Problems in the Teaching of "Engineering Drawing" and Measures to Improve the Teaching Effect

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Abstract: "Engineering Drawing" is a technical basic course with strong theory and practice required for mechanical engineering and related majors. The purpose of "Engineering Drawing" course is to learn the theory and method of reading and drawing engineering drawings, train students' ability of space thinking, and make students master the technology of reading and drawing engineering drawings. First, the characteristics of "Engineering Drawing" are analyzed, such as the combination of theory and practice, the requirement for students to have a good spatial imagination, more contents and less hours, etc. Secondly, the problems existing in the course teaching of "Engineering Drawing" are summarized, such as: the students feel that the course is difficult to study because of their little engineering experience, and the teaching method is too single, which leads to bad teaching effect, the course contents are many but the course hours are few, the teaching effect is difficult to guarantee and so on. Finally, some measures are put forward to improve the teaching effect of "Engineering Drawing" from the aspects of optimizing teaching contents, reforming teaching methods, using multimedia and other intuitive teaching methods, refining teaching contents according to the specialty, and adopting new comprehensive assessment system.

1. Introduction

"Engineering Drawing" is a technical basic course with strong theory and practice required for mechanical engineering and related majors. The purpose of the course is to learn the theory and method of reading and drawing mechanical drawings, exercise students' ability of space imagination, thinking, and enable students to master the technology of reading and drawing mechanical drawings. Engineering drawing is a technical "language" in the field of mechanical engineering, an important technical data for designing, manufacturing and using products, and a tool for technical exchange among technicians. Drawing and reading engineering drawings correctly is the premise and basic guarantee for normal technical exchange and research. Therefore, in the teaching process of "Engineering Drawing", teachers should also pay attention to the cultivation of students' serious and rigorous learning and working attitude. The teaching effect of "Engineering Drawing" not only plays an important role in the follow-up study of relevant professional courses and the effective development of practice practice links, but also has a direct and indirect impact on students' employment, work, scientific and technological learning and research. It is very important for students majoring in mechanical engineering and related majors to learn "Engineering Drawing" well. Based on the analysis of the main content and characteristics of the course of "Engineering Drawing", the problems existing in the teaching of "Engineering Drawing" are analyzed, and some measures to improve the teaching effect of "Engineering Drawing" are put forward [1-3].

2. Main Contents and Characteristics of "Engineering Drawing"

The course of "Engineering Drawing" mainly includes three parts: Descriptive Geometry,

Drawing Foundation and Mechanical Drawing. Descriptive Geometry requires students to master the basic principles and methods of orthographic projection, graphic spatial geometry, and graphic simple spatial geometry problems, which requires students to have a strong concept of space. Using multimedia courseware and intuitive model and other auxiliary teaching methods, guide students to combine observation, spatial analysis and imagination, study the relationship between objects and projections, and gradually cultivate students' ability of spatial imagination, thinking and analysis. In Drawing Foundation, students are required to understand the basic provisions of national standards such as engineering drawing and technical drawing, learn the basic methods of dimension, and use tools and instruments to draw; the basic theory, basic knowledge and basic skills in Drawing Foundation are the criteria and basis for learning to draw and read mechanical drawings, which must be learned well. However, the content of this part is many and complex, and students need to be familiar with and master this content in the process of reading and drawing engineering drawings. Mechanical Drawing is a teaching content that is closely related to theory and practice. It is the practice and application of Drawing Geometry and Drawing Foundation. It requires students to master the basic ability of drawing and reading the part drawing and assembly drawing of common components. In teaching, multimedia assisted teaching means should be used, prepare sufficient teaching objects, conduct a lot of drawing exercises. Through the training, students are required to master the projection principle, projection law and drawing method, the basic theory and basic skills of Drawing Foundation. When conditions permit, students can be taken to the production line to participate in drawing and reading mechanical drawing practice, and train students to master the skill of drawing and reading mechanical drawings [1, 3].

In short, the course of "Engineering Drawing" has a lot of contents, and less hours are arranged; students are slow to learn and difficult to learn at an early stage; in teaching, students are needed to mobilize their interest in learning and stimulate their initiative in learning; the combination of theory and practice of the course is strong, and a large number of homework exercises are required in and out of class. Therefore, according to the characteristics of "Engineering Drawing" course, teachers need to focus on arousing students' interest in learning, with the aid of intuitive teaching tools such as multimedia and physical models, adopt appropriate teaching methods, continuously improve teaching methods and measures, improve teaching quality and ensure teaching results[4].

