# The Teaching Reform Study of Mechanical Drawing in China's Higher Vocational and Technical Education

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**Abstract.** Combined with the actual situation of China's higher vocational and technical education, this paper has carried on the preliminary research and exploration on the teaching reform of mechanical drawing course. The problems existing in the teaching process of mechanical drawing course was introduced and the scheme that the mechanical drawing teaching reform ought to cultivate the students' professional ability as a starting point has been proposed. Based on the practice training, the curriculum assessment could be combined with the identification of professional qualification and technical level, which also has broadened the students' employment. For students major in mechanical engineering, the training of engineering drawing recognition ability in practical teaching content should be strengthened. The actual production patterns in the manufacturing enterprise are advised to be adopted during the training process of engineering drawing recognition aiming at enriching students' knowledge, strengthening practical application and expanding quality structure.

**Keywords:** Mechanical drawing, teaching reform, practical application, techniques cultivation.

## 1. Introduction

The mechanical drawing course is one of the foundation courses of engineering and other related subjects. Although it belongs to the traditional professional courses, due to the continuous improvement of the course system and the increased complexity of practical application in manufacturing enterprise, the enterprise have more requirements on the students' practical application ability along with the expansion development of Chinese mechanical manufacturing industry.

According to the particularity of higher vocational and technical education, which is different from the general colleges and universities, the targeted reform should be corresponding with the problems existing in the teaching process of mechanical drawing course [1]. The advanced technology applied students cultivated from the higher vocational and technical education should have not only certain professional knowledge of mechanical drawing, but also strong ability of practical computer graphics to meet the needs of today's society development [2].

## 2. Problems existing in the mechanical drawing teaching process

### 2.1 The students' weak foundation

Due to the enrollment reform of higher vocational and technical colleges in recent years, the students' foundation is ragged and many liberal arts students study in the mechanical engineering, whose knowledge level and practical ability exist big difference. Mechanical drawing course is a practical basic professional course studying the mechanical design drawing and the regulation of engineering drawing recognition and its main task is to cultivate students with basic drawing ability to recognize the mechanical drawings. However, the content and object of current course are not fit for those students.

### 2.2 Lack of interest in the autonomous learning

As is known to all, the learning ways in university stage have certain differences with that in high school. High school learning ways belong to cram school and the teaching contents are unitary, while the study during the university stage emphasizes on the autonomous learning. Many freshmen have not been able to change their learning habit in time, leading to the lack of initiative learning. At the same time, due to the diverse content and huge knowledge of the mechanical course, some students feel boring during the course processing, gradually losing interest in learning.

### 2.3 Singularity of the teaching content

There is a big difference in the teaching plans of various kinds of machinery subjects and there are not unified regulations in the mechanical drawing course. Considering the mechanical drawing course belongs to the traditional professional course, the course content has not been enriched in time with the fast development of the society and the improvement of the science and technology, and is not synchronous with the practical application in manufacturing enterprises, causing the students cannot adapt the knowledge obtained in school to the development needs of manufacturing enterprises.

## 3. Reform and exploration analysis of the course teaching

### 3.1 Diversity of the curriculum arrangement

The engineering drawing is called as the engineers' communication language, which is a basic skill for students majoring in engineering [3]. Our country's higher vocational and technical education has vivid professional and skilled characteristic and is a further continuity and improvement beyond the secondary vocational education. The typical application, outstanding skills and strong practicality determine the curriculum arrangement should always be around with the topic of cultivating the professional ability. The curriculum ought to be organically combined with the cultivating objects and practical ability, not engaged in the systematicness and integrity of the subject. Based on the capacity factor and position requirement of the training objective, the professional knowledge content should be selected, which has direct relation with the professional ability and is widely applied in the practical works. On the premise of moderate basic theory and practical education, the main body which emphasizes on comprehensive ability training can meet the balance between practical objects and theory learning.

According to the technician's actual work content in the manufacturing companies, the mechanical drawing teaching content can be divided into three parts, namely basic parts drawing, assembly drawing and the actual engineering design drawing. On the basis of the three course teaching parts, students can quickly adapt to the actual work in the future, not confined to single work content. Considering the systematicness of the curriculum arrangement, the comprehensively theoretical teaching content can be simplified, but not wiped off during the practical teaching process.

