

Construction of four-dimensional practical teaching system for engineering cost specialty in vocational colleges

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Abstract: *Practical teaching is an important component of talent training in higher vocational colleges. It is very important to establish a practical teaching system according to the talent training objectives and choose the supporting practical teaching content. Engineering cost major is an application-oriented major with strong practicality. Graduates of this major are mainly engaged in engineering cost consulting activities, and their professional practical skills during school will directly affect their ability to participate in work. This paper proposes to construct a four-dimensional practical teaching system of engineering cost major based on engineering type, practical training type, practical way and professional category, and designs practical training courses from the simple to the deep and step by step, so as to exercise students' practical ability from a multi-dimensional and all-round way.*

Keywords: *Vocational college; Construction cost; Practical teaching*

1. Introduction

The major of engineering cost is a complex major of engineering technology, engineering economy, management, construction law and engineering informatization, and also a major of cultivating scientific quality, humanistic idea and professional ethics. This major pursues a meticulous craftsman spirit and pays attention to the sustainable development of business ability. Therefore, graduates of engineering cost major are required not only to have sufficient theoretical knowledge and professional quality, but also to master basic professional skills, so as to be competent for the engineering cost consulting work of construction related companies.

Engineering practical operation ability comes from practice, and only through strengthening the training of professional skills can we acquire the ability to deal with practical problems. The engineering cost major is a major that attaches great importance to the ability to deal with practical problems, so it has always paid attention to the cultivation of professional skills^[1]. The practical teaching of engineering cost should be demand-oriented, and a practical teaching system should be established with practice ability training as the core. At the same time, the practical teaching of engineering cost cannot exist in isolation. It is necessary to have the perspective of development connection, expand the relevant knowledge of the whole life cycle of linkage engineering project, and create a comprehensive practical teaching system of engineering cost.

2. Construction of four-dimensional practical teaching system of engineering cost major

Engineering cost major should focus on cultivating students' ability in practical operation and establish practical teaching aiming at improving problem-solving ability^[2]. Through years of practical application and improvement, it has gradually established a four-dimensional practical teaching system with engineering type, training type, practical and professional category. See Figure 1 for the four-dimensional practical teaching system:

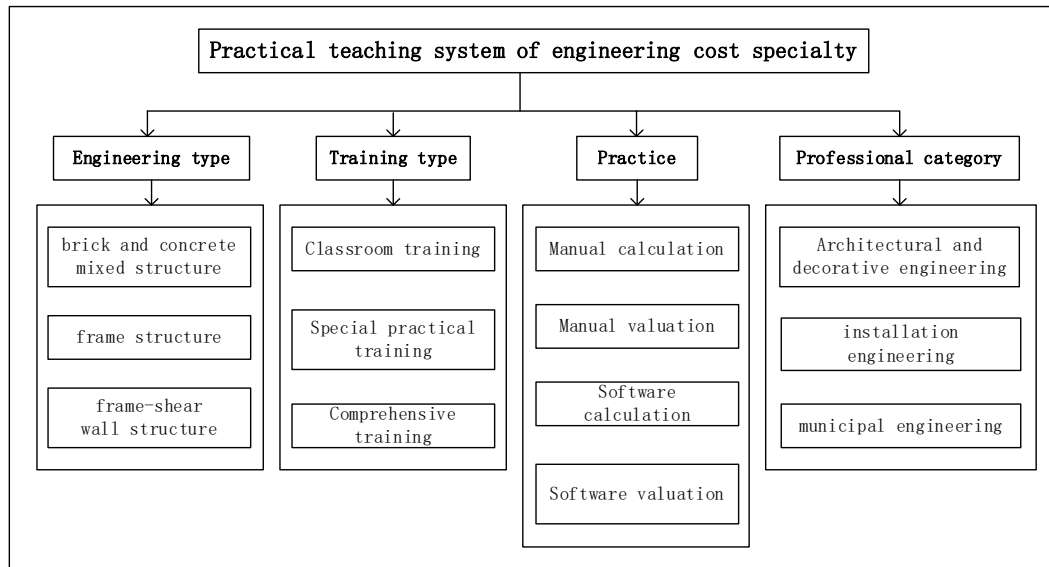


Figure 1: 4-D Practical teaching system diagram of engineering cost major

2.1 Dimension of engineering type

Teaching based on the dimension of engineering type mainly refers to distinguishing various projects according to their building purposes and structural forms, and then selecting commonly used brick and concrete structure, frame structure, and frame-shear wall structure according to the building structure for engineering cost teaching.

