

Exploration and Practice of Research-based Learning in Civil Engineering Drawing Course

Feng Qiao^{1, a}

¹Department of Civil Engineering, Luoyang Institute of Science and Technology, Luoyang 471023, P.R. China

^ajoearch888@yeah.net

Abstract. Through the reform and practice of research-based learning teaching mode in civil engineering drawing course, this paper explores the ways to reform the teaching method, which takes students as the main body and takes the coordinated development of knowledge, ability and quality as the goal, and solves the difficult problems in teaching by using appropriate teaching methods and research-based learning, so as to train students' practice and innovation ability, and guide students to change the passive learning mode into the active exploratory learning mode, put forward suggestions and measures to improve the reform of the independent research learning mode of civil engineering drawing course.

Keywords: Drawing Course, Research-based Learning, Teaching Ideas, Teaching Practice, Teaching Evaluation

1 Introduction

As an important basic course of civil engineering specialty, the main goal of civil engineering cartography course is to improve students' three-dimensional spatial imagination and spatial analysis ability by cultivating the basic concepts, principles and applications of projection method. At the same time, students are guided to draw by learning relevant national standards of cartography. Read engineering drawings and master the operation methods of various drawing instruments. Combining with the characteristics of Civil Engineering Specialty in our college and aiming at cultivating applied talents, the teaching and assessment of the course should be based on the application, grasp the scope and depth reasonably, integrate the teaching content through continuous exploration, lay emphasis on practicability and pertinence in the teaching content and teaching methods, and take into account the basic principles as well as the teaching methods. The study and training of plane and three-dimensional expression, on the one hand, lays equal stress on drawing and drawing, gives guidance to the drawing and drawing methods and steps of typical drawings, and grasps the relevant drawing norms, methods and techniques; on the other hand, pays attention to the specialty of drawing and drawing, from bare-handed practice, ruler drawing to computer drawing, from drawing tools. To grasp the essentials of drawing skills, students can acquire the basic drawing knowledge and skills that contemporary engineers and technicians should possess.

Engineering drawings in civil engineering drawing are not only an important technical document of engineering technology department, but also an important tool for expressing and communicating design ideas. As the first specialized technical course that students come into contact with after entering school, this course systematically improves students' spatial imagination thinking ability and comprehensive transmission ability of image information. The content of training is rigorous and logical. Studying it is helpful to cultivate the students' conscientious and rigorous spirit of engineers in pursuit of excellence. For this reason, for many years, the cartography teaching team of Civil Engineering College has been exploring research-based learning strategies aiming at cultivating students' initiative to discover problems and actively solve problems, collecting ideas, adopting appropriate teaching methods to improve teaching quality, and constantly exploring teaching and assessment methods of research-based learning.

2 Teaching Thoughts of Research-based Learning

Educating people is the fundamental task of higher education. In the personnel training mode, exploring the teaching ideas of research-based learning is an important issue that should be paid attention to in the transformation and development stage of the college. Research-based learning refers to learners actively consulting materials according to research objectives or characteristics of research projects, learning in the process of summarizing and collating materials, independently identifying problems, raising problems, discussing problems and exploring ways and means of solving problems in learning practice, and gradually forming independent thinking, being good at discovering and daring to innovate^[1].

2.1 Focus on the Integration of Design Object Expression and Spatial Thinking Ability Training

The teaching aim of civil engineering drawing course is to satisfy the needs of senior engineers and technicians for expressing design objects, which requires the cultivation of their effective spatial thinking ability. In view of this goal, research-based learning encourages students to actively participate in the process of teaching activities. On the basis of obtaining sufficient knowledge, students can design questions, answer questions, comment and explain, and then

evaluate and score. This is conducive to students' building their external knowledge system in their own cognitive structure.

2.2 Focus on the Combination of Foundation and Advancement

Introducing the modern computer graphics teaching practice course into the traditional engineering drawing teaching is not only a change in the way of drawing, but also a reflection that the teaching content itself can meet the requirements of practical work from the basis. It lays a foundation for the comprehensive expression and reading of information graphics in the traditional basic and professional courses of civil engineering. It also lays a good foundation for the following modern computer aided design (CAD), finite element analysis (FEA), building information model (BIM) and other courses.

