The Practice Exploration of Mechanical Drawing Teaching Reform

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Keywords: Machinery Drawing; Teaching Reform; Theory and Practice; Space Imaginative Faculty; Practice Exploration

Abstract. Mechanical Drawing is a compulsory professional basic course of mechanical engineering and related professional. Considering the characteristics of Mechanical Drawing that course contents are much and miscellaneous, class hours are relatively tight, courses learning requires a strong spatial imagination, and course knowledge is with strong theory and practice, a series of teaching reform practice explorations are carried out. Such as according to different specialty, adjusted teaching outline; basing on the integration of theory and practice teaching philosophy, the teaching system of Mechanical Drawing experiments and practices links are established; a series of effective measures are taken to mobilize the enthusiasm of students and improve teaching effectiveness; and the curriculum assessment methods are reformed to focus on capacity-building and so on. The better teaching results are achieved.

Introduction

Mechanical Drawing with the characteristics of strong theory and practice is a compulsory professional basic course of mechanical engineering and related professional. Mechanical drawings are composed by graphics, symbols, and words and digital and so on, is a technology language of mechanical engineering; a tool for technical exchange of technical personnel; and is important technical information for designing, manufacturing, using and repairing products. The course group teachers in the years of teaching practice, for the characteristics of Mechanical Drawing course that knowledge is much and miscellaneous, with strong features of theory, practice and profession, a series of teaching reform measures are taken, such as adjusting syllabus according to different professional, the construction of experiments and practices links teaching system, and the improvement of teaching methods and teaching means. The teaching quality of Mechanical Drawing course is improved and obtained good teaching effect.

The Contents and Features of Mechanical Drawing Course

The contents of Mechanical Drawing course include basic drawings, descriptive geometry and mechanical drawings, the contents and characteristics of each part are shown in Table 1, and the general characteristic of Mechanical Drawing are shown in Table 2 [1-2].

Adjust Syllabuses Basing on Different Professional

Different profession has the different needs of drawing knowledge, and the application of drawing knowledge in subsequent related courses and work practice are vary. Therefore, combining with the total amount of different professions drawing course class hour’s arrangements, cleared the drawing knowledge needs of different profession, featured teaching contents, determined the focus and difficulty of teaching contents, and timely adjusted the curriculum and optimized the teaching contents, which are more conducive to achieve the teaching purpose and good teaching effect [3,4].

Table 1 The contents and each part's characteristics of *Mechanical Drawing*

Course contents	Specific contents and characteristics
Basic drawings	The basic provisions of *Mechanical Drawing* and *Technical Drawing* national standards. The theory, knowledge and skills of this part are the criteria and basis for learning to read and draw mechanical drawings, and contents are more and complex.
Descriptive geometry	The basic principles and methods of orthographic, graphic space geometry, and graphic simple geometric space problem. Requiring students to have strong spatial concept, skills of strong spatial imagination and thinking.
Mechanical drawings	Drawing and reading parts and assembly drawings of common components. Mechanical drawing is the practice and application of descriptive geometry and basic drawing, which requires students to master the basic ability of drawing and reading parts and assembly drawings of common components through lots of practices of drawing and reading drawings.

Table 2 The general characteristic of Mechanical Drawing

No.	The general characteristic
First	The course contents are more and complex, and the class hours are tight. In our school Agricultural Machinery arranges 90 class hours that is relatively abundant. Measurement and Control, New Energy, Mechanical and Electrical, and other professions arrange 60 hours that is more intense. Food Science, Biological Engineering, Environmental Science and other professions arrange 36 hours that is very tense.
Second	Courses learning require students to have a strong spatial imagination, need the help of multimedia, physical models and other visual teaching tool, and by the exercises of drawing and reading drawings from objects to drawings and drawings to objects.
Three	The course combination of theory and practice is strong, in class and after class requires a lot of homework exercises to strengthen student's ability of drawing and reading drawings.

