

# *Ideological and Political Exploration and Teaching Practice of Engineering Drawing Course*

Wenbo Zhu<sup>1,a</sup>, Yuanyuan Cui<sup>1,b</sup>, Shengluo Yang<sup>1,c</sup>, Jun Ma<sup>1,d</sup>

<sup>1</sup>*School of Mechanical Engineering, University of Shanghai for Science and Technology, Shanghai, 200093, China*

<sup>a</sup>*teacherzwb@163.com*, <sup>b</sup>*yyhdlg@163.com*, <sup>c</sup>*yangshengluo@usst.edu.cn*, <sup>d</sup>*2521384780@qq.com*

**Keywords:** Engineering Drawing, Ideological and Political Element, Teach and Cultivate, Craftsman Spirit

**Abstract:** Engineering Drawing is a compulsory basic course for engineering students. It covers a large number of subjects and is quite instructive. By enumerating the typical characters and cases related to the chapter, the learning initiative of students can be stimulated. By citing positive and negative engineering examples, the standardization, science and seriousness of drawing and reading drawings can be emphasized. Taking the craftsman spirit of the new era as the starting point, the craftsman spirit of excellence, dedication, continuous focus, innovation, pursuit of perfection and other essential connotations can blend into the curriculum. Finally, the perfect combination of teaching and educating people can be realized to achieve the trinity of knowledge imparting, ability training and value leading education and teaching goals.

## 1. Introduction

It has been clearly pointed out at the National Conference on Ideological and political work in colleges and universities that ideological and political work should be carried out, the role of classroom teaching should be given full play, and ideological and political theory courses should be constantly innovated and reformed to form a joint educational force. Classroom is the main position for colleges and universities to carry out the task of moral education, and we should implement classroom teaching to improve the quality of talent training<sup>[1]</sup>. The course of Engineering Drawing is a basic course of engineering major, covering a large number of areas. Furthermore, it is the first professional basic course for freshmen to contact, which play a guiding role of education in this major<sup>[2]</sup>. Ideological and political course is to deeply excavate the hidden ideological and political education elements in the basic professional course, to integrate students with knowledge and skills and ideological and political education<sup>[3,4]</sup>. With the theme of loving the motherland and science, the students should be cultivated with a serious and responsible attitude and rigorous and take the meticulous style as the theme, and the moral education infiltration teaching design and practice like smooth and silent should be carried out<sup>[5]</sup>. Taking the new era craftsman spirit as the starting point, the craftsman spirit of excellence, dedication, continuous focus, pioneering innovation, and perfection of the essence should be integrated into the curriculum, to achieve the perfect combination of teaching and education, and truly achieve the trinity teaching goal of knowledge imparting, ability cultivation

and value guidance.

## **2. Ideological and Political Construction Objectives of Engineering Drawing Course**

Drawing is not only an important technical document to guide production, but also an important tool for technical exchange. It is the language of the engineering field that every engineering technician must master. As an important technical foundation of engineering major, large and wide, the main task of engineering drawing is to train students the unarmed drawing, gauge, computer drawing, reading mechanical drawing ability and the three-dimensional shape of spatial logical thinking ability and image thinking ability, for the subsequent professional course learning and students work in engineering design in the future to lay a solid foundation.

The core goal of the ideological and political construction of the course of Engineering Drawing is to cultivate the rigorous, serious, responsible and meticulous work quality of students, as well as the spirit of meticulous, practical and dedicated craftsman. The teaching method is mainly classroom explanation, supplemented by offline teaching. In class, PPT explanation and blackboard writing are combined to explain the normativity, science and seriousness of drawings. In addition, typical characters and events related to drawings are introduced in the form of pictures and videos (detailed videos are placed in offline teaching) to convey positive energy. In order to build moral education and train students, we should strengthen the ideological and political construction of the curriculum. Ideological and political education is carried out through the graphic teaching process. Only by combining the value orientation of the curriculum with the knowledge orientation, clarifying the moral education function of the curriculum, enhancing the educational consciousness of each teacher, the educational effect of the curriculum can be grasped and the trinity education pattern can be build.

