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Application and Effect of Realia and Virtual Simulation in Molds of Plastics Processing Course

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Abstract

The molds of plastics processing course and its curriculum design is the core course for students majoring in polymer material and engineering. This course covers a wide range, and the mold structure, technological process and technological parameters are complicated, which makes it difficult for students to understand. This project aims to cultivate students' perceptual understanding and improve the quality of teaching by means of realia, virtual simulation and reformed experimental teaching. In the whole course teaching, including classroom theory teaching and practice teaching, through the mold realia, plastic products, multimedia animation and virtual simulation experiment, to deepen students' basic understanding of the mold. Students' perceptual knowledge of the course rises to a rational understanding, which is finally applied in course design, graduation design practice and even employment practice. At the same time, teachers can constantly improve their teaching skills and research skills in the whole research project. In general, the teaching method has played a positive role in the teaching quality and discipline construction of this specialty, and has obviously promoted the teaching level of professional teachers.

Keywords

Realia; Virtual simulation; Molds of plastics processing; Teaching reform.

1. Introduction

Materials need to be shaped to become a variety of products with use value, and more than 95% of plastic products are formed by mold. Mold is an important process of industrial production equipment, the use of mold production parts with high production efficiency, good quality, energy saving and raw materials, low cost and a series of advantages. Mold forming is a variety of molding process has the most potential development direction, playing an increasingly important role in the development of national economy and society. According to statistics, China's mold industry currently has more than 6 million employees, but only 600,000 engineers have mold design ability. In addition, according to the labor department survey, the current enterprise demand for mold talent is huge. In Beijing, Guangdong, Zhejiang, mold designers, mold developers, mold maintainer have become one of the most in needed people. In view of the current situation in China, the mold industry needs long-term experience. General mold designers need to learn 2 to 3 years, while an excellent designer who can design molds independently needs at least 10 years of working experience. Because the initial learning is very boring, many beginners often give up halfway. Therefore, according to the demand of the society for talents, we must work out a scientific and modern talent training plan that combines the curriculum structure, theory and practice.

Polymer material and engineering major set up the course of molds of plastics processing and the corresponding course design. This course is an important part of the series of post-processing courses, which mainly trains students' understanding of injection mold, extrusion

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mold and compression mold of polymer plastic, and their ability to transform the knowledge into practical design drawings [1]. Through the study of this course, students can expand employment and improve the employment rate of students. However, in-depth investigation revealed that only less than 20% of students can fully learned the technology of molds of plastics processing. In the course design, few students show the high quality which they should have. Therefore, in the course of teaching, more efficient to the actual production of teaching methods and teaching tools are needed [2-4]. We should strengthen practical teaching, pay attention to the training of practical ability and innovation ability.

2. Methods

The Traditional education has certain limitations: the learning process of students like memory process. Students lack of awareness of innovation ability, and many students can not well adapt to the needs of social development after going out of school. For the molds of plastics processing course, the course involves complex assembly drawings and moving and setting coordination. Traditional education such as books and PPT has high requirements for logical thinking and imagination, which makes it difficult for students to fully interpret and understand. In addition, this course involves a wide range of knowledge, including professional knowledge of mechanical drawing, polymer materials, plastic and rubber forming process, etc. Furthermore, students do not understand the importance of this course and no interest in the course. Moreover, the traditional education has low student participation and no interaction between teachers and students. Teachers cannot grasp students' understanding of knowledge in time, resulting in the disconnection between theoretical teaching and practical teaching. Therefore, according to the above key issues, we plan to strengthen students' understanding of mold through practical visits, and cultivate students' interest in forming molds. In the classroom teaching, the realia and virtual simulation are used to deepen the students' basic understanding of mold. Through the guidance of teachers, students are required to actively use their hands and brains in practice teaching, so that they can understand the mold structure, processing requirements, assembly requirements and so on, and improve the quality of teaching. Specific measures are as follows.

First, add on-site observation before the course to deepen students' understanding of the mold industry. Arrange students to visit the engineering laboratory center before the formal course. Explain the structure and specific work of the equipment and mechanism related to the mold. Students are also required to take notes and summarize the visit report. Second, explain the typical mold structure by using physical realia. In the key and difficult content, we explain the mold structure and complex action through the realia model, and give students the opportunity to disassemble typical injection plastic mold. Then compare the textbook to find out the structural components and the composition of each movement. On this basis, we will focus on targeted explanation to ensure that students systematically master this part of the knowledge. Third, use virtual simulation technology to explain complex movement and plastic parts forming process. Through multimedia and virtual simulation technology to demonstrate injection, extrusion molding, demoulding mechanism, lateral parting and core-pulling, and let students design the mold molding process. Students receive information from the visual, compared with more attractive to students. Receiving information visually is more attractive to students than word exposition. Fourth, through the practice process, strengthen students' understanding of plastic parts technology and molding process. Introduce experimental steps in the course to closely link book knowledge with actual production in the specific molding of plastic parts. Specific experiments can deepen students' memory and understanding of the knowledge, so as to help students understand the knowledge, stimulate students' thirst for

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knowledge and curiosity, and achieve the goal of cultivating students' creative consciousness and independent inquiry ability. The specific implementation is shown in Figure 1.

