

Research on Teaching Reform of Engineering Surveying Course under the Background of Engineering Education Professional Certification

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Abstract: With the rapid development of my country's engineering construction industry, employers need high-quality talents with technical ability and professional quality. In order to cultivate high-quality talents that meet the needs of employers, our college has close contact with employers, actively deepens teaching and curriculum reforms, and adapts to the needs of employers. Based on the background of engineering education certification, this paper analyzes the effectiveness and methods of curriculum reform in the engineering measurement course of water conservancy and hydropower engineering majors in local application-oriented undergraduate colleges from the aspects of teaching content, mode, means and method. The results show that the traditional engineering measurement teaching mode is relatively backward. Local application-oriented undergraduate colleges formulate reasonable teaching content and instrument settings for engineering surveying courses, and further strengthen production-oriented teaching and the reform of diversified teaching modes for obtaining information, which has a good effect in cultivating high-quality talents.

1. Introduction

In order to promote the reform of engineering education in China, improve the quality of engineering education, establish an engineering education certification system that connects with the engineer system, promote the connection between engineering education and the business community and the national mutual recognition of engineering education in China, and enhance international competitiveness [1]. In 2006, the Ministry of Education began to deploy the pilot work of engineering education certification, and began to popularize it in 2009. The China Engineering Education Professional Certification Association launched the latest "Engineering Education Certification Standard" (trial) in mid-March 2015. The standard set Professional Supplementary Standards and Common Standards. The implementation of this system in my country is conducive to improving the quality of engineering education and promoting the cultivation of engineers and engineering and technical personnel in accordance with international standards. It is the basis and

key to promoting the international mutual recognition of engineer qualifications in my country. It is of great significance [2]. According to the requirements of my country's engineering education professional certification standards (2018 edition), the major must have clear training objectives and graduation requirements, and at the same time meet the requirements of the number and structure of teachers. The curriculum system should be able to support the achievement of graduation requirements [3].

Engineering surveying in the major of water conservancy and hydropower engineering in colleges and universities is an important basic discipline course. Measurement technology has been applied in all stages of water conservancy construction, which directly affects the success or failure of water conservancy construction sites, such as dam, bridge, tunnel measurement, etc. It plays a leading role in cultivating students' engineering knowledge and other abilities. For graduates of water conservancy and hydropower engineering, mastering engineering measurement skills is the basic condition for engaging in construction sites, and it is also a necessary technology for students to be competent for front-line work in enterprises after graduation. It is helpful to cultivate students' engineering practice literacy. Engineering measurement teaching usually adopts the mode of "theoretical teaching + in-class experiment + intensive practice". Interspersed with in-class experiments in theoretical teaching, students can combine theory with practice to achieve the purpose of mastery. After the course teaching is completed, a two-week field training will be conducted [4]. However, compared with the traditional measurement teaching system, new technologies such as UAV aerial survey technology and 3D laser scanning technology are gradually applied in the market, and the requirements for measurement accuracy in different engineering practices are also increasingly diversified. The measurement has caused a certain impact. On the one hand, due to the compression of class hours, it is faced with insufficient class hours; on the other hand, new equipment cannot be replenished in time, so in the teaching process, it is faced with the embarrassing situation of "drawing cakes to satisfy hunger". How to take into account the traditional measurement teaching in the limited class time, and introduce new teaching content when the new teaching equipment is insufficient or even not available, which requires us to think about changes when we are "poor", and make full use of virtual teaching, A variety of teaching modes combining three-dimensional simulation, online and offline [5].

