# Some Thoughts on the Engineering Cartography Course of Industrial Engineering Specialitys

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**Abstract.**ªthe thesis provides a general thinking of offering engineering graphics course by analyzing the characteristics of Industrial Engineering subject£º1) Graphics courses ought to be standard into ¡°engineering graphics¡± or ¡°engineering drawing¡±£» 2) Standard teaching material should be made. State Ministry of Education or universities may organize experts to compile a standard teaching material considering IE characteristics, necessary class hours being flexible for various schools. CAD or CPD materials can also be compiled or adapted from available resources£»3) Shortness of Qualified Teachers£»4) Considering the present shortage of the teachers that have overall knowledge about mechanics, civil construction and electric graphics, relevant factories and companies may develop multimedia courseware that integrates the above-mentioned knowledge and supply them for teaching use£»5) School hours of the course can be increased reasonably. The school hours needed in CAD could be involved. Two teaching materials, of engineering graphics and CAD, may be adopted. It is the best for one teacher to carry out the course. Well, two teachers are acceptable if situation doesn¡¯t permit.

## Introduction

Engineering graphics is one of the most essential and necessary foundation courses for engineering majors. The quality of the course directly affects how well students will be when study subsequent foundation and specialty courses. Engineering graphics course is commonly offered in high-tech engineering specialty. The representative ones include a course entitled Descriptive Geometry and Mechanical Drawing offered for mechanics and electro-relevant specialties and the engineering graphics course offered for civil engineering specialty. Available graphics courses also involve those concerning computer-produced drawing (drawing function in CAD).

The latest definition of quality by ISO is: a set of intrinsic characteristics of product, system or process that bears on its ability to satisfy the needs of the customers and of other concerned parties. Since its birth, industrial engineering gives priority to the quality of ¡°product¡±. Product here means the product in a broad sense, including hardware, software, processing materials and services. Quality and reliability fall into the category of industrial engineering. Modern production systems like LAF all premise on quality assurance and aim at the customers¡¯ satisfaction. Great changes have taken place in today¡¯s definition of quality, whose connotation is updated. It requires the enterprises and other economic organizations in accordance with the customers¡¯ demands to adjust type, batch and index of products, even including packaging.ISO9000 family standard and ISO14000 series standard are coordinated with each other. Modern industrial engineering requires that quality management system of modern production system should be integrated with environmental protection consciousness. Green manufacturing and green apparatus are popular throughout the world. The prerequisite of enhancing the efficiency is to assure the quality. To enhance the quality by efficiency and to ensure the efficiency by quality have become the soul of modern industrial engineering.

Industrial engineering, devotes itself to increase system efficiency and benefit through tapping latent power, is a newly emerged interdisciplinary. In China, it is a developing specialty of vitality

and potential. Since 1993, more than forty domestic colleges and universities have formally offered Industrial Engineering specialty. Quite a lot schools are actively making preparations for bringing the specialty into being.

Since industrial engineering possesses the characteristics of both technology and management, the specialty subjects itself to different faculties in our colleges and universities. For instance, some universities put the specialty under the catalogue of Management College (or Department), some under that of Mechanics College (or Department), some under other faculties (such as Resources Engineering), some others then take the specialty as an independent department; several universities even offer Industrial Engineering (IE) specialty in both Mechanics College (Department) and Management College (Department). Though the Ministry of Education presently has approved to set Industrial Engineering specialty as a secondary subject under Management Science and Engineering (the first-level subject), most universities still take it as a specialty offered by engineering-concerned departments because they hold the idea that Industrial Engineering must be supported by certain technology. Industrial Engineering fellows have reached a common understanding that an Industrial Engineering specialty is not a qualified specialty if it has no technological background.

Industrial Engineering almost involves every area or place of human activity. Theoretically speaking, Industrial Engineering technicians should be familiar with all kinds of engineering techniques. However, the reality is another story because students are limited in both their time at school and energy. Therefore, most colleges and universities select extensively covered electromechanical technologies to support Industrial Engineering.

As what was said above, it is evident that the requirements on industrial graphics course for Industrial Engineering are different from that for other engineering specialties. The author makes a summary as the following:

1) Course content should be all-sided as much as possible that mechanical drawing, electric (electrician and electronic) drawing and construction drawing must be involved. Besides, students are also required to command the latest standards on some signs, symbols and terms.

2) The course has quite high requirements on computer-produced drawing because modern Industrial Engineering largely relies on computers. The professionals who work in virtual industrial engineering, analogue simulation, etc should well command CPD skills.

## The Status Quo and Difficulties of Offering Engineering Graphics Courses

The author has participated in various international academic conferences and teaching symposiums concerning Industrial Engineering and engineering management for many times. The author believes that, through what he learned, the offering of IE engineering graphics courses in China is far from satisfaction.

