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The Exploration of Instruction Reform in Engineering Drawing Course Based on The Cultivation of Engineering Expression Ability

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Abstract: Many universities are actively exploring new ideas and methods for the instruction reform of engineering drawing courses to improve the quality of talent cultivation and meet the demand for practical and applied talent cultivation in the context of the new economy. Considering the actual situation of our school, taking the engineering education certification as an opportunity and the OBE teaching philosophy as the purpose, this article explores a new instruction reform model for engineering drawing courses based on the cultivation of engineering expression ability. This will provides a reference for improving the teaching quality of engineering drawing courses.

Keywords: Engineering expression ability; Engineering drawing; Education reform

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Introduction

As is well known, teaching content and knowledge points of engineering drawing courses are complex and numerous. At the same time, there is also a significant reduction in class hours from 96 to 48. These difficulties have brought great challenges to the teaching of drawing. Therefore, Considering the actual situation of our school, taking the certification of engineering education as an opportunity and taking the overall and systematic aspects as the starting point, we adopted a teaching mode reform based on the cultivation of engineering expression ability.

1. Overall Plan

The instruction reform of engineering drawing course in our school is based on the cultivation of engineering expression ability is carried out from two aspects: creating a configured modular engineering drawing course system and reforming instructional design with the goal of improving curriculum efficiency.

1.1 Creating a modular and configurable engineering drawing curriculum system

Taking engineering education certification as an opportunity and industry requirements as the goal, a universal basic module, a professional drawing module, and an extension module have been constructed. Following “the principle is the necessity and sufficiency", each major selects teaching projects under each module as needed, improving the scientific arrangement of teaching content.

1.2 Instructional design reform with the goal of improving curriculum efficiency

The reform of instructional design with the goal of improving course efficiency involves developing a case library with professional background, integrating online and offline teaching, and unifying theoretical and practical teaching, in order to improve students' engineering views, enhance the knowledge capacity of classroom teaching, and achieve subject integration with subsequent professional courses.

2. Concrete Implementation

2.1 Create a modular and configurable engineering drawing course system to make the teaching content more scientific

We constructed a modular engineering drawing course system based on the OBE teaching conception, and ultimately decomposed the course into three modules, namely the general basic module, professional drawing module, and extension module . The general basic module is a compulsory module for various majors, focusing on cultivating students' basic drawing skills. The professional drawing module is selected according to the demands of each kind of major, with a focus on cultivating students' specialized skills to fulfill the needs of their respective positions. The extension module refers to allow students to go outside of the classroom and participate in engineering training, aiming to strengthen their drawing skills and integrate the multiple disciplines.

Module 1--General basic module: This module breaks the traditional content of drawing courses. Starting from reality, it selects and synthesizes general basic knowledge according to the principle of "the most necessary, basic, and central", highlighting the instrumental role of the course. When teaching, the key content should be "precise and deep", and the general content should be "coarse but broad".

Module 2--Professional drawing module: Each major has different professional characteristics, so this course has established several learning projects corresponding to the actual professional requirements. During teaching, students from different majors choose different projects to deepen their learning, strengthen specialized knowledge and skills to achieve zero distance integration with the actual needs of enterprises. For example, adding pharmaceutical equipment diagrams, process piping, and instrument flow diagrams to the pharmaceutical engineering module. Industrial design professional module has added axonometric and unfolded drawings. For the students with food science major, relative professional food machinery drawing will be selected.

Module 3--Extension module: In the traditional teaching philosophy, homework is the main focus of extracurricular learning. But in this course construction, we will further extend extracurricular learning by encouraging students to participate in subject competitions and scientific research projects, such as engineering design expression competitions and "Qimingxing" college student technology innovation and entrepreneurship projects. In addition, we plan to establish profound cooperative relationships with enterprises, design institutes, and other institutions, allowing students to directly participate in real engineering projects in the enterprise. For example, students can use their professional knowledge in engineering drawing, AutoCAD, Solidworks, Revit, and other fields to collaborate with the enterprise in drawing, design, and other collaborative projects, enabling them to grow in practice and apply what they have learned. In addition, in practical applications, students are able to continuously comprehend their drawing skills and achieve integration with other relevant course knowledge systems, thereby positively promoting the improvement of students' drawing ability, laying a solid foundation for entering their work position in the future.