3. The Problems in the Teaching of "Engineering Drawing"

Based on the summary of teaching process and teaching effect, the problems in the teaching of "Engineering Drawing" are summarized as shown in Table 1 [2-5].

Table 1. The problems in the teaching of "Engineering Drawing".

Problems	Specific description
The engineering practice experience of students is few, and it is difficult to learn the course.	For freshmen who are new to the university, they have little contact with the society, little experience of factory practice, unclear concept of mechanical parts and mechanical drawings, and weak foundation of spatial imagination. Therefore, most of the students will find it difficult to understand, imagine and express the three-dimensional internal structure when they study the "Engineering Drawing" course. At the same time, due to less class hours, the time for students to think and practice is correspondingly reduced, which makes them feel difficult to learn.
The teaching method is too single and the teaching effect is not very good.	The classroom teaching of "Engineering Drawing" has been adjusted from the single blackboard writing mode to PPT + Blackboard writing mode, which partially alleviates the contradiction between more teaching contents and less class hours. However, the excessive teaching contents and accelerated teaching progress have reduced the time for students to think, practice and correct errors in the classroom. This leads to an increase in the time for students to review and understand after class, thereby increasing the burden and pressure on students, making it difficult for students to fully understand and master the knowledge

	taught in the classroom, which reduces the effectiveness of classroom teaching.
Problems	Specific description
It is difficult to guarantee the teaching effect due to less class hours and more contents.	At present, some colleges and universities have reduced the class hours of "Engineering Drawing" to about 50 class hours. The 50 class hours include both theoretical class hours and related practical class hours. Completing more teaching contents in a limited number of hours makes the teaching effect greatly reduced. Due to the limited class hours, there is almost no interaction between teachers and students in the classroom, and little time for classroom practice is arranged, which greatly affects the effect of teaching.
Disconnection between knowledge learned and engineering practice.	The knowledge learned in the course of "Engineering Drawing" is out of touch with the engineering practice, part of which is due to the fact that the practical engineering practice experience of the students is few; in addition, the teachers do not combine the engineering practice in the teaching process, resulting in the students not clear about the knowledge and skills often used in the engineering practice.
Students' poor spatial imagination.	The "Engineering Drawing" course has higher requirements for students' ability of spatial imagination. Students are required to be able to imagine a plan according to the physical model and a physical model from the plan. In the real teaching, due to the unsuitable teaching methods and teaching methods, coupled with the fact that students have less contact with the real objects and models, and lack of engineering practice experience, students' understanding of graphics is restricted, resulting in poor image thinking and spatial imagination ability of students.
Multimedia teaching mode leads to low participation of students.	In multimedia teaching, teachers are too busy operating equipment and demonstrating courseware, failing to be able to observe the response of students in a timely manner, and failing to understand students' mastery of classroom knowledge, which affects the teaching effect. In addition, due to the excessive pursuit of the amount of information in classroom teaching by some teachers, the content of the curriculum has become more complicated, and the contradiction between the contents of the curriculum and the compression of class hours has become more acute.
The teaching mode is relatively old and the teaching method is relatively simple.	At present, in the teaching of "Engineering Drawing" course, there is a phenomenon of teacher-oriented explanations, and the classroom teaching method is singular. Teachers output knowledge in one direction and students receive passively. This singular teaching method makes the course teaching boring, which is not conducive to students' mastery of course knowledge and skills.
Pay more attention to teaching process than teaching quality.	In the teaching process of "Engineering Drawing", some teachers rely too much on multimedia means to show the contents of course by making some exquisite PPT courseware. Through the multimedia courseware teaching, there is a common situation that students can understand in class and can't leave class. Paying attention to the teaching process and neglecting the students' classroom feedback are not conducive to the cultivation of students' spatial imagination ability and affect the teaching quality.
The professional aim of the course teaching is not strong.	For different majors, the key learning contents of "Engineering Drawing" are not the same. Some colleges and universities use the same teaching materials for all engineering students, and similar parts are also used for typical examples learned in teaching. This will weaken the characteristics of different professional cartography, not closely connected with the follow-up professional knowledge learning, and to some extent, weaken the realization of curriculum teaching objectives.
Problems	Specific description

Unscientific assessment method.	In the assessment of "Engineering Drawing" course, some teachers take a test paper for assessment. This old, singular assessment method lacks scientificity, neglecting the investigation of students' practical skills, and lacking the comprehensive evaluation of students' learning attitude and learning quality in the learning process. This kind of assessment method can not fully reflect the learning results of students' courses, which is not conducive to the cultivation and improvement of students' learning ability, problem-solving ability, innovation ability and engineering awareness.
Few practical links.	At present, most colleges and universities pay more attention to theoretical knowledge in the teaching of "Engineering Drawing", and there are few practical teaching links; there are few design competition activities related to the curriculum. In addition, due to the limited class hours, it is often impossible to ensure that students get sufficient learning and practice. The lack of practical teaching, not only makes students lose interest in theoretical classroom teaching, but also may make students' theoretical knowledge and practical content out of line, unable to achieve good application results.