Based on the Integration of Theory and Practice Teaching Philosophy, the Teaching System of Mechanical Drawing Experiments and Practices Links are Established

Based on the work task, and the integration of theoretical knowledge and practical hands-on teaching theory, the experiments and practices links system of Mechanical Drawing is built. In our school Agricultural Machinery profession for example, the Mechanical Drawing experiments and practices are divided into two parts of curricular and extra-curricular, shown in Fig.1. In the Mechanical Drawing experiments and practices links teaching, teachers switched roles becoming expertise mentors to guide students completing a task, achieving the unity of knowledge and skills, processes and methods, and attitudes and values learning, students showed good spirit of studying [5,6].

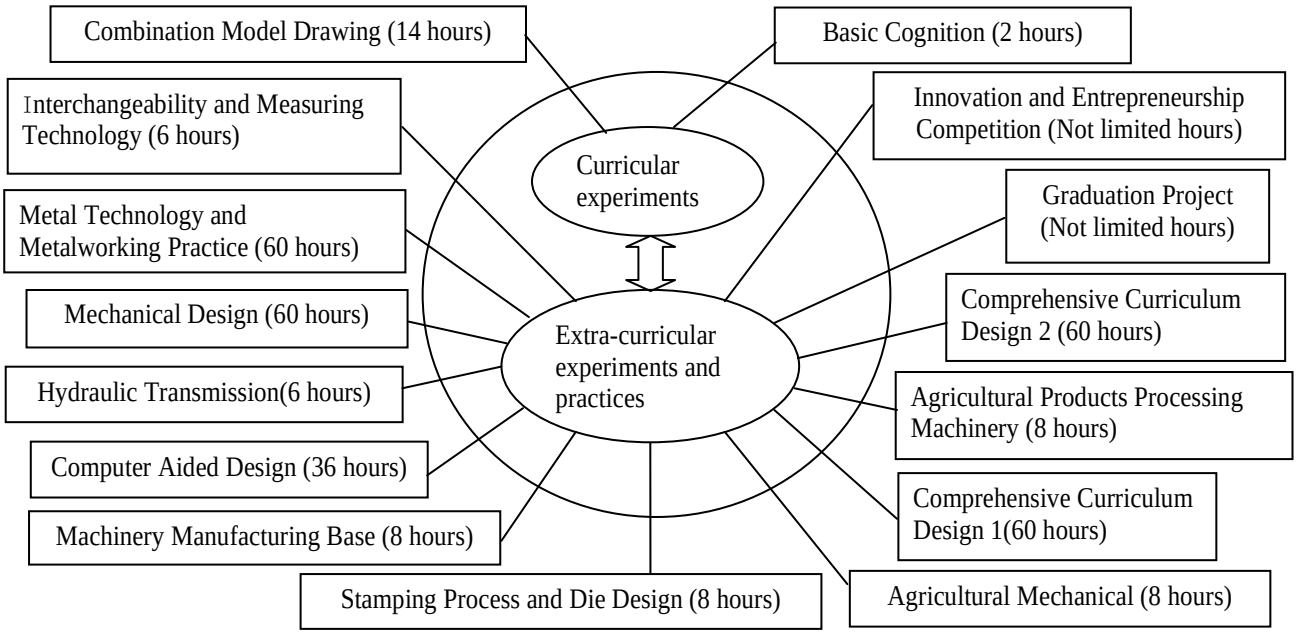

Figure. 1 The architecture of Mechanical Drawing experiments and practices links

Taking Effective Measures to Mobilize the Studying Enthusiasm of Students and Improve the Teaching Effectiveness

Due to lack of space imagination and related engineering background knowledge, students generally responded more difficult in early learning. Considering the characteristics of course contents and students in the curriculum teaching process, teachers took appropriate teaching methods, and improved teaching means and measures, which mobilized the students' interest in learning, and improved teaching quality and ensured the teaching effect.