2.3 Focus on the Integration of Civil Building Materials Industry and Local Economic Construction Needs

In order to meet the needs of civil building materials industry and local economic construction, practical courses such as architectural drawing and building CAD are specially offered to college students after the course of Civil Engineering Drawing Theory. The assessment of these courses should try to extend the basis of engineering drawing to the professional basic field, and directly serve the follow-up professional courses as well as the completion of the course, thus meeting the needs of employers for personnel training.

3 Teaching Practice of Research-based Learning

Based on the characteristics of research-based learning and combined with the reform of teaching contents and specialty settings of civil engineering cartography, the feasibility of the application-based assessment model of research-based learning and students' self-evaluation is demonstrated in practice, and the Research-based Learning Model Reform for students' learning ability, comprehensive practical ability and comprehensive quality training institute is summarized^[2]. The practical results further put forward suggestions and measures to improve the independent research-based learning model reform of civil engineering drawing.

3.1 Reasonable Use of Appropriate Teaching Means

The application of engineering drawing and computer drawing technology runs through all stages of architectural engineering design and construction. From the initial conceptual design, sketch design, scheme design, preliminary design to construction drawing design, all links need to draw and read engineering drawings, and use manual surveying and mapping, drawing with instruments, computer drawing. There are many ways to make two-dimensional design drawings and three-dimensional modeling design drawings. Therefore, in the course teaching, through the display of multimedia courseware, especially the stage animation demonstration, students can feel the expression content and concrete application of engineering drawing and computer drawing in different design stages in a hierarchical and orderly way, so that students can have a general understanding of the course overview and learning content. For example, the descriptive geometry part of drawing has always been a difficult point in learning, which requires students to transform their previous plane thinking habits into three-dimensional graphical thinking. Therefore, in learning, students must always be reminded to pay attention to the analysis of spatial geometric relations and the relationship between spatial geometric elements and plane graphics, requiring students to take every step. The process of problem solving illustrates its corresponding ideas and principles of application. On the other hand, students are required to clarify the meaning and spatial relationship of each concept, principle, rule and method, and to fully grasp these basic contents and make good use of them by practicing after class and demonstrating on the platform. With the development of these teaching activities, students no longer simply read books, but actively use rulers and compasses to draw on paper, and make some simple models with the help of simple materials such as foam plastics and plastic accelerating boards to intuitively understand the composition and composition of the building. When demonstrating the problem solving on the students' platform, it is necessary to clarify the known conditions clearly first, and then make spatial analysis by using the projection principle that has been learned, to study how to obtain the required results from the known conditions and what steps are needed to achieve the final results. At the same time, we should make every effort to be accurate in drawing. After completing the drawing, we should make a comprehensive check. The following students can judge whether there are any mistakes in the drawing process, whether the drawing is accurate or not, and give a reasonable score according to the requirements of the examination.

3.2 Using Research-based Learning to Solve Difficult Problems in Teaching

The descriptive geometry part and the drawing part of civil engineering drawings need students to have full spatial imagination and three-dimensional construction on the basis of grasping the basic principles and rational thinking. This transformation of two-dimensional and three-dimensional is throughout the study of engineering drawings. For example, solving the ridge line of sloping roof, its position and spatial shape has always been one of the difficulties for students to learn. In the course of teaching, we use multimedia courseware and computer graphics software to assist teaching, dynamically display the formation of roof and gutter, the change of their relative position relationship with architectural form, and different projections. Students then expand and practice the projection methods of different roof forms under various plane shapes, and finally master the projection drawing method of roof ridge lines of sloping roofs. In the part of axonometric projection, students are encouraged to use computer graphics software such as SKETCHUP to design

three-dimensional solid modeling, construct real-time three-dimensional objects, and dynamically demonstrate the formation process of three-dimensional objects. Student's independent research-based learning not only makes them really understand the drawing method of Axonometric projection, but also further familiarizes them with the solid modeling method, which not only embodies the application of information technology in teaching, but also achieves the teaching effect that traditional teaching methods are difficult to achieve, and helps students to carry out the transform between three-dimensional space and two-dimensional plane.