2. Background and Existing Problems

With the rapid development of engineering measurement technology, employers need students to have good overall quality. Engineering measurement is not only the layout of construction site stakeout and control points, but also applied in the testing industry. This requires surveyors to have higher practical and theoretical analysis capabilities. Local undergraduate colleges and universities mainly train students to be front-line technical and design talents engaged in construction, design, supervision and testing in cultivating water conservancy and hydropower engineering majors. It is particularly important for the engineering measurement course to cultivate technical talents. However, at present, many local application oriented undergraduate colleges have problems such as outdated and more detailed equipment, slow updating of textbooks, conventional instruments still used in teaching, younger teachers, and most young teachers without corporate experience [2]; The number of training bases is small, which is difficult to match with the real production conditions. In the process of assessing students, it is mainly based on passing the test, lacking subjective initiative, and not really starting from the perspective of improving students' ability. Failing to verify the effectiveness through the results of production practice, the teaching improvement of engineering measurement lags behind. In order to allow students to quickly adapt to enterprise production, improve their technical ability, professional quality and ability to solve problems at work. Local

application-oriented undergraduate colleges and universities should closely follow social development and actively deepen the reform of pedagogy.

3. Teaching Reform of Engineering Surveying Course

Engineering education certification is a specialized certification implemented by professional certification bodies for engineering majors opened by higher education institutions. Engineering education certification mainly advocates the concept of "student-centered, result-oriented, and continuous improvement" [6], focusing on the cultivation of seven core competencies such as familiarity with professional practical skills and the use of creativity. The supporting conditions of engineering education professional certification and engineering measurement course teaching reform are shown in Table 1.

Table 1: Engineering surveying course teaching reform and engineering education professional certification supporting conditions

Engineering Education Professional Certification		Support conditions	Contents of Teaching Reform of Engineering Surveying Course	
core competence	Familiar with professional practical skills	①⑥⑧	Teaching content and instruments	① Teaching content optimization
	Implement standard operating procedures	①③④		② Renewal of instruments and equipment
	Use creativity	①⑧	Reform of teaching mode	③ The combination of teaching and engineering
	teamwork	⑤⑥		④ Production of practical training
	Solve practical technical problems	③		⑤ Strengthen the construction of the second classroom
	Continuous learning	⑥		⑥ The combination of teaching evaluation and industry standards
	Understand professional theory	①		
idea	Keep improve	②	Reform of teaching methods	⑦ Various modern teaching methods
	Results oriented	③④⑤⑥		⑧ Case teaching method
	Student centered	①③④⑤⑥ ⑦⑧		

3.1. Reform of Teaching Content and Instruments

The principle of optimizing the content of engineering surveying disciplines for water conservancy and hydropower engineering majors in Suihua University is based on engineering education certification, "student-centered, training goal-oriented", in order to cultivate students' familiarity with professional practical skills, implement national standard operating procedures, and use creative professional skills Provide a platform for five core competencies such as teamwork spirit, solving practical technical problems, and continuous learning and understanding of professional technical theory. Among them, the practical training courses of engineering surveying can best reflect the implementation of national standard operating procedures. The introduction of

engineering measurement related software reflects the professional skills of using creativity. Familiarity with professional practical skills and understanding of professional theory are included in the entire content system. Specifically as shown in Table 2.

Table 2: The updated content of the engineering surveying course in Suihua University

	Specific optimization content	Completion
The traditional content of theoretical courses is retained	<ul style="list-style-type: none"> ① Angle measurement and level measurement; ③ Distance-measurement and straight line orientation; ④ Basic knowledge of measurement error; ⑤ Control Measurement and wire measurement; ⑥ Surveying and mapping of large scale topographic maps in small areas; ⑦ Basic knowledge and application of topographic maps; ⑧ Basic method of construction lofting. 	completed
New knowledge new technology and new methods in theoretical courses	<ul style="list-style-type: none"> ① Total station and digital integrated mapping technology; ② Global Positioning System (GPS) technology and measurement methods. 	Completed in 2019
Measurement practice training course	Using special surveying practice teaching materials, the course practice focuses on engineering construction staking technology, and in 2020, the RTK automatic staking of Global Positioning System (GPS) will be realized for students' use.	2020 Partially Completed
Related Teaching Software	The introduction of topographic map surveying and mapping software CASS, global positioning system (GPS) processing software, and surveying applet programming technology suitable for engineering can be completed by opening a second class.	2021 Partially Complete

3.2. Reform of Teaching Mode

3.2.1 Production-Oriented Teaching Mode

The engineering surveying course of Suihua University makes the students and the employees of the enterprise consistent with the requirements through teaching reform, moves the teaching classroom to the construction site, and focuses on strengthening the professional quality and technical training ability. In the teaching process, combine theory (teaching) with practice (construction site), realize practical production, actively promote the construction of second classrooms such as student competitions, and combine engineering measurement teaching assessment with measurement industry standards. This fully reflects the "student-centered, result oriented" principle of engineering education certification.