4. Measures to Improve the Teaching Effect of "Engineering Drawing"

4.1 Optimizing Teaching Contents and Arranging Course Hours

Under the circumstance that the "Engineering Drawing" course class hours are compressed, the teaching contents need to be optimized, streamlined, and the key points should be highlighted. For example: the theory of orthographic projection method should be the focus of teaching, especially "long alignment, high level, equal width" should be implemented in each chapter of the course; the projection analysis and expression of plane stereo and rotary stereo, and the views, sectional views and sectional views of the expression method of machine parts should be the focus of teaching; basic knowledge of drawing, projection basis of points, lines and planes, part drawing and assembly drawing and so on, should be the secondary key contents; for some details of the national standard regulations, as well as some other knowledge, students can be appropriately arranged for self-study and practice [6-7].

4.2 According to the Contents and Characteristics of the Course, Arouse Students' Interest and Enthusiasm for Learning

Through the interpretation of the introduction chapter of the course, the combination of lectures and exercises in the classroom and other effective measures to stimulate students' interest and mobilize students' enthusiasm for learning, the specific measures are shown in Table 2 [7-8].

Table 2. The measures to stimulate students' interest and enthusiasm for learning.

Measures	Specific description
Pay attention to the psychological needs of students and give a good introduction.	In the introduction teaching, teachers should explain the characteristics, tasks, contents and learning methods of the course, and combine with engineering examples to explain to students that the knowledge comes from production practice and serves production practice. To make students clear that drawings are the language of the engineering community, students learn to master the knowledge contents of the course, which not only has an important impact on the follow-up course learning, but also has a close relationship with recruitment, employment and other aspects related to students' vital interests, so as to guide students to generate the internal driving force for course learning and cultivate the interest in course learning.
Measures	Specific description

Combine teaching with practice, enliven classroom atmosphere and arouse students' enthusiasm.	In the classroom teaching, a certain amount of time is reserved for the practice of drawing assignments in the classroom and after class, so that students can master the knowledge and at the same time exercise the students' ability to apply knowledge. Through classroom questioning, student demonstration drawing, discussion, mutual inspection and other forms, give full play to student autonomy and create a democratic and harmonious teaching atmosphere. Teachers should be the guides and motivators of student learning, and stimulate students' interest in learning.

4.3 According to Different Teaching Contents, Take Corresponding Practical Measures to Help Students Build Confidence in Learning

According to the key and difficult contents in the textbook, teach students according to their aptitude, and put forward different requirements for practical exercises to help students build confidence in learning. Specific implementation measures are shown in Table 3 [7-8].

Table 3. Taking corresponding practical measures to improve students' self-confidence according to different teaching contents.

Measures	Specific description
First understand in the classroom, master through the homework exercises.	It is related to the ability to read and draw mechanical drawings, but it is not direct and compact. The key and difficult contents that students can easily grasp through self-study, such as the drawing of isometric side drawings, the surface connection between geometric bodies, the drawing method of thread and threaded fasteners, the drawing method of gear and circular column gear, etc. In the classroom teaching and explanation, teachers pay attention to these points, so that students can understand the principles of these knowledge contents, and digest and absorb these contents through the after-school practice.
First class understanding, then test and master through classwork exercises.	It is related to the ability to read and draw mechanical drawings, but it is not direct and compact. Some key and difficult contents that are not easy for students to master through self-study, such as: projection of a straight line at a special position, projection of a plane at a special position, projection of point and line on a plane at a special position, etc. In the classroom teaching explanation, teachers pay attention to explaining the main points of these contents, so that students can master the principles of knowledge content, interspersed with appropriate exercises of relevant content in classroom teaching, so that students can digest and absorb these contents in the classroom.
First understand in class, then consolidate through homework exercises.	It is related to the ability to read and draw mechanical drawings, and it is also direct and compact. Some key and difficult contents that are more difficult for students to master through self-study. Such as the basic regulations of "Engineering Drawing" and "Technical Drawing", the formation principle and characteristics of the three views, etc. It takes a lot of drawing work for students to gradually master, so in the classroom teaching, teachers pay attention to explain the main points of these contents, so that students understand the principle of knowledge content, and then through the homework exercises, students can digest and absorb these contents.