Teaching Well Course Introduction to Stimulate Student Interest in Learning. In the teaching of introduction, based on the introduction of course characteristics, tasks, contents, learning methods and so on, combining with the engineering examples, made it clear to students that drawing knowledge derives from production practices but serves the production practices, and mechanical drawings is the language of engineering, prompting students to recognize that the course have something to learn, inspiring the desire of students learning. In addition, making students to realize that drawing knowledge is not only play a very important foundation role on the learning of subsequent professional courses, and mechanical drawings as an communication tools of engineering technology personnel, are widely used in engineering practice. At last, making students to understand that mechanical drawings knowledge is related to the vital interests of the student employment, work and so on. All above those effectively stimulated students' intrinsic driving force to learn drawing courses [7, 8].

Combining with Teaching and Training to Inspire Students' Initiative. *Mechanical Drawing* knowledge has strong practicality, some drawing theoretical knowledge require by the appropriate graphics work practice to master. In the teaching, combining with teaching and training, through classroom and after-school job drawing practice, so that students gradually mastered the capability of drawing and reading drawings.

Creating Democratic and Harmonious Atmosphere to Establish the Learning Confidence of Students. Teacher should become a guider and motivator of learning for students, through classroom questioning, student demonstrating drawing, and discussion and so on, to create a democratic and harmonious teaching atmosphere. Teachers should be good at finding the thinking bright spot of students, giving a full understanding to student's wrong, encouraging students dare to think, say, do

and make mistakes, so that students mastered the knowledge in the process of making mistakes and correcting mistakes [5].

Taking Visual Teaching Means to Train Students' Spatial Imagination. The learning of mechanical drawing require that students should have strong spatial imagination, using physical model assisted instruction and the use of multimedia teaching means in teaching, can effectively improve students' spatial visualization and analysis capabilities, and enhance students interest in learning to master drawing.

Using Physical Model Assisted Instruction to Improve Students' Perceptual Knowledge. Perceptual knowledge is the basis for the formation and development of spatial imagination, through the observation and analysis of the physical model, the space perceptual knowledge of objects are built in the minds of students, and space frame are formed, then be abstracted to form a planar graph of space physical. By the repeated conversion exercises of diagram and objects, so that more three-dimensional information is stored in the mind of students, and thus enhanced the ability of spatial thinking [9].

Taking Multimedia Teaching Means to Train Students' Spatial Imagination. Students in the course of learning, because the concept of space is not established, resulting in poor spatial imagination and course learning difficulties. Using vivid, specific visual images of multimedia, the principles of orthographic projection, and the formation of three views are vividly and visually displayed, so that students clear at a glance, helping to establish the concept of space, train space analysis and imagination, and improve teaching efficiency [9, 10].

Reforming Curriculum Assessment Methods to Focus on Capacity Building

Course evaluation is the main basis and means to assess student learning, and test teaching quality and effectiveness. Mechanical Drawing is a strong practical course, the main task of courses is to train students with the capabilities of drawing and reading drawings, but the traditional closed book written can not comprehensive reflect the full range of the skills of students drawing and reading drawings. The new evaluation methods that combine the knowledge assessment and skills assessment, through the great work of drawing and reading drawings, and the practice links of drawing parts and assembly drawings, which on the one hand more objectively reflect students' mastery situation of drawing knowledge, while strengthen students skills of drawing and reading drawings. In addition, changes the way of grading evaluation methods, take the way of comprehensive evaluation that based teacher evaluation, supplemented by student peer assessment and self-assessment, all these can give students objective and comprehensive assessment, strengthen students' ability of drawing and reading drawings the same time, and highlight the cultivation and improvement of students' comprehensive ability.

Summary

Mechanical Drawing course teaching effect not only has a direct impact on subsequent professional courses study, experiments and practices involving drawing knowledge, graduation project and innovative design contest, and as well as has a significant impact on student work, employment and scientific research, etc. Therefore, how to ensure teaching effectiveness of Mechanical Drawing course, enable students to master basic skills of drawing and reading mechanical drawings, is bounden duty of drawing course teachers. Courses teachers must be based on a high degree of responsibility and mission to make unremitting efforts to explore Mechanical Drawing teaching reform, and continuously improve the Mechanical Drawing teaching effectiveness.

Acknowledgements

This work was financially supported by the Project of Tianjin Agricultural University Mechanical Drawing Excellent Courses (201304).

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