To be specific, starting from the use function of buildings, a class of buildings that students have frequent daily contact with and are familiar with are selected as the main training objects, such as student dormitories, teaching buildings, high-rise residential buildings, etc. Then, from a kind of building, different structural forms of buildings are selected as teaching cases, such as teaching buildings as the main object of training. In the first stage, brick and concrete structure teaching buildings are taken as teaching cases, in the second stage, frame structure teaching buildings are taken as practical training cases, and in the third stage, high-rise framed shear wall office buildings of middle and large education groups in the city are taken as practical operation cases. The purpose of this three-stage training is as follows: in the first stage, students should start with simple and repetitive buildings and learn to recognize drawings and calculate quantities; In the second stage, students are trained in drawing recognition and calculation skills of common buildings by using more difficult cases. The third stage is to strengthen students' ability of drawing recognition and calculation for non-standard and multi-form buildings by using difficult cases. Through such training, students can learn the important and difficult points of various engineering drawing recognition and calculation, and finally achieve the purpose of learning different types of engineering drawing recognition, calculation and valuation.

2.2 Dimension of training type

Teaching with the type dimension of practical training mainly refers to the practical teaching carried out from three aspects: classroom training, special practical training and comprehensive training.

Classroom training mainly refers to that after the completion of the explanation of a single theoretical knowledge point, the teacher will lead the students in class to select the corresponding partial and sub-project to carry out the demonstration of drawing recognition, measurement and pricing, and then the students will complete the drawing recognition of similar sub-projects and calculate the engineering quantity and comprehensive unit price by themselves. In the calculation of students, teachers should give timely guidance, and then unified explanation. This training method can not only deepen students' understanding of theoretical knowledge, but also conduct preliminary training of students' practical ability. Special practical training of the course refers to the special training based on the knowledge points of the course after the completion of a professional course, such as the construction drawing reading training after the course of architectural drawing recognition and construction, and the calculation and valuation training of the construction and decoration engineering

of a teaching building after the course of measurement and valuation of building construction and decoration engineering. Comprehensive training is a separate practical course, which is carried out in the last academic year. It is a practical training that integrates the relevant knowledge learned in the professional course, mainly training the ability of drawing recognition, calculation and pricing, and requires the preparation and review of measurement and pricing documents such as bidding quantity list, bidding control price, bidding quotation and engineering settlement.

2.3 Dimension of practice

The method of practice mainly refers to the method of calculating the quantity of works and the comprehensive price, which is mainly divided into four aspects: manual calculation of quantities, manual valuation of comprehensive prices, calculate the quantity of projects by software and software valuation of prices.

Manual calculation of quantities and manual valuation of comprehensive price are mainly used in classroom teaching practice. One is to facilitate the development of training activities, manual calculation of the amount of projects is not much, easy to complete, manual calculation of the comprehensive price is a single project price, the calculation process is simple. Second, through manual calculation, students can strengthen the reading ability of construction drawings, deepen the understanding of engineering quantity calculation rules, and improve the understanding of the comprehensive price valuation process. They can integrate the three basic abilities of reading drawings and calculating quantity valuation, so that students can check the right or wrong results of software calculation and modify methods when using software measurement and valuation. Calculate the quantity of projects by software and software valuation of prices is mainly to let students adapt to the actual work state, software calculation engineering quantity are mainly to draw and identify three-dimensional components to complete, software valuation is to choose quota software automatically calculate the unit price, which greatly reduces the intensity of work, improve the work efficiency, to meet the needs of the development of The Times. The combination of manual calculation and software calculation not only makes students familiar with the rules of engineering quantity calculation, pricing principle and calculation process, but also closely combines with the practical work in the future.

2.4 Dimension of professional category

According to the 2021 Engineering Cost Consulting Statistical Bulletin issued by the Ministry of Housing and Urban-Rural Development, the engineering cost consulting Service Institute is divided into the following majors: housing construction engineering, municipal engineering, highway engineering, thermal power engineering, water conservancy engineering, etc. Among them, the cost consulting service income of housing construction engineering (including architectural decoration and installation) was 67.753 billion yuan, accounting for 59.3% of the total national cost consulting service income. The cost consulting service income of municipal engineering major is 19.792 billion yuan, accounting for 17.3% of the total national cost consulting service income, and the two professional businesses account for 76.6% of the whole cost consulting^[3]. It can be concluded that cost consulting services are mainly focused on housing construction projects and municipal engineering, and the main employment directions of students after graduation are also these two directions. Therefore, the key courses for students majoring in construction cost should be: theoretical study and practical training of housing construction and decoration engineering, installation engineering and municipal engineering.

3. Application practice of 4D practical teaching system of engineering cost major

The specific course is the carrier to realize the teaching idea and training goal, and the value of the practical teaching system is also realized through the practical training course. In order to achieve project-based teaching, we need to customize courses according to professional needs and truly realize project-based teaching through integration with other courses^[4].

Therefore, in combination with the overall curriculum arrangement of cost major in higher vocational colleges, this paper gives the professional practical training teaching curriculum schedule of cost major students in higher vocational colleges based on the four-dimensional practical teaching system, the specific table is shown in Table 1.

