Research on Curriculum Reform of Sensor Technology and Application under Engineering Education Professional Certification

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ABSTRACT
Engineering education accreditation is the trend of higher education accreditation evaluation. It plays a leading role in promoting the internationalization of electronic information engineering and improving the quality of education. Guided by the three concepts of engineering education accreditation, this paper explores the