The basic drawing part includes the preliminary knowledge of pattern, projection drawing, expression method of parts, standard pats and common parts. Mastering the basic knowledge of mechanical drawing is the basis and enlightenment stage of drawing, helping to reduce subsequent learning difficulty. Assembly drawing part is a transitional stage from basic cartography stage into the application stage. The part drawing is the important foundation of learning assembly drawing. During the assembly drawing teaching stage, the ability to read and draw the part drawing has been further consolidated and improved. Actual engineering drawing part not only has its own characteristic, but also has connection with the mechanical pattern. According to the specific needs of each professional, the welding figures, metal structure, the drawing principle of expansion and specified representation in the national standard should be clearly explained to expand students' knowledge and the ability to draw and read professional pattern. The actual production patterns in the manufacturing enterprise are advised to be adopted during the training process of engineering drawing recognition aiming at enriching students' knowledge, strengthening practical application and expanding quality structure.

### 3.2 The variety of course teaching ways

At present in our country, the main drawing work in enterprises is completely finished by computer aided drawing and computer graphics technology has been the technology foundation in machinery and other fields [4]. Due to the mechanical products has gone into the era of digital design, analysis and manufacturing, the traditional teaching mode must be adjusted to strengthen the ability training of freehand drawing. After reaching the basic requirement of manual map plate, the content of the computer graphics needs to be introduced especially in order to meet the actual needs of modern design and production.

Nowadays most mechanical drawing teaching material gradually include the AutoCAD computer drawing software, but only introducing the 2D part of the AutoCAD drawing. The three-dimensional solid design has given CAD a new connotation for the necessity that teachers should transform the CAD from the theoretical computer aided drawing to the modern design concept, setting up concept that starting from the three-dimensional design. Taking the three-dimensional entity model as the required content and the main point of mechanical drawing and breaking the original teaching system promote the development and application of computer design technology and the teaching and learning of the mechanical drawing. This is the nowadays' teaching emphasis focusing on cultivating mechanical drawing ability with plentiful computer aided design training.

Mechanical drawing principle is the basis of computer drawing 2D graphics and computer graphics provide the advanced methods, means and tools for 2D mechanical design. Only by mastering the principle of mechanical drawing, the learners can successfully meet the requirements of the mechanical design regulations and also can correctly read mechanical pattern. To adapt to the requirement of mechanical technology development, the substantial progress should be made in the efficiency of drawing, drawing reuse and drawing management.

### 3.3 Practical application of theoretical knowledge

On the basis of the curriculum design of product design calculation and the drawing practice in computer drawing room, combined with the specific condition in school training base, the large-scale machine tool plant and machinery manufacturing enterprises, make students deep into the first line of production practice and cultivate the ability to solve practical problems by the means of starting from CAD department staff to do a more complicated project independently. Combined with practical engineering problems, the teaching mode can break through the limitations of template and typical illustration during the traditional teaching process, which is not matter from the quantity but also the complexity of the mechanical parts. Through the internship in factory and seeing related video to obtain the common sense of the parts production and processing, the students can have a perceptual knowledge about mechanical design. If the students could take part in the practical disassembly and assembly process, students' enthusiasm and initiative could be mobilized and achieving the result of get twice the result with half the effort.

### 3.4 Combination of curriculum evaluation and vocational qualification

To some extent higher vocational education is employment education, so the higher vocational cultivation should focus on the higher vocational characteristics and professional characteristics to carry out the teaching arrangement, unifying the teaching and employment. The key to this point is that the curriculum assessment could be combined with the identification of professional qualification and technical level, which improve the social credibility and validity of the evaluation, and also get the corresponding post qualification certificate, such as the vocational credentials of the technician series. Taking the professional qualification certificate as the niche of teaching reform stage can enhance the students' employment competitiveness and widen the employment ways.

## 4. Conclusion

In view of the current problems existing in the teaching of mechanical drawing course, some corresponding teaching reform has been proposed. Although the theoretical reform tips are a bit of macroscopical, the teaching arrangement should conform to students' the actual situation, which ought to be guiding and suitable. Strive to explore the characteristics of students, and at the same time

can achieve the purpose of this course teaching reform, achieving the cultivation target according to students themselves. The course arrangement reform makes the mechanical drawing course into a new teaching stage, realizing the win-win between students, schools and enterprises, promoting the rapid development of society and economy.

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