3.2.2 Combining theory with Practice

Suihua University is a local undergraduate application-oriented college, which mainly cultivates applied talents. The major of water conservancy and hydropower engineering mainly cultivates front-line technical talents. The nature of the major not only allows students to master technical skills, but also requires students to have the ability to solve problems and analyze problems on the spot ability. Through the study of engineering measurement theory and practice courses, students

can not only learn the operation and data arrangement of measuring instruments, but also analyze their accuracy and structural stability through data. For example, the bearing capacity of the foundation is analyzed through the settlement and displacement of the foundation of dams, bridges and buildings. Therefore, in the teaching reform of engineering surveying course, a combination of classroom theoretical teaching and actual construction site is adopted, and students are actively encouraged to participate in practical activities such as foundation pit monitoring, floor stakeout and control point layout in the actual construction site, which allows students to participate in practical activities in engineering practice. Familiar with engineering measurement skills and can learn to analyze data, judge its reliability and accuracy, and fully cultivate students' ability to solve technical problems at work and the ability to implement national standard operating procedures. For example, in the construction of the eleventh student apartment in Suihua University, students were led to carry out actual control point layout, foundation pit slope monitoring, and let students learn to analyze data and compile relevant reports.

3.2.3 Production of Practical Training

The production of practical training refers to organizing students to carry out practical training in accordance with the production process of the enterprise during the teaching process, focusing on cultivating students' ability to implement national standard operating procedures [2]. To this end, Suihua University signed an internship training base with a number of enterprises such as the Provincial Longjian Road and Bridge Group Corporation and the Provincial Water Conservancy and Hydropower Supervision Company. It can provide teachers and students with irregular practical training to continuously enrich their practical ability. Individual courses with strong practicality, such as engineering surveying, engineering drawing recognition and construction courses, are combined with the combination of teachers with strong on-site practical ability hired from engineering units to come to the school. The one-week survey practice link in the talent training program allows students to complete the layout of control points, construction stakeout and foundation pit monitoring at the construction site, and to summarize the work. Suihua College of Agriculture and Water Conservancy Engineering attaches great importance to students' graduation practice: every summer vacation, the party and government leaders of the colleges and departments lead a team to form an inspection and assessment team. Internship inspections for students from Beijing, Hebei, Kunming and other places). Practical courses and internships are an important part of the engineering surveying course, and they are also the fastest and the first work for students to enter the enterprise, such as the layout of on-site construction control points and construction staking and other basic work. In order to enable students to improve their measurement technology and professional quality, our college organizes young measurement teachers to go to practice units to assess students' measurement practice and work ability every year, so that the theoretical teaching content of the course can be closely combined with production practice.

3.2.4 Classroom Construction of the Second Lesson

In order to mobilize students' enthusiasm for learning, give full play to students' practical ability, allow students to apply what they have learned, and provide students with interest in engineering surveying courses, truly student-centered, and cultivate students' teamwork ability. The School of Agriculture and Hydraulic Engineering of Suihua University strengthens the construction of the second course, and stipulates that students complete the credits corresponding to the second course in the training plan. The most important of these is the participation of students in academic competitions. The School of Agriculture and Water Conservancy Engineering of Suihua University held a surveying and mapping skills competition for college students, and selected outstanding

students to participate in the national and Heilongjiang provincial surveying skills competitions and achieved good results. In order to give full play to the subjective initiative of students, the Suihua College Vertical and Horizontal Measurement Association was established under the encouragement and suggestion of teachers, and widely attracted students who are interested in measurement disciplines to join. The model of "teacher encourages and guides, students trains students" has been piloted, and the surveying association is the main body, and the school-wide surveying skills competition is funded by the sponsors of Zhonghaida and Huawei. The "Zhonghaida Cup" measurement skills competition; the first "Huawei Cup" measurement skills competition was held on October 10, 2017; the third "Zhonghaida Cup" measurement skills competition was held on July 9, 2018, so as to give full play to the students The practical ability of hands-on and curriculum has greatly increased the popularity of engineering surveying disciplines in the school.