At present, though courses of engineering graphics have been offered by almost every IE specialty, they are various distinctly from courses names and class hours. Some universities name the course as descriptive geometry and mechanical drawing, the same as that offered in mechanics specialties. But the class hours are not adequate. Several universities do not offer separate graphics courses; instead, they are put under the catalogue of mechanical foundation courses with set class hours. Only a few universities offer engineering graphics course, of which the class hours are merely about 70; the teaching content of the course is not worthy of its name for the teaching material is in fact mechanical drawing. Most universities do not offer CAD (computer aided design) courses.

Apart from the above, the teachers who are in engineering graphics courses are not sufficiently ideal and the requirements called by the specialty are far beyond their teaching levels and capabilities[1-3].

## Reasons and Measures

A. Reasons

How to assure graphics courses quality is a task that Chinese IE teachers and professionals are facing. The reasons why there are above-mentioned problems in the courses mainly lie in:

1) Inadequate understanding towards IE. Presently the majority of our colleges and universities have offered IE specialty not long before and are not clear about the appropriate way of offering graphics course so as to meet IE requirements; even those elite universities that began to offer the specialty earlier lack of experience since their graduated students have stepped into the society short time ago; qualified professional teachers are in urgent need due to recent enlargement of students enrollment; many teachers lack of sufficient understanding towards IE subject, considering it a management specialty and graphics knowledge not very important.

2) Shortage of a unified ideal teaching material. One of IE goals is to cultivate students who are able to undertake corresponding engineering technological jobs. In the foundation course of engineering technology, engineering graphics is essential since it is a communicative tool, a language used in the subject. Technicians won¡¯t do without it. Currently, however, not a unified teaching material of complete content can be found. As a result, favorable teaching effect will never be reached without an ideal teaching material.

3) Shortness of Qualified Teachers. The graphics teachers in colleges and universities mostly shifted their professions from original mechanics or civil construction. Knowledge commanded by many teachers, who haven¡¯t got a chance for further study for a long time, should be updated immediately. In particular, engineering graphics courses offered in IE require the teachers to have extensive knowledge about the subject, be familiar with the latest standards in mechanics, civil construction and electric & electronic as well as well master CAD. However, in most universities except few elite ones, there is a great want of teachers who can deal with regular teaching, not to mention excellent and capable ones. Nowadays, with teaching reforms in colleges and universities deepening, traditional graphics course and Auto CAD courses tend to be combined into computer engineering graphics course. Generally speaking, quite a number in available teachers in colleges and universities are seen obviously with inadequate abilities in teaching relevant courses[4-5].

B. Handing Measures

As a rising subject, Industrial Engineering will surely bring forward increasingly great influence towards China¡¯s economic development. Hence, our educational authorities must attach great importance to IE subject. The author believes that the following measures should be taken to solve the problem of industrial graphics courses:

1) Graphics courses ought to be standard into ¡°engineering graphics¡± or ¡°engineering drawing¡±. According to the IE characteristics and requirements, graphics-concerned courses should be standardized as ¡°engineering graphics and drawing course¡±. Resources show that many IE specialties offered by American and Taiwan colleges and universities name the course ¡°engineering graphics¡± (including computer produced drawing) Engineering graphics should involve mechanical drawing (as a main part), electric & electronic drawing and civil engineering drawing.

2) Standard teaching material should be made. State Ministry of Education or universities may organize experts to compile a standard teaching material considering IE characteristics, necessary class hours being flexible for various schools. CAD or CPD materials can also be compiled or adapted from available resources.

3) More qualified teachers ought to be trained. In view of the status quo of teacher resources, we believe that every university should take measures to strengthen talent team by introducing high-quality teachers and sending excellent young teachers for further study so as to promote the integral level. Besides, we suggest that conditional elite universities offer special subject of engineering graphics to cultivate high-quality professionals.

4) Considering the present shortage of the teachers that have overall knowledge about mechanics, civil construction and electric graphics, relevant factories and companies may develop multimedia courseware that integrates the above-mentioned knowledge and supply them for teaching use.

5) School hours of the course can be increased reasonably. The school hours needed in CAD could be involved. Two teaching materials, of engineering graphics and CAD, may be adopted. It is

the best for one teacher to carry out the course. Well, two teachers are acceptable if situation doesn¡¯t permit.

## Conclusion

Industrial drawing course, as a component of industrial graphics, still has many problems worthy of being discussed. And the course calls for support from the whole society. We have reasons to be convinced that through the cooperation and efforts of the workers and teachers in IE subject and industrial drawing, all the difficulties and problems now existing in the course will be finally resolved. Industrial Engineering specialty in China must have a bright and promising future.

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