

## Teaching Reform of Drawing Design Course under the Background of School-enterprise Integration

Yunfei Liao

Chongqing Industry Polytechnic College, Chongqing, China

### Abstract

The related courses of drawing and design are the basic courses of equipment manufacturing, and play an important role in the overall quality of Vocational education. Under the background of School-enterprise integration, there are some problems existing in the current course of drawing design in Vocational education, such as weak career orientation, loose course connection and low efficiency of education for students. Starting with the content and teaching method of the course of cartography and design, this paper analyses the problems existing in the teaching content, means and practice and proposes solutions.

### Keywords

School-enterprise Integration; Engineering Drawing Course; Teaching Reform.

### 1. Introduction

Since the General Office of the State Council issued Several Opinions on Deepening the Integration of Production and Education in 2017, the Integration of Production and Education has become the overall institutional arrangement for national education reform and talent development[1]. The National Implementation Plan for Vocational Education Reform published in 2019 pointed out that we need to summarize the pilot experience of modern apprenticeship and New Apprenticeship in enterprises, jointly study and formulate talent training programs, timely incorporate new technology, new technology and new standards into teaching standards and contents, and strengthen students' practical training; To meet the development needs of "Internet + Vocational Education", improve the teaching methods and methods with modern information technology, and promote the construction and universal application of network learning space such as virtual factories[2].

The course of drawing design is a major basic course in mechanical manufacturing and a theoretical basis and required course for Vocational Education Undergraduates[3]. Manufacturing practitioners, regardless of their industry, must master this technology, otherwise they will not be competent. However, with the development of computer technology, computer drawing has gradually replaced manual drawing[4], and reconstructed the original process from two-dimensional drawing to industrial product (Figure 1). Nowadays, it is common practice for enterprises to design three-dimensional products directly (Figure 2), then produce engineering drawings and finally process products[5]. In this process, even two-dimensional drawings cannot appear.

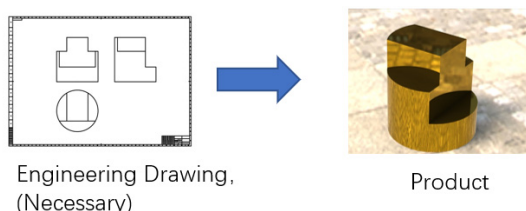
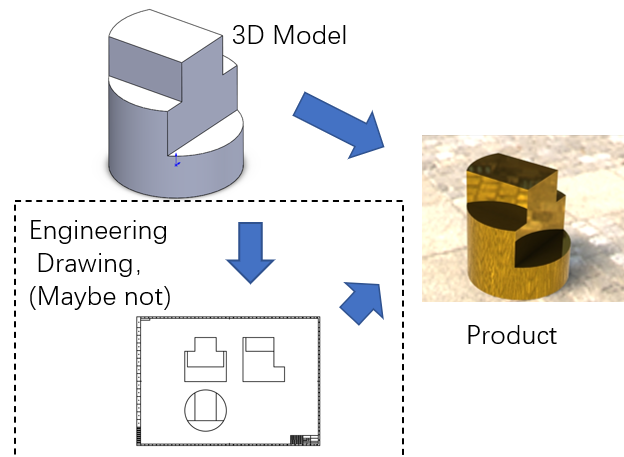


Figure 1. Early workflow



**Figure 2.** Modern workflow

## 2. Overview of Current Teaching Contents and Methods

At present, among the manufacturing majors in Vocational schools, the course of drawing design is generally divided into two categories. One is mechanical drawing design which focuses on drawing two-dimensional engineering drawings, the other is three-dimensional design.

### 2.1. Main Teaching Objectives and Contents of Drawing and Design Course

The course focusing on two-dimensional drawings is mainly Engineering Drawing. The teaching objective of this course is to firmly grasp projection theory and projection method, cultivate and improve spatial thinking ability and spatial imagination ability through the study of this course. To gain a deep understanding of the laws of transformation from three-dimensional to two-dimensional graphics and the correct method of imagining three-dimensional shape from two-dimensional graphics so as to master certain drawing and reading abilities; Grasp the correct drawing and reading methods and procedures, and be able to correctly consult the relevant national standards, and constantly improve the skills of drawing by various means, so as to make the drawing correct and standard.

Specific content generally includes basic knowledge of drawing, descriptive geometry and engineering drawing. Students are required to master the basic rules of Engineering drawing, drawing tools and their use, geometric drawing methods and marking methods in an all-round way. Three-view projection law and drawing method of space geometric objects (point, line, surface and body); Basic representation of typical parts, representation of common standard parts, specification and drawing of assembly drawing, etc.

### 2.2. Main Teaching Objectives and Contents of Basic Course of Three-dimensional Design

The main course focusing on three-dimensional product design is Basic of Computer Three-dimensional Modeling. The teaching objective of this course is to enable students to master the modeling method of CAD three-dimensional modeling of CNC products. Have comprehensive use of CAD three-dimensional modeling function and performance capabilities; Develop students' comprehensive expression ability of three-dimensional components and production model of CNC products; And grasp and flexibly use the motion simulation function of CAD to carry out various forms of mechanical products.

Specific contents generally include: understanding the sketching function and practical skills of CAD styling design; Master the design of CAD three-dimensional modeling of stretching and

rotating parts; (Extension, rotation, scanning, mixing, screw scanning, variable profile scanning and other modeling functions); CAD three-dimensional modeling design of milling parts such as box, shell, rib, etc. (holes, shell pulling, ribs, die pulling, array, etc.); surface modeling function; component function; motion simulation function modeling and rendering, etc.