## **3. Engineering Drawing Ideological and Political Course Construction Plan**

### **3.1 Course Teaching Overview**

Cultivating the engineering, innovative and international talent is the orientation of our school, and engineering is the characteristics of our talent training. Engineering drawing course is a professional basic course, which is a compulsory course for students of all engineering majors in our school. Our school divides the engineering drawing course into engineering Drawing (1) and Engineering Drawing (2). Engineering Drawing (1) is for all engineering majors in our university, opening in the first semester of our freshman year. There are more than 2500 students. Its teaching contents conclude the explanation of the basic skills and knowledge of national standards, such as sheet, proportion, font, line and dimension, the basic principle of projection method; point, straight line, plane and three-dimensional projection, the reading and drawing skills of three-view combination, and the common expression method of engineering drawing. Engineering Drawing (2) is the subsequent course of Engineering Drawing (1), oriented to intelligent manufacturing, opening in the second semester of the freshman year. There are more than 1400 students. The teaching contents are the drawing and marking of common parts and structural elements, the expression methods of various parts, the marking method of various technical requirements, the reading and drawing method of assembly drawing. Together, those two courses fully explain the principle of mechanical drawing, national standards, and engineering method of expression. The core goal of the teaching goal is to make students with reading and drawing parts (standard parts and non-standard parts) and assembly ability, and to have a broad range of professional knowledge to lay a solid foundation for the future learning mechanical courses (such as mechanical design, mechanical structure design, etc.).

### 3.2 Curriculum Ideological and Political Elements and Integration Points

On the premise that the original knowledge system and teaching system remain unchanged, when explaining the specific course content, the ideological and political elements of the course are integrated, and typical figures and cases related to drawing are introduced through pictures or short videos. Students are required to attach importance to the course of drawing in their thinking, laying a solid foundation for subsequent courses and future work. The specific contents are as followed:

(1) The necessity of learning drawing. The introduction of the course introduces the contribution of the famous architect Liang Sicheng in drawing, and the experience of the outstanding graduates of our school "Drawing lays a solid foundation for future work", explaining the importance of drawing, so that students should pay attention to drawing learning at the beginning. For example, James Watt is a famous British inventor, an important figure in the Industrial Revolution, a member of the Royal Society of Britain and a foreign academician of the French Academy of Sciences. He made a series of major improvements to the original prototype of the steam engine, invented the single cylinder single action and single cylinder double action steam engine, and improved the thermal efficiency and operational reliability of the steam engine. His outstanding contributions were inseparable from his attests in the field of drawing. There is also another inspiring story of Yang Wei, the deputy chief engineer of AVIC, who insisted on fighting in Chengdu scientific research line for years, and developed Thunder Dragon and other aircraft. At the same time, combined with the video of Made in China 2025, Great Power and Heavy instrument and the Chinese government's Manufacturing Power strategy, teachers can guide students to establish lofty ideals and patriotic feelings, build a correct outlook on the world, life, and values, shoulder the glorious mission given by the eras bravely, and improve the ideological and political quality of students comprehensively.

(2) The importance of standardization and preciseness. In the teaching process of parts drawing and assembly drawing, specific cases are cited appropriately, emphasizing the standardization and rigor of drawing. For example, a girl accidentally fell to her death from a balcony guardrail on the 7th floor of her home. In accordance with the relevant regulations of the state, the fence spacing cannot be greater than 0.11 meters. After the accident, the household owner measured, and the fence spacing in his home reached 0.13 and 0.15 meters. From this case of a child falling dead because the construction party does not follow the national regulations, we can get the inspiration that it is necessary to learn and master the relevant knowledge of drawings. Drawing design is as important as drawing reading. It must be familiar with and strictly implement relevant national regulations and standards. The design and construction should be refined, and there should be no carelessness, otherwise it may cause major accidents or casualties.

(3) The spirit of conscientious conscientiousness, responsibility and craftsman. In the class, the short videos can be used to explain what is the craftsman spirit and the positive energy can be spread by typical people. Specifically, in May 2016 at the government work report delivered at the Fourth Session of the 12th National People's Congress, Premier Li Keqiang said that we should encourage enterprises to carry out customized and flexible production, and foster a craftsman spirit of striving for perfection. This is the first time that the term of artisan spirit has been mentioned in the government work report. Engineering drawing is the language of engineers, and students must be trained to attach importance to the standardization and seriousness of parts drawings. Students should strive for excellence, pay attention to details, pursue perfection, and be meticulous to ensure that every painting is well painted. In the usual learning process, students should pay attention to persistence, study hard, and carefully complete each assignment. In the future, students should love their major, learn their major well, talk about fame and fortune, work steadily, regardless of personal fame and fortune, and pay their own strength for the future construction of the motherland. The students should be called to have a heart with the craftsman spirit.

