods. When teaching abstract theories and operating principles, most of the teaching aids used are static flat images to assist teaching, which requires students to have high three-dimensional imagination ability to understand the course content. However, for most students, it is difficult to fully grasp and understand the teaching content. Teachers mainly focus on explaining theoretical knowledge and neglect the development of practical teaching. Professional theory and skill operation teaching are not truly integrated and isolated from each other, making it difficult for students to feel dull in their learning due to the single teaching form.

4.The application advantages of 3D printing in "mechanical design" teaching

4.1 Convenient classroom teaching for teachers

Creating a learning atmosphere for 3D printing technology will make students more proactive in their learning, greatly improving classroom teaching efficiency and making it more convenient for teachers to teach in the classroom. At present, using 3D printing technology, teachers can print teaching models, guide students in the classroom to analyze the structure and characteristics of the model, and clearly understand the structure and functional information of the model graphics, so as to make it easier for students to understand the mechanical principles of the model. The use of 3D printing technology in the teaching of "mechanical design" allows teachers to involve students in the design of models. This not only stimulates students' interest in learning, but also improves teaching effectiveness, in order to achieve mutual learning between teaching and learning, change the passive situation of paper-based discussions in the past, and make students more willing to learn.

4.2 Increasing students' interest in learning

For the first time in contact with the complex and abstract subject of "mechanical design", students will learn a lot about the structure of parts from books, but they have not seen the actual object with their own eyes. It is not easy to imagine it alone, and they cannot fully grasp the various shapes of machinery and analyze the internal structure of products. How to solve the problem of presenting physical teaching aids for mechanical parts is a key aspect of "mechanical design", and the practical value of 3D printing technology as a new technology industry precisely has the function of solving this problem. Naturally, under the continuous development requirements of new modern education, it has become the best choice to improve the teaching quality of "mechanical design". The application of 3D printing technology in the teaching of "mechanical design" in universities not only helps to broaden students' spatial imagination, but also provides opportunities for students to hands-on operate and turn inspiration into reality, in order to gain a sense of achievement brought by the comprehensive application of theory and practice in teaching, increase students' interest in learning "mechanical design", and contribute to the development of the entire "mechanical design" system teaching.

5.Suggestions for the application of 3D printing in the teaching of "mechanical design"

5.1 Teacher's production of 3D classroom teaching aids

The use of physical teaching aids in teaching should be the main teaching mode of "mechanical design", but under the traditional teaching process and considering teaching funds, the current provision of physical teaching aids in teaching is very weak. So in exploring the introduction of 3D printing technology in teaching, teachers can take the lead in using 3D printing technology to print and produce as many mechanical and component models as possible, so that the originally empty concept explanations in the classroom can be turned into intuitive practical teaching aids, thereby improving the quality of teaching. In the process of using teaching mode in the production of physical teaching aids models, teachers can also fully leverage the application advantages of 3D printing technology, find some students to participate in the design and production process of physical teaching aids models, give students more opportunities to be exposed to 3D printing technology, and achieve the cultivation and improvement of students' imagination

5.2 3D printing runs through the mechanical principles classroom

Mastering the knowledge of mechanical principles is highly practical, but according to the feedback from students on the effectiveness of teaching, students' mastery and understanding of mechanical principles are not ideal, indicating that students have difficulty accepting knowledge in learning mechanical principles. The current teaching mode of "mechanical design" still needs improvement. Integrating 3D printing technology into mechanical principles lectures will help change teaching modes, stimulate students' interest in learning mechanical principles, and motivate them to participate in classroom learning so as to apply what they have learned, and improve teaching effectiveness.

5.3 Students' mastery of 3D modeling skills

In the traditional teaching of mechanical design drawing, there are generally several parts, including the foundation of drawing, the application of projection theory, surveying and mapping sketches, and the teaching of component assembly drawings. The main teaching goal is for students to master the ability to make and read drawings while being clear about the various standards of mechanical technology drawing stipulated by the state. The current teaching drawing standard combines theory with computer drawing operations, and the main auxiliary drawing method used is AutoCAD's flat drawing software. In the reform of the teaching mode of "mechanical design", the introduction of 3D printing technology is also a reform of the technical foundation. It is necessary for students to shift from mastering standard plane drawing AutoCAD to learning 3D modeling software SoliWorks, and it is also a cultivation of students' mechanical professional ability and the ability to develop new technologies in enterprises. The SoliWorks modeling is included in the teaching of "mechanical design", so that students can master the 3D modeling ability through learning, draw the 3D model of the corresponding product on the computer, save the document format as STL file, input the 3D printer, and print the mechanical model directly and quickly, in order to increase the interest of students in active learning mechanical design for 3D modeling and drawing.

6. Conclusion

In summary, in the teaching of "mechanical design", a distinctive teaching mode is formed by applying 3D printing technology to solve the problem of physical teaching aids in "mechanical teaching", which improves the quality of professional teaching. At the same time, combining 3D printing technology with comprehensive teaching of mechanical principles, flat drawing teaching is transformed into 3D modeling teaching, which provide students with more flexible learning methods, and promote students' independent innovation and practice. Faced with the challenge of changing this teaching mode, it is necessary for teachers to have more professional teaching knowledge and actively explore and improve teaching methods. But this is also an opportunity, a development direction for universities to cultivate high-end skilled talents.

References

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