

Teaching Reform and Practice of “Mechanical Drawing” from the Perspective of “Curriculum Ideology and Politics”

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[**Abstract**] The course of “Mechanical Drawing” contains rich ideological and political elements such as craftsmanship spirit, patriotism, dialectical thinking, and professional literacy, making it an extremely important ideological and political education platform. Based on the characteristics and learning situation analysis of “Mechanical Drawing”, the construction goal of curriculum ideology and politics and the selection of ideological and political elements have been formulated. The “5S” teaching mode is used to design teaching ideas, and the expression method of gear parts is taken as an example to organize and implement the integration of ideological and political elements into the appraisal and evaluation system, so as to achieve the teaching objectives of knowledge, ability, and education in “Mechanical Drawing”, and provide references for the reform and practice of curriculum ideology and politics.

[**Key words**] “Mechanical Drawing”; curriculum ideology and politics; “5S” teaching method; teaching and practice; appraisal and evaluation

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In December 2016, General Secretary Xi Jinping emphasized at the National Conference on Ideological and Political Work in Colleges and Universities that “ideological and political work should be carried out throughout the whole process of education and teaching, so as to create a new situation for the development of China’s higher education”. In 2020, the Ministry of Education issued “Guidelines for the Construction of Curriculum Ideology and Politics in Colleges and Universities”, which explicitly put forward that the construction of curriculum ideology and politics should be comprehensively promoted in all colleges and universities, as well as all disciplines nationwide. Since then, the education of curriculum ideology and politics has been formally included in the documents of the Ministry of Education, and deployed and promoted in colleges and universities nationwide.

Nowadays, colleges and universities are focusing on the concepts of “three-wide education”, “five-wide education”, “foster virtue through education” and “practice and promote core socialist values” to carry out the teaching reform of curriculum ideology and politics. Classroom teaching, as the main channel, should be actively explored and leveraged, realizing the education model in which all kinds of courses and ideological and political theory courses go in the same direction and form a synergistic effect.

“Mechanical Drawing” is a compulsory professional basic course for engineering majors in colleges and universities, and the first professional basic course that students come into contact with. At the same time, the course contains rich ideological and political elements such as craftsmanship spirit, patriotism, dialectical thinking, and professional literacy, making it an extremely important ideological and political education platform. Therefore, how to effectively integrate the ideological and political education in the teaching process of “Mechanical Drawing”

has become an important topic in the teaching reform of “Mechanical Drawing”. In recent years, the research group has focused on the construction of curriculum ideology and politics in “Mechanical Drawing”, developed the construction objectives of curriculum ideology and politics in accordance with the characteristics and the learning situation analysis of “Mechanical Drawing”, combined with its teaching content, and chose the appropriate entry point and teaching method to infiltrate ideological and political education into the whole process of the teaching of “Mechanical Drawing”. As a result, the teaching content has been optimized and the evaluation system has been innovated, enhancing the quality of talent cultivation.

1 Objectives of ideological and political construction in the course teaching

The goal of “curriculum ideology and politics” is to educate people. In every course, “process and method” and “emotional attitude and values” are teaching objectives as important as “knowledge and skill”. Therefore, ideological and political objectives of “Mechanical Drawing” are to take course content as the carrier, and engineering application as the orientation, to realize the organic combination of ideological and political objectives and course objectives, to achieve the educational objectives of enhancing skills and cultivating sentiments, and to conduct the teaching model characterized by teaching process, combined with the concept, method and means of education and teaching, specifically including:

(1) In terms of teaching content, according to the basic principles embedded in the content of the teaching chapters of the course, combined with the practical application of engineering, the ideological and political elements in the teaching of “Mechanical Drawing” are developed, including rigorous learning spirit, craftsmanship spirit, patriotism, professional literacy and social responsibility, so as to build a “three-wide education” teaching system for the course.

(2) In terms of teaching method and means, based on that traditional mechanical drawing courses stay in the teaching basis of knowledge transfer, the use of “5S” teaching mode—“introducing events (1S) – triggering thinking (2S) – extracting knowledge (3S) – verifying through practices (4S) – expanding thoughts (5S)”, can stimulate students’ subjective initiative and innovation in learning with cases occurring in engineering applications. At the same time, it can cultivate students’ professional literacy in complying with national standards and engineering ethics.

(3) In terms of appraisal and evaluation system, a diversified evaluation system combining sub-evaluation and comprehensive evaluation, process evaluation and formative evaluation, self-evaluation and peer-evaluation is established to cultivate students’ strong professional ethics, and teamwork and innovative spirits. Finally, a combination of questionnaires and students’ online evaluation of teaching is used to evaluate students’ gains and feelings at the level of knowledge, ability and value of the course.

2 Design of ideological and political elements in the course teaching

The elements of curriculum ideology and politics refer to the integration of ideological and political education elements in professional courses to achieve the educational purpose of value leadership and fostering virtue through education. “Mechanical Drawing” is a professional basic course with strong practicability, aiming to train students to master the reading and drawing skills of mechanical images, which is one of the basic skills that engineers and technicians must have. There are many elements of ideological and political education embedded in its objectives of knowledge and ability. Therefore, based on each knowledge node of “Mechanical Drawing”, guided by core socialist values, and combined with the typical people, events or things in the practical application of engineering, the ideological and political education elements of the course teaching content are designed, and integrated into the course teaching process in the form of text, picture or short video. For example, the introductory part mainly focuses on the history of the development of national cartography, the national standard of cartography and the cartography knowledge in the domestically produced C919 aircraft, to establish students’ core socialist values such as patriotism, social responsibility and professional literacy; the assembly drawing part focuses on the relationship between parts and assemblies, reflecting the spirit of teamwork and the relationship between the whole and the part; the disassembly and mapping part focuses on the use of gauges and inspection tools, emphasizing standardization and preciseness, and reflecting the sense of social responsibility and craftsmanship spirit.