2.2 Implementing instructional design with the goal of improving curriculum efficiency

2.2.1 The case library with professional background

Based on the teaching content, a case library with professional background has been developed to strengthen the connection between the foundation and the profession. For example, the Case method of pharmaceutical equipment drawings has been added to the pharmaceutical specialty, such as drawing of storage tank, a commonly used equipment in pharmaceutical production. And the engineering specialty can be combined with the subsequent course of Product Organization Design to add case method of drawings of common mechanical products in life, such as the drawing of common parts of bicycles. The Case method of food machinery and equipment drawings can be added to the major of food science, such as the reading of reducer drawings.

2.2.2 Online and offline integrated teaching

Online and offline integrated teaching can make up for the shortcomings of reduced class hours and improve students' autonomous learning ability. With the help of platforms such as Rain Class, Cloud Class, Enterprise WeChat Group, China University MOOC, and the network resources of high-quality shared courses, a new integrated teaching platform for online and offline integration is constructed to provide students with diverse learning resources. This will solve the problem of compressed class hours and enhances students' interest in learning.

Taking the teaching of AutoCAD computer graphics as an example, it is recommended that students learn the AutoCAD course of a famous university in MOOC. Teachers can assign a preview assignment before class, asking students to learn videos in the self-study course online. In the offline class, teachers can summarize key points, provide Q&A guidance, and practice more with the saved time. After class, students will watch the video again to check for deficiencies and fill in gaps in knowledge points, and preview the next teaching video. This mixed online and offline teaching has significantly increased the capacity of classroom knowledge and cultivated

students' ability for sustainable development.

For example, using enterprise WeChat groups and Rain Class to flip online and offline in the classroom, igniting students' learning motivation and improving teaching quality. When discussing what engineering drawings are in class, traditional teaching involves using PPT to explain the definition of engineering drawings. However, students are passive learners. After the educational reform, students can first search for engineering drawings on the internet using their mobile phones and send them to the enterprise's WeChat account. Then, based on the drawings searched by students, they can explain what engineering drawings are. Finally, they can tell students that this is the ultimate learning task of this course. By analogy, the total number of speeches made by students in the enterprise WeChat group is calculated at the end of the term, and the corresponding score is included in the overall evaluation score. Students' curiosity and competitiveness are fully released, and the improvement of learning initiative is significant.

2.2.3 Integrated teaching of theory and practice

The integrated teaching of theory and practice focuses on cultivating practical skills and improving students' learning outcomes. For example, increasing surveying and mapping class hours, reducing theoretical teaching, and allowing students to learn while doing works. Here is a actual case: Surveying and mapping the straw in our school's restaurant. A seemingly simple straw contains multiple knowledge points, such as the drawing method of the rotational parts, the intersection line, and dimensions. During teaching, the teacher first assigns the learning task of drawing the straw, then provides an overview and explains the location of the knowledge points in the book. Then, when the students learn and practicing drawing, the teacher will tour the classroom and give out advice to the drawing methods of each student. In the end of the class, the teacher summarizes the common mistakes of students and the knowledge they had learn. In traditional teaching, the first step is to explain the knowledge points through PPT, followed by doing exercises, which cost more time and can’t attract student’s attention. By comparison, it can be seen that learning from physical objects around us, learning by doing, and learning by doing, this heuristic teaching method has more advantages.

3. Conclusion

Through the preliminary exploration of the instruction reform of engineering drawing courses based on the cultivation of engineering expression ability, teachers and students have generally reported that the reform has achieved certain results, mainly manifested in multiple aspects. first, by creating a modular and configured engineering drawing course system, the teaching content is more scientific, students' basic drawing skills are more solid, and the drawing course is organically connected with subsequent professional courses. Preliminary integration between professional basic courses and professional courses has been achieved. Second, through the implementation of teaching design reforms aimed at improving curriculum efficiency, students' professional interests are significantly strengthened. Third, students' knowledge transfer and self-directed inquiry learning abilities have been improved by participating in real project training, and a global and engineering oriented professional pattern has quietly been embedded in students' engineering thinking.

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