### 2.3. Analysis of Learning Situation of Drawing and Design Course

Vocational education aims at enterprises to cultivate professional skilled talents[6], which determines that students in vocational colleges have strong practical ability and visual thinking ability, while their abstract understanding ability and logical thinking ability are relatively weak (Figure 3). Because of this situation, students often feel abstract, boring and difficult to understand when they are learning engineering drawing course, they do not have a deep understanding of knowledge and skill points, and they have low participation in learning. On the contrary, three-dimensional modeling course is based on existing software such as Solidworks, Cero, NX UG, etc., which enables students to intuitively and sensibly acquire the knowledge and skills contained in the course with high learning enthusiasm and efficiency.

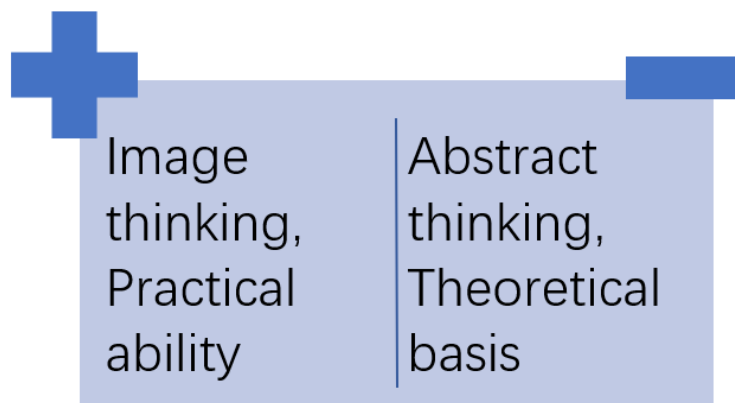


Figure 3. Characteristics of vocational students

### 3. Existing Problems

1. Teaching methods have not kept pace with the times. In the teaching process of Engineering drawing, although the traditional hand-drawing has been replaced by CAD drawing software and the traditional teaching aids, models and flipcharts have been replaced by three-dimensional models, their connotations are not different. When students encounter problems that are difficult to understand, they can also not imagine their specific characteristics. This is determined by the characteristics of students in Vocational education. Our teaching methods should keep pace with the times and carry out targeted teaching reform.

2. Teaching content is out of line with enterprise production practice. In the process of product design, existing enterprises always complete the construction of three-dimensional model first, and then derive the two-dimensional map after many steps such as interference check, motion simulation and performance adjustment. Based on the two-dimensional drawings, the engineering drawings are modified to meet the requirements of specifications and meet the requirements of material procurement, process preparation and on-site production. That is, engineering drawings used in modern manufacturing are not directly drawn in two dimensions, but are based on sound three-dimensional drawings. The current teaching method, which separates the drawing of two-dimensional engineering drawings from the modeling of three-dimensional products, can no longer meet the needs of modern manufacturing industry.

3. There are differences between teaching practice and teaching objectives. Due to the shortcomings of the above-mentioned teaching methods and contents, it is difficult to achieve

the set teaching objectives in teaching practice. The systematic teaching of two-dimensional drawings and three-dimensional modeling makes it difficult for students to understand the concrete products behind the two-dimensional drawings. At the same time, it makes it difficult for students to take into account the requirements of standardization behind product design when modeling three-dimensional models. To close the difference between teaching practice and teaching objective has become an important problem to be solved urgently in current courses.

## 4. Solutions

To break through the current dilemma of drawing and design courses, we need to start from two aspects of teaching content and teaching methods. In order to reform the teaching content, we should first carry out the reform of the textbooks.

### 4.1. Integrating Courses and Compiling New Textbooks

The textbooks for vocational education should firstly aim at the needs of enterprises for talents, design teaching contents and compile new textbooks. To decompose and analyze the design process of enterprises, keep up with the front line of production technology and introduce production design cases, to embody the core skills of industrial product design, and then organically integrate the existing two courses of engineering drawing and three-dimensional modeling. Borrowing resources from the original two courses and re-integrating elements such as product conception, drawing skills and standardized expression to form a new course. Through the combination of visualized three-dimensional and abstracted two-dimensional, to adapt to the characteristics of Vocational teaching, such as strong practical ability and visual thinking ability, while relatively weak abstract understanding ability and logical thinking ability, the adaptability of enterprise talent demand is reflected from the high level of course setting.

### 4.2. Adapt to the New Course and Reconstruct the New Teaching Method

In order to make the integrated courses conform to the learning conditions of students in Vocational education, to teach students according to their aptitudes, to stimulate students' learning enthusiasm, and to accomplish talent cultivation with pertinence. The new teaching method no longer regards engineering drawing and three-dimensional modeling as independent course systems, but as an organic whole, through setting different projects, students can repeatedly learn different contents between two-dimensional drawing and three-dimensional modeling, to achieve learning, understanding, mastering, in-depth learning, in-depth understanding and grasping, learning new knowledge and skills. Understand the spiral cycle of acquiring new knowledge and skills. Give full play to the characteristics of vocational students with strong image thinking and practical ability, which can not only promote strengths while avoiding weaknesses, but also conform to the process of enterprise design and production.

## 5. Summary

The course of drawing and design is the core basic course of equipment manufacturing major. Reconstructing it is of great significance in exploring the way of teaching reform of Vocational education. In the current vocational education, the knowledge and ability of design and mapping are divided into two courses: two-dimensional drawing and three-dimensional model drawing, which can not adapt to the learning conditions of Vocational students, nor match the work flow of manufacturing industry at this stage. Obviously, necessary reform is required. The integration of these two courses can seamlessly link up with the production design process of modern manufacturing industry, give full play to the characteristics of vocational students with strong image thinking and practical ability, so as to teach students according to their aptitudes

and form the vocational courses with the times. In order to complete the integration of this course and construct new teaching materials, the design of new teaching methods will become the core of the course reform.

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