Teaching Reform Practice of Sensor and Detection Technology Course Based on Engineering Education Certification

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Keywords: Engineering education; Sensor and detection technology; Teaching mode; Curriculum reform.

Abstract. As an important professional course for automation undergraduates, sensor and detection technology focuses on cultivating students' practical ability. However, the traditional teaching method is mainly classroom teaching, which is not enough for the cultivation of students' practical ability, especially in the context of engineering education certification, the original teaching mode and assessment mechanism cannot meet the training needs. According to the training goal of engineering education certification talents for automation major, this paper carries out the curriculum reform of sensor and detection technology, aiming at solving problems, guiding students to learn effectively, cultivating students' engineering awareness, team spirit and the ability to solve practical problems.

Introduction

Engineering education certification is to set out from the professional orientation and training objectives, take the quality of talent training as the foundation, take the students as the main body, take the construction of major and curriculum as the core, take the school running conditions and management mechanism as the guarantee, and build a scientific and reasonable engineering education certification standard that adapts to the national conditions, is in line with the international standards and sustainable development [1]. In November 2017, the Engineering Education Certification Association issued a new engineering certification standard. In order to better ensure the achievement of the training objectives of engineering certification and cultivate engineering talents, this paper explores and practices the teaching mode reform of the course of sensor and detection technology, and designs the course content, teaching method and assessment method to adapt to the engineering education background. Through more than two years of practice, it is proved that the new teaching mode of sensor and detection technology is in line with the concept of engineering education certification, and has achieved good results.

The Deficiency of the Course of Sensor and Detection Technology

The course of "sensor and detection technology" is an important professional course for automation major. The course is relatively abstract, there are many kinds of sensors, and the theoretical knowledge of detection is complex and fragmentary. Summarizing the traditional teaching methods of sensors and detection technology for many years, there are mainly three points that are inconsistent with the concept of Engineering Education Certification:

Traditional Teaching Methods

The traditional teaching method is teacher centered, and the teacher's theory teaching still occupies the leading position in the teaching work. The theory teaching involves many calculations to deduce the characteristics and principles of all kinds of sensors, which requires students to have good engineering mathematics, physics, and electronics foundation. In the classroom, students often feel that the teaching content is theoretical and many concepts are obscure and difficult to understand. In teaching, students have been passively accepting all concepts and knowledge, and
there is no room for independent thinking, exploration and innovation. After the examination, most of the students soon forget this knowledge, and the teaching effect can be imagined. The traditional teaching method does not conform to the concept of student-centered engineering certification [2].

**Confirmatory Experiment is still the Main Part of Experiment in Teaching**

The traditional teaching method is that teachers instill the students with theoretical knowledge of the working principle, measuring circuit and basic application circuit of each sensor, and then students carry out experimental verification according to the established experimental steps and methods. In the traditional experimental course, there are few experimental hours. Several experiments are based on the known sensor working principle and the sensor principle verification of the measurement circuit. On the basis of the existing experimental platform, students can observe the output results and record them. Finally, error analysis can be carried out. Experimental projects tend to verify the theoretical knowledge, there is no interesting experiment, almost no innovative experiment, which is contrary to the guiding ideology of engineering education professional certification, and cannot give full play to the students' subjective initiative [3].

**The Examination Method is Final Exam**

The traditional way of assessment is to give priority to the final examination paper results, plus the usual results, the final results account for more than 80%. The application of engineering knowledge has become a knowledge point that must be memorized. In order to achieve high scores, students review the key test points, and the learning of professional knowledge has become a memory competition. The result of such assessment does not conform to the characteristics of the course, and the final score is comparative evaluation, unable to measure the students' mastery and application of knowledge, and does not conform to the OBE concept of engineering certification [4].

**Reform of Course Content and Teaching Method**

We reform the course content. First of all, according to the graduation requirements of automation major which meet the engineering certification standards, the teaching requirements of sensor and detection technology are specified, and then the teaching content is formulated according to the teaching requirements. The traditional teaching content is the scattered and partial introduction of various types of sensor principle and detection technology, rarely involving the application of sensor engineering. Therefore, in the new syllabus, the contents of signal transformation circuit, signal acquisition and processing technology, anti-interference technology and sensor application are added. Train the students' ability to choose the technical way to meet the signal detection index in the automatic control engineering problems, and the ability to design the non-electric signal detection scheme, which meet the requirements of engineering certification.

Secondly, on the basis of teaching materials, tracking the existing development, while teaching the traditional classic content, it also introduces the latest cutting-edge technical data in relevant publications and network information, such as the current development status of sensor miniaturization, integration and intelligence technology, as well as the popularization and application of wireless sensors in the Internet of things technology. At the same time, it points out that the current research and development of cutting-edge technology at home and abroad, such as artificial intelligence and data fusion information processing, sensor detection and control technology, new materials science and other interdisciplinary new technology fields.