3 Design and implementation of the process in the course teaching

3.1 Design ideas

Teaching design ideas are the important basis for the implementation process of the course teaching. The so-called “5S” refers to the five basic elements throughout the whole teaching process of curriculum ideology and politics: events, thinking, knowledge, practices and thoughts. In other words, the course should be introduced through specific events from the engineering application, so as to stimulate students to think about the cognition of the events; then the professional theoretical knowledge should be extracted under the guidance of the teacher, and the verification through practice should be conducted combined with the specific objects in the events; finally the thought-expansion program should be carried out from the particular to the general.

3.2 Implementation process of the teaching

3.2.1 Introducing events

Gear is an indispensable basic component in the mechanical industry. It is used in various fields of the national economy, such as rail transportation, aerospace and high-end machine tools. The processing precision and quality of gear directly affects machinery life and production safety. For example, when the tooth of a certain gear is broken, there will be abnormal sound in the crane and breakdown in the resistor box, and then lifted objects will fall down, resulting in property damage. Integrating the application of gears with the country's great power, as well as the production accidents caused by broken gears with the teaching content, students can establish a strong sense of national pride and patriotism, while being able to understand the holistic perspective and sense of safety responsibility for “small things make big differences”.

3.2.2 Triggering thinking

Based on the introduction of specific events, the teacher guides students to collect knowledge about various aspects of gears to stimulate students' curiosity to take the initiative to learn new knowledge. At the same time, taking different shapes of gear teeth as an example, students can observe the structural characteristics of gears, and understand the important role of gears as well as how to express them. By asking questions in the classroom, the teacher points out the applications and types of gears seen in daily life, as well as the specific national requirements and norms on the application of gears, to deepen students' cognition of gears.

3.2.3 Extracting knowledge

On the basis of students' full cognition of gears, the teacher explains the knowledge points related to gears, including the concepts and basic technical parameters of gears, as well as the drawing method of a single straight-toothed cylindrical gear. The main points include: the top circle and the top line of the teeth are represented by thick solid lines; the root circle and the root line of the teeth are represented by thin solid lines or being omitted; the root line of the teeth is represented by thick solid lines in the sectional view; the pitch circle and the pitch line are represented by dotted lines; the gear teeth part is non-sectional in the sectional view. It allows students to elevate from structural cognition to theoretical cognition, and cultivates students to abide by national technical standards and specifications, master scientific engineering principles and abide by strict engineering ethics, thus establishing a correct outlook on the life, world and value.

3.2.4 Practical operation

Practical operation is an important part to test students' understanding and mastery of theoretical knowledge. When expressing gear engagement, the principles to be followed include: the overlap of two pitch lines is represented by dotted lines in the sectional view; the root line of the teeth is represented by thick solid lines; in the top line of the teeth, the visible gear tooth is represented by thick solid lines, the covered gear tooth is represented by dotted lines; in the view projected as a circle, when the two pitch circles are tangent, the root circle of the teeth is represented by thin solid lines or being omitted; the top circle of the teeth is represented by thick solid lines, and the top circle in the engagement region can be omitted.

In the teaching process, the emphasis should be placed on the rigorous work style, as well as the quality concept of engineering product designs and the sense of responsibility, extending to young students' continuous pursuit for excellence towards higher standards, higher levels, and higher quality efforts, subconsciously

strengthening their craftsmanship spirit to strive for excellence.

3.2.5 Expanding thoughts

From the explanation and training of the basic concepts, applications and basic drawing methods of gears, students can just master the basic content of gears. However, the gear is only the most typical type of disc parts. Regarding the expression methods of other disc parts, such as flange, end cap, and flat-belt pulley, the teacher can guide students to analyze their structural characteristics, think independently about the selection of the appropriate expression method, and complete the drawing, which can strengthen the ability of students to solve practical problems, thereby strengthening the cultivation of students' innovative and creative thinking abilities.

4 Appraisal and evaluation in the course teaching

The teaching appraisal of the course is carried out through "classroom test + post-class training", "theory test + practice examination" and "project design + group defense", forming a diversified evaluation system combining sub-evaluation and comprehensive evaluation, process evaluation and formative evaluation, self-evaluation and peer-evaluation. In the appraisal process, the ideological and political elements such as love and respect for work, craftsmanship spirit, cooperative consciousness, and innovative thought are integrated into the appraisal and evaluation system, which really achieves the education goal of curriculum ideology and politics.

5 Conclusion

In order to improve the teaching effect and quality of the course, and give full play to the education function of professional courses, combined with practical engineering applications, the education concept of curriculum ideology and politics in "Mechanical Drawing" based on "5S" teaching method is used, integrating the ideological and political elements into the entire teaching process. It fully mobilizes students' learning enthusiasm, enhances students' attention to the course, and effectively cultivates students' analytical ability and critical thinking, as well as innovative ability and practical ability, so as to achieve the knowledge, ability and education goals of "Mechanical Drawing" teaching and to provide references for the reform and practice of curriculum ideology and politics.

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