3.3 Developing Students' Engineering Practice and Innovation Ability by Using Research-based Learning

Civil Engineering Drawing Courses have such characteristics as: listening to the lecture is clear, doing problems is difficult; looking at the drawings is easy, drawing is difficult. In order to solve this problem, students are required to clarify the relationships and relative positions between the most basic geometric elements in space, such as parallel, vertical, intersection, etc. in the normal assessment and final assessment. Then, a series of questions from shallow to deep, from simple to complex are completed. Through efficient exercises, the students gradually realize that each question has to go through the following logical steps: first, the two-dimensional known conditions in the question are transformed into three-dimensional information in space, and the position relations of various spatial geometric elements are clarified; secondly, the basic drawing method is worked out based on the projection principle, and the drawing steps are sorted out. Finally, the steps of solving space problems are implemented on the projection map, and the correct answers are obtained step by step. What's more, in the process of research-based learning, students can constantly put forward new ideas and methods to solve problems, and their practical and innovative abilities have been greatly improved. In the teaching of architectural and structural surveying and mapping, we introduce research-based, Inquiry-based and collaborative learning methods into the practical teaching of Surveying and mapping, guide students to group and fully demonstrate various expression schemes, find out the problems existing in surveying and mapping objects, boldly evaluate the characteristics of various expression schemes, and finally select the best expression scheme. At the same time, in the process of Surveying and mapping, students learn the use of Surveying and mapping tools by themselves, discuss and solve the problem of dimension measurement of various building components, and effectively cultivate students' practical engineering operation ability and innovation ability.

4 Teaching Evaluation of Research-based Learning

Since the opening of engineering drawing series courses, teachers not only undertake the teaching tasks of engineering drawing courses, but also undertake some senior professional courses, professional elective courses, various kinds of internships and teaching tasks to guide graduation design. They extend the teaching content of the basic course of engineering drawing technology to other teaching links, and at the same time, infiltrate the development of other teaching links into the basic course of drawing. This coherent and systematic teaching context can help students master the basic knowledge of engineering drawing and also enable them to understand the frontier development of the subject^[3]. For example, in the stage of graduation design, research-based learning will transform passive cramming learning mode into active and autonomous learning mode, guide students to master scientific design methods by reading a large number of professional drawings and design works, and enable students to learn to use them independently; at the same time, encourage students to go out of the classroom on the basis of textbooks at the same time. We should make full use of all kinds of advantages of teaching resources and experimental equipment to improve the research ability and the ability of comprehensive application of knowledge in the process of acquiring knowledge^[4]. Through the annual evaluation of the teaching effect of the teachers in the whole school organized by the school educational administration department and the situation reflected by the colloquium organized by the college, it can be seen that the research-based learning model and the corresponding teaching methods can really fully mobilize the enthusiasm and initiative of students in learning, and set up for the follow-up courses and graduation. Considering that the future work has laid a good foundation, students' spatial thinking ability and image expression ability have indeed been trained and improved.

5 Conclusions

Several years of exploration and practice have basically achieved the desired results in the teaching reform of the research-based learning model of civil engineering cartography. More importantly, it has also played a very positive role in cultivating students' good psychological learning quality and excellent professional quality^[5]. The following three points can be summarized preliminarily:

Firstly, the research-based autonomous learning model provides a vivid and active learning atmosphere for the previous relatively boring and passive cartography course learning, and to a certain extent, makes students truly become masters of self-learning. Novel and challenging learning methods and practical projects enable students to change from "I want to learn" to "I want to learn". In the long-term teaching activities, I deeply realize that the potential of students is huge, they are willing to prove their strength. As long as they are provided with a platform to give full play to and display their comprehensive strength, they can stimulate their potential and rapidly enhance their ability to learn and apply comprehensive knowledge in practical research projects.

Secondly, students are willing to accept research-oriented topics with practical application value, even if they encounter various difficulties, they are also willing to face challenges, because they understand the value of giving and

harvesting in the complete process of carrying out a specific work, not only accumulate practical work experience, but also experience real social labor. In this process, many excellent qualities and good psychological qualities have been trained, exercised and improved, and ideas have been grown and improved.

Finally, more importantly, students learn to cooperate and cooperate, communicate and communicate in an independent and open learning environment, which effectively improves the comprehensive efficiency of learning. It also understands the meaning of collective wisdom ^[6].

It can be seen that research-based learning mode is a learning mode worthy of promotion. Combining with the in-depth development of the teaching of civil engineering cartography, we can continue to explore practical problems and suggestions for improvement, summarize experience and gradually improve it.

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