The teaching adopts various teaching methods, especially based on the CDIO Engineering Education Concept, focusing on the cultivation of students' engineering basic knowledge, personal ability, interpersonal team ability and engineering system ability, and carrying out various teaching activities. In the classroom teaching, students are required to preview in advance to understand the relevant knowledge. In the classroom teaching, students are organized to conduct case analysis, design, scheme discussion and discrimination in the form of groups. In this process, students' understanding and mastery of practical knowledge will be deepened, students will be encouraged to
"question" each other, and their ability of thinking and independent analysis will be improved through debate.

Through case teaching, improve students' basic engineering knowledge and ability to solve complex engineering problems. We should reduce the content of some simple basic theories (students can master them by self-study), increase the specific case analysis and design, and use modern means to achieve both theory and application.

In teaching, in addition to traditional teaching methods, multimedia is used to create teaching situations and stimulate students' interest in learning. The teaching mode of combining theory and experiment is adopted. After the theory teaching, the experimental class stage is immediately entered. For example, after teaching the electric energy sensor, electric parameter sensor and displacement digital sensor, enter the laboratory to conduct the performance analysis and verification experiment of the sensor, and arrange the students to preview the contents of signal transformation circuit, signal acquisition and processing and anti-interference part after class, so as to prepare for the design of a comprehensive detection system.

The Reform of Practical Teaching

Experimental teaching takes different forms of practice according to different theoretical courses, mainly including basic verification experiment and comprehensive design experiment. In order to deepen the understanding of the theoretical knowledge in the classroom, the original csy-998 sensor experimental instrument is used for the basic experiments such as the strain gauge single arm characteristic experiment, the differential transformer displacement measurement experiment and the capacitance sensor displacement experiment.

In order to train the students' ability of using sensor knowledge to design related non electric measuring circuit, the comprehensive design experiment is added, such as the comprehensive experiment of positioning system based on ultrasonic sensor. Students are required to use the relevant interface circuit and application circuit to design the sensor measurement circuit. For some new applications, because of the limitation of laboratory equipment, we can use Lab View software to simulate. Lab VIEW simulation software is an image programming software, which can complete the system functions of data acquisition, processing and display in virtual environment.

In addition, other changes have been made in practical teaching. We have carried out open experimental teaching, completed a number of innovation and entrepreneurship experimental projects, and participated in various competitions. These team projects can not only comprehensively improve the application ability of engineering technology, but also improve the team consciousness of students, and provide the comprehensive ability of engineering technology and team cooperation ability.

Changes in Evaluation Criteria

Changing the traditional course assessment method is mainly to assess students' mastery of theoretical knowledge through examinations. This one-time assessment method cannot truly reflect students' mastery of knowledge and their professional application ability, while a good assessment system can arouse students' interest and enthusiasm in learning. In order to better reflect the learning situation of students in this course, the evaluation mechanism of this course is mainly divided into two parts: one is the theory exam, which accounts for 60% of the total score; the other part is the process assessment result composed of the experimental course design classroom performance, which accounts for 40% of the total score.

Experimental assessment: 15% of the total score. During the acceptance inspection, not only the experimental data should be checked, but also the standard of experimental operation and the mastery of basic theoretical knowledge should be checked. The submitted experimental report should include the introduction of theoretical basis, circuit principle analysis, test curve drawing and error analysis, rather than just obtaining correct test data and conclusions.
Course design assessment: 15% of the total score. The course design is evaluated according to the performance of demand analysis, scheme design, system circuit design, software design, and report and innovation consciousness. At the beginning of course design, requirements analysis and program review are critical. Different students based on different basis first put forward their own questions and needs analysis, teachers review the rationality.

Classroom discussion and performance: teachers and students study together in class. Project-based teaching requires students to preview in advance, find materials in groups in advance and propose solutions. Therefore, classroom discussion performance is an important evaluation index point, accounting for 10% of the total score.

Conclusions

Under the background of engineering certification, the curriculum construction reform of sensor and testing technology is carried out. A series of reforms have been carried out on classroom teaching, practical teaching and assessment methods from the perspective of results-oriented thinking and student-centered thinking. The course implementation has been carried out in the automation major of grade 12, 13 and 14, and the actual teaching effect has proved that the course has achieved significant results after the reform. Students' interest in learning this course has increased, and their practical ability and innovation ability have been greatly improved. With the help of the ability training division required by the engineering certification, the specific reform of classroom teaching is carried out to make the cultivation concept of application-oriented and innovative talents run through the classroom teaching. With the spread of various advanced teaching concepts in engineering education and the emergence of various teaching methods, the curriculum reform of sensor and testing technology should constantly adjust the ideas and methods to meet the requirements of The Times, so as to maintain the effect of curriculum learning and make contributions to the cultivation of qualified engineering talents.

Acknowledgement

This research was financially supported by teaching reform and innovation project of colleges and universities in Heilongjiang Province (SJGY20190307).

References