## 4. The Ideological and Political Case of Engineering Drawing Course

This chapter will take the reading part drawing as an example to introduce the course ideology and politics. The knowledge objective of this course is to master the steps and methods of reading part drawings. The ability goal is to train students to have the ability to read and draw part drawings. The value goal is to train students to have the consciousness of "making drawings like a man, no rules cannot be accomplished", and to train students to be rigorous, serious, responsible and meticulous.

### 4.1 The Key and Difficult Points in This Chapter

The key difficulty of this course is to teach students how to read the internal and external structure of parts. It is emphasized that the method of reading the parts drawing. Specific methods concludes: (1) reading the parts drawing must first look at the title bar, looking at the parts name and materials, and determining what kind of parts. According to the type of parts, the structure of parts is analysed from the function of parts. According to the material, the basic processing technology of the parts can be roughly judged, and the process structure of the parts can be assisted to understand; (2) reading the common expression methods carefully, seeing the graphics, and judging what the expression method is; (3) mastering the basic principles of graph reading. We should grasp the principle of length alignment, height and width equality in the projection relation to read the graph. Look at the large structure first, then look at the small structure; Besides, first look at the basic view, then look at the local view, from the outside to inside, from left to right, and from top to bottom.

### 4.2 Teaching Content

Before class, that is, after the last lesson, the learning online requires students to review and watch parts process structure videos, expression methods review videos, etc. As shown in Figure 1. The specific process of classroom teaching is divided into four teaching sections.

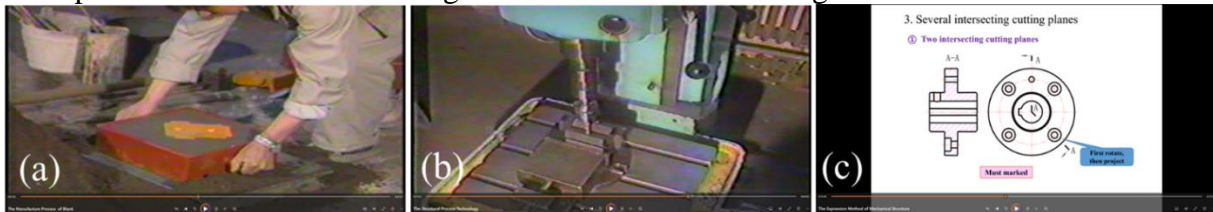
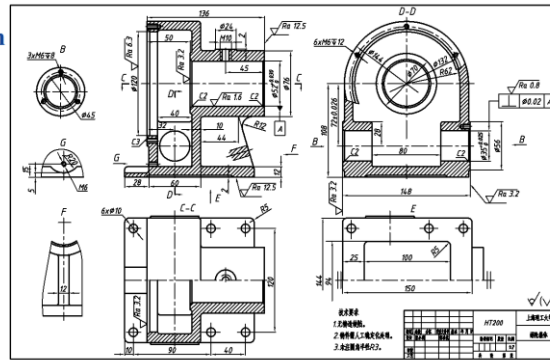


Figure 1: Online review video before class. (a) The process of blank (at 8'4''); (b) The explanation of structural processing technology (at 16'0''); (c) The expression method of mechanical structure (at 33'10'').

(1) Lesson introduction (5 minutes). Explaining the purpose and requirements of parts drawings, and reading part drawings are the ultimate goals of learning drawing. It is also one of the abilities that intelligent manufacturing students must have for learning follow-up courses and future technical work. Then, the teacher shows a picture of the parts and asks the students to read it with questions, as shown in Figure 2.

(2) Reading the part drawing (30 minutes). The teacher took the "worm wheel box" in Figure 2 as an example to explain the sequence of reading the drawing, emphasizing that reading the parts drawing must first look at the title bar. The first step is to look at the title bar to get an idea of the part. The part name is worm gear box, which is inclusive of worm gear and worm transmission mechanism. Then, the teacher briefly reviewed the knowledge learned in Chapter 6, gear meshing, inspired and guided students to design a part containing worm gear and worm, so as to further understand the box parts.



Question?



Q1: What do you see at first glance?

Q2: What is your idea of reading this Part drawing?

Q3: Do you look at the dimensions while looking at the graphics?

Figure 2: Curriculum introduction.

Next, by looking at the material as "HT200", it is a casting. The first process must be the casting process, so there must be casting round corners and transition lines in the drawing. The second step in reading a part drawing is to analyze the view and imagine the structural shape of the part. The teacher explains each figure in turn, emphasizing that it is necessary to understand the expression method, and checking whether the teacher has watched the video of reviewing the expression method according to the teacher's requirements. The teacher emphasizes the method and order of looking at the drawing, looking at the figure while looking at the size. The third step is size analysis. From the point of view of the functional structure of the parts, the dimensional reference and the positioning dimension are analyzed. The fourth step is to analyze the technical requirements. Combined with the current graphics, the teacher led the students to review the surface roughness, dimensional tolerances, geometric tolerances.