3.2.5 Combining Assessment Methods with Industry Standards

During the assessment reform of the engineering surveying course for water conservancy and hydropower engineering majors in Suihua University, the previous assessment method and closed-book examination are no longer used, but a multi-link assessment method is used for evaluation. Professional quality, in the assessment process, a combination of teacher assessment and industry external teachers will be tried out. Taking the assessment of engineering measurement practice as an example, it focuses more on key issues such as teamwork, instrument operation, data sorting and measurement speed. For example, in the assessment of the fourth-class closed level measurement course, the group is used as a unit, and each group has 4 people. The internal and external fields that complete the assessment content are regarded as team points, and the standardized operation of each group is additionally scored, and the prescribed time is 45 minutes (exceeding the deduction). Minute). A mode in which the team's individual scoring team accounts for 70% and the operation accounts for 30% of the weight ratio. The scoring principle is completed by the teachers of the school and the external teachers of the engineering unit in accordance with the relevant industry standards of engineering measurement. Reasonable extra points will be given to students with high enthusiasm and good attitude in the practice process. The reform of teaching methods is conducive to improving students' ability to familiarize themselves with professional practical skills, teamwork and continuous learning.

4. The effect of Teaching Reform

4.1 Modern Teaching Methods

Compared with traditional blackboard writing, multimedia teaching has the advantages of intuition, both pictures and texts, and a large amount of information [7]. In the teaching reform of engineering surveying course in Suihua University, modern teaching methods are used to explain the specific content of teaching by means of video and images, so that it can be displayed to students more intuitively. For abstract and difficult problems such as the internal structure and measurement principle of engineering measuring instruments, multimedia courseware and engineering models can be used if necessary to improve the efficiency and enthusiasm of students in course listening [8]. However, for the formula of the course, the traditional teaching mode is still used to explain on the blackboard, which can increase the impression of the students. Such as misclosure, measurement error and other formulas and wire industry calculations.

4.2 Case Teaching Method

During the teaching reform of engineering surveying course in Suihua University, a large number of practical cases were obtained by means of materials provided by cooperative enterprises, projects done by students during their internships, and online downloads. Teachers explained in the classroom by selecting representative cases. In addition, in the course of teaching, in order to improve the cultivation of students' practical skills, group discussions, competitions, and achievement presentations are used to improve students' interest in learning, teamwork and competition awareness, and also cultivate students' practical ability.

5. The Effect of Teaching Reform

Through the teaching reform of engineering surveying courses, students perform better in the assessment of engineering surveying theory courses, and give full play to their subjective initiative in practical course assessments. Most students have the professional quality and technical ability required by employers, and their overall quality has been significantly improved. , reflects the effectiveness of the engineering surveying curriculum reform, and truly cultivates the high-quality technical personnel needed by the enterprise. The school strongly supports the renewal and replacement of the college's engineering measuring instruments. With the development of drone surveying and mapping technology, the college purchased the latest DJI drones for surveying teaching in July 2020.

6. Conclusions

Based on the concept of "student-centered, result-oriented, and continuous improvement" of engineering education certification as the guiding ideology of the teaching reform of engineering measurement courses, the education and teaching reform of local application-oriented undergraduate colleges and universities will be further strengthened. Compared with the traditional concept of engineering surveying course teaching reform, the traditional teaching concept has been unable to meet the high-quality personnel training required by today's enterprises. In order to cultivate high-quality talents required by enterprises, application oriented undergraduate colleges and universities should formulate reasonable teaching content and instrument settings, and accelerate the reform of production-oriented teaching and information diversification teaching mode. Only in this way can the high-quality talents needed by the enterprise be cultivated.

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