4.4 Adopt Intuitive Teaching Methods to Cultivate Students' Space Imagination and Enhance Students' Interest in Learning

In the teaching work, the use of physical models to assist teaching and the use of multimedia teaching methods have an important role in improving students' spatial imagination and spatial analysis ability, improving students' interest in learning, and mastering drawing and reading skills. The specific discussion of intuitive teaching methods is shown in Table 4 [6-8].

Table 4. The intuitive teaching method to cultivate students' spatial imagination and improve their interest in learning.

Measures	Specific description
Adopting physical model to assist teaching and improving students' perception.	Through the observation and analysis of models and objects, students establish a spatial perception of objects in their minds to form a spatial skeleton, which is then abstracted into a flat figure of the spatial form. When reading engineering drawings, from drawings to planes and from planes to three-dimensional, the concept of one engineering drawing being a three-dimensional is formed. Through repeated conversion exercises between engineering drawings and objects, students' spatial thinking ability is enhanced and students' interest in learning is enhanced.
Using multimedia teaching methods to cultivate students' spatial concepts.	Freshman first contact with the course of "Engineering Drawing", because the concept of space has not been established, it will feel difficult to learn. Using multimedia vivid, concrete and intuitive pictures can organically combine and clearly show the projection principle of orthographic projection and the method of three views, and vividly and intuitively show the formation and development process of three views, so as to improve the teaching effect [4].

4.5 Reform Teaching Methods

Teachers should change the teaching method of single explanation, adopt the teaching situation, task, project and other methods to optimize the teaching method of "Engineering Drawing" course. By creating a teaching situation and integrating the course contents into the teaching situation, the advantages of the teaching situation such as intuition, image and vividness can be brought into play. Using tasks, projects and other carriers, students can carry out learning activities purposefully driven by tasks and projects, and stimulate students' initiative in learning engineering drawing courses [6-7].

4.6 Refine Course Contents According to Different Majors

Different majors have different needs for knowledge of engineering drawing. It is necessary to determine the teaching contents and teaching focus of different majors, and build an "Engineering Drawing" teaching system for different majors. During the teaching process of "Engineering Drawing", the instructor should introduce the corresponding engineering background, improve the professional relevance of engineering drawing teaching, be close to engineering practice, and improve students' learning initiative.

4.7 Emphasizing Theory and Practice to Strengthen Teaching Practice

Make full use of school teaching resources, strengthen "Engineering Drawing" teaching practice links, and increase students' interest in learning. The model room can be used as a fixed-time drawing place for students. Students can discuss and communicate with each other, and it is also convenient for answering questions to the teacher. Drawing with reference to the model has deepened the students' impression of the graphics and further cultivated students' ability to read and draw engineering drawing. In addition, increase the time for internships, strengthen the construction of off-campus internship bases, let students participate in more engineering projects, and enhance students' practical ability [8].

4.8 Exploring New Evaluation System for Courses

The "Engineering Drawing" curriculum assessment advocates the use of a variety of assessment methods, not only to examine students' theoretical learning results, but also to scientifically evaluate students' practical results, and organically combine process evaluation and result evaluation. Based on the theoretical knowledge of the curriculum, the final grade test paper designs some subjective questions and examines the students' ability to analyze and solve problems. Ordinary grades mainly evaluate students' performance in the course of learning, with attendance rate, classroom discussion speech, question answering situation, and homework as the evaluation basis. Taking a multi-level

curriculum assessment method can arouse students' enthusiasm for learning and help to cultivate students' ability to solve and analyze problems [6-8].

Conclusion

At present, higher education is constantly undergoing reforms, and it is particularly important to reflect on the teaching of "Engineering Drawing" and improve the quality of teaching. "Engineering Drawing" as an important technical basic course, through optimizing the teaching contents, in the teaching process, teachers should continuously sum up experience, study teaching rules, analyze teaching objects, and continuously study and improve teaching methods. According to the contents and characteristics of the "Engineering Drawing" course, adhere to the student-oriented teaching concept, focus on cultivating students' interest in learning, enhance students' confidence in learning the "Engineering Drawing" course, and use intuitive teaching methods to increase student space thinking ability and spatial imagination ability, comprehensively improve students' reading and drawing skills. Through multiple assessments, students are made to understand that learning is not to cope with exams and graduation, and knowledge storage is to be applied to engineering practice. Through the above measures, the teaching effect can be effectively guaranteed, and the teaching quality of the "Engineering Drawing" course can be improved.

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