(3) Class discussion (5 minutes). The assignment of this class is to copy the "worm gear box" with A2 drawing in 1:1 ratio. Students discuss and communicate to understand the part and find questions.

(4) Excellent works display (5 minutes). Finally, the excellent drawings of previous students and Master Liang Sicheng's hand-drawn drawings of Foguang Temple in Wutai Mountain will be displayed. As shown in Figure 3.

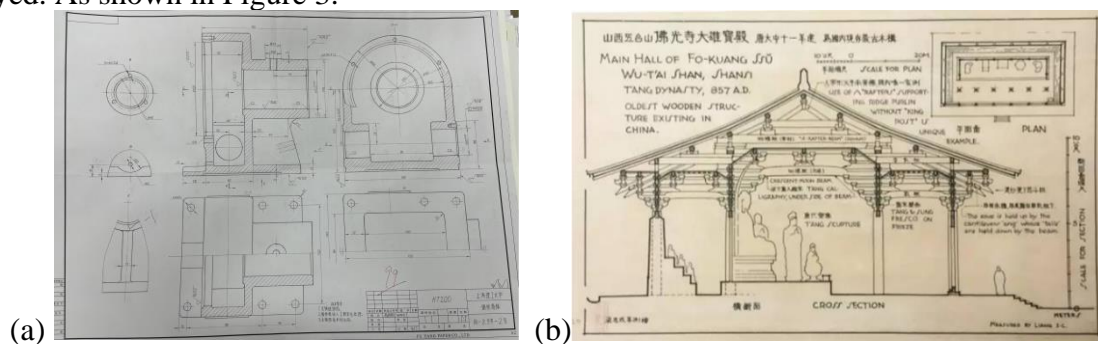


Figure 3: Display of excellent works. (a) The student work. (b) Section view of Daxiong Hall of Foguang Temple (hand-drawn drawing by Liang Sicheng).

## 5. Conclusion

Under the premise of keeping the original knowledge system and teaching system unchanged, the ideological and political education of Engineering Drawing course is deeply exploring the recessive ideological and political education elements in the course by silently teaching. By introducing the



typical characters and events related to drawing by means of pictures and videos, the positive energy can be transmitted, the interest of students in drawing learning can be activated, to further improve the ability to read and draw parts drawing. The teaching should focus on training students to have a serious and responsible attitude and rigorous and meticulous style, and deepen students' awareness that drawing and reading drawings must follow the national standards of awareness. The course takes the craftsman spirit in the new era as the starting point, and integrates the essence of the craftsman spirit such as excellence, dedication, continuous focus, innovation, and pursuit of perfection.

## Acknowledgements

This work was supported by 2023 Undergraduate Teaching Research and Reform Project of University of Shanghai for Science and Technology (Office of Academic Affairs, University of Shanghai for Science and Technology [2023]5); 2023 Construction Project of Undergraduate Demonstration Course with Ideological and Political Content (Office of Academic Affairs, University of Shanghai for Science and Technology [2023]18).

## References

- [1] Cui Yuanyuan, Niu Tianye, Wen Shuo, etc. Mining of Ideological and Political Elements and Teaching Design of Ideological and Political Content for Mechanical Drawing Course[J]. *Advances in Educational Technology and Psychology* 2023; 7: 137-141.
- [2] Mu Haozhi, Xue Yahong, Xue Lijun, etc. Teaching Principles, Contents and Methods of Engineering Drawing under the Concept of Curriculum Ideological and Political Education [J]. *China Modern Educational Equipment* 2023; 9: 105-107.
- [3] Li Zhe, Song Jian, Cai Jingxuan, etc. Reform and Exploration of Ideological and Political Elements in Engineering Drawing Course [J]. *Education and Teaching Forum* 2022; 6: 113-116.
- [4] Zhao Xueke, Tong Ying. Reform and Exploration of Engineering Drawing Course from the Perspective of "Curriculum Ideology and Politics [J]. *Equipment Manufacturing Technology* 2022; 9: 96-99.
- [5] Wang Lili. Research on the Reform and Practice of Ideological and Political Teaching in Engineering Graphics Course [J]. *The Theory and Practice of Innovation and Entrepreneurship* 2021: 2: 22-24.