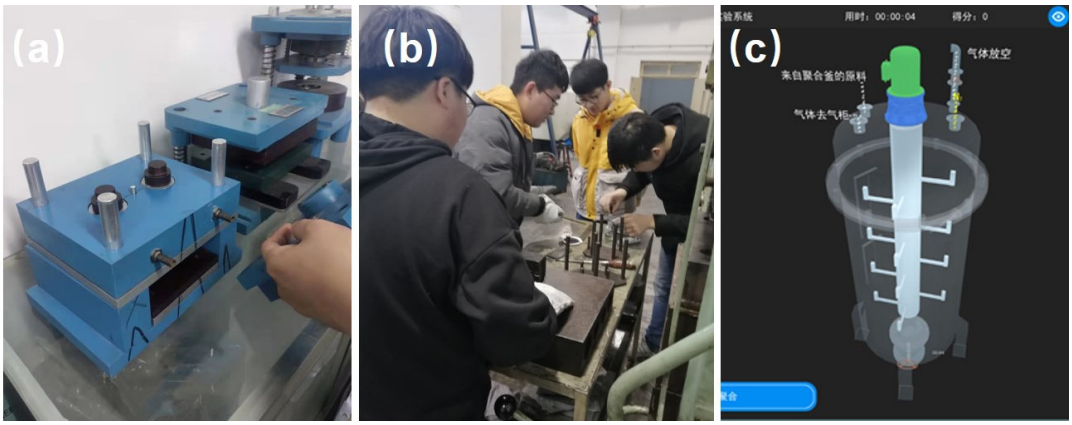

Figure 1. (a) photos of mold realia, (b) practical teaching and (c) virtual simulation system

3. Results and Discussion

After nearly two years of research, we found that this curriculum system can reduce students' dependence on abstract thinking. We have concluded a set of teaching methods suitable for students in independent colleges of molds of plastics processing, which can effectively improve students' understanding of mold knowledge, speed up the transformation from exam-oriented education to quality-oriented education, and solve the contradiction between enterprise demand and teaching effect.

3.1. Construction of Curriculum System

A set of molds of plastics processing curriculum system with good teaching effect has been established. In classroom teaching, teachers are required to be able to explain theoretical knowledge smoothly, and at the same time, teachers must have the ability to train students to explore. In addition, by answering students' specific questions, teachers can smoothly supplement students with relevant knowledge such as new research results and new development direction of this major. Discussion class and experiment class are adopted to deepen their knowledge and understanding, and further learn classroom knowledge through practical operation and observation, so as to cultivate students' practical ability. Moreover, in practical teaching such as curriculum design and graduation design, students are encouraged to choose topics freely and conduct independent research according to the curriculum content. Students are full of enthusiasm and innovation in the reference materials preparation and essay writing, which enables students to have in-depth experience and harvest in the theoretical and practical learning of professional courses.

3.2. Improvement of Teaching Effect

We have summarized students' scores of plastic molding courses and course design in the two semesters of 19-20 and 20-21, as shown in Table 1. We can find that after the teaching reform, students' performance has improved significantly. There are a total of 72 students in 19-20 semester, most of students get 70-79 score, indicating that students have a certain basic understanding of the course. But there are few students with high scores, indicating that they do not master the difficult points well. After the teaching reform, there were 59 students in the 20-21 semester, about 6.78% of students scored more than 90 marks, 40.68% scored more than 80 marks. The average score was 79.3 and the highest score was 94. It can be seen that not only

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the average score of students has been improved, but also the number of students with high scores has increased, and the teaching effect has been significantly improved.

Table 1. Summary of plastic molding course scores in 19-20 and 20-21 semesters

semester	90-100	80-89	70-79	60-69	0-59
19-20	0%	29.58%	53.52%	7.04%	9.86%
20-21	6.78%	40.68%	40.68%	10.17%	1.69%

3.3. Improvement of Software and Hardware Conditions

Plastic mould and application exhibition room have been basically completed. The center can simultaneously provide six sets of plastic typical mold models. In addition, the experimental center also includes the injection machine required for production and several sets of production molds equipped with it. Multimedia and virtual simulation experiment website has been basically completed. The gradual completion of software and hardware conditions, such as mold practice center and simulation experiment website, undoubtedly provides sufficient impetus for the improvement of teachers' teaching level and students' professional learning effect.

4. Conclusion

This project introduces realia and virtual simulation technology to help students to understand the key points and difficulties in classroom teaching. This method can effectively transfer knowledge, deepen students' understanding of complex structure and dynamic and fixed coordination, as well as effectively improve the quality of teaching. This reform of the curriculum can effectively reduce the difficulty of learning, deepen the understanding of professional knowledge and improve students' professional knowledge level. It provides a new improvement measure for similar courses which requiring a lot of abstract thinking.

Acknowledgments

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