To be specific: In the first semester, the course of architectural drawing is offered, in which I will

learn relevant theoretical knowledge and draw relevant lines and legends by hand. After the course, I will have a one-week practical training on drawing, in which I will be familiar with the expression and characteristics of construction drawings by hand drawing construction drawings of brick and concrete structure dormitory buildings, laying a foundation for drawing and calculating.

Table 1: Practical teaching course of engineering cost major

semester	classroom training	special practical training	comprehensive training
1	Architectural drawing	Architectural drawing training	
2	Architectural recognition and construction		
	Auto CAD and Tianzheng Software		
		Comprehensive practical training of architecture (including cognition practice)	
3	Construction cost principle and valuation	Engineering cost principle and pricing practice training	
	Drawing recognition and calculation	Drawing recognition and calculation training	
4	Building construction and decoration quantities list compilation and valuation	Building construction and decoration quantity list preparation and valuation training	
	Installation project measurement and valuation	Installation engineering measurement and pricing training	
	Engineering software measurement and valuation		
	Building information modeling		
5	Municipal engineering measurement and valuation		
6			Post internship (including graduation project)

In the second semester, courses of architectural drawing recognition and construction, Auto CAD and Tianzheng software are offered. The courses of architectural drawing and construction are mainly to complete the training of architectural drawing and understanding of architectural structure in class. Auto CAD and Tianzheng software complete the drawing of construction drawings of brick-concrete dormitory buildings with drawing software through the integrated classroom of science and practice. The comprehensive practical training of architecture (including cognition practice) is a two-week special practical training. Through masonry, plastering, binding of steel bars, erection of scaffolding, support of formwork and other methods, students can have an intuitive understanding of the construction process and strengthen their understanding of construction drawings.

In the third semester, the courses of engineering cost principle and valuation, graphic recognition and calculation are offered. The engineering cost principle and valuation mainly complete the training of the use of quota, and can calculate the comprehensive unit price of each division and item of the project. The course of drawing recognition and calculation mainly completes the understanding of the reinforcement engineering construction drawings of the foundation, column, beam, plate, wall and other components of the frame structure, and completes the calculation of the quantities of each part by hand. At the end of the semester, two special practical trainings were arranged, namely, engineering cost principle and valuation, drawing recognition and calculation in plain method, each lasting one week. The unfinished part of the classroom practical training was continued to be completed. The engineering quantity was calculated by hand and the project unit price and total project price were calculated by software.

The fourth semester is a professional skills training course set up after the completion of the professional basic course practical training. The main classroom practical training includes four courses, including building construction and decoration engineering quantity list compilation and pricing, installation engineering measurement and pricing, engineering software measurement and pricing, BIM modeling, etc. The first two courses are the classroom practical training while learning theoretical knowledge, and the last two courses are in the classroom integrated with practical knowledge. To further study the application of measurement and valuation software, through the software can complete the calculation of engineering quantity and comprehensive unit price and project cost calculation. At the end of the semester, there are two special practical training, including building construction and decoration engineering quantity list preparation and valuation training, installation

engineering measurement and valuation training, each week, requiring the use of the theoretical knowledge and the basic skills of classroom training, using software measurement and valuation to complete the engineering quantity calculation of a frame structure teaching building and bidding control price preparation.

In the fifth semester, I completed the study of municipal engineering metrology and valuation, which was mainly based on classroom practical training. Through the practical training of the previous basic professional courses and specialized courses, I will learn to expand the new major category of municipal engineering, so that students can broaden their scope of knowledge and exercise their independent learning ability.

In the sixth semester, on-the-job practice is the main practice, allowing students to participate in real work and make comprehensive application of theory and practice^[5]. At the same time, during the internship, the school teachers do not leave the guidance post, but work with the enterprise mentors at any time to provide guidance for students, answer questions for students, help them better understand and apply relevant knowledge, and accompany them on the last journey towards society^[6].

4. Conclusion

Practical teaching is an important teaching method for personnel training. The four-dimensional practical teaching system of engineering cost major proposed in this paper can connect the isolated practical training courses and content of each major, thus forming a systematic and hierarchical practical training teaching system. In this teaching system, students can better exercise the practical ability, but also can get more comprehensive practical training, to engage in the future engineering cost professional work have a deeper understanding and understanding, so that students can quickly adapt to the practical work after graduation. The four-dimensional practical teaching system proposed in this paper provides a new idea for the practical teaching of engineering cost major. However, with the wide application of big data, the promotion of prefabricated buildings, the rise of BIM, and the rapid development of artificial intelligence and cloud computing, the four-dimensional practical teaching system still has shortcomings and needs to be continuously improved with the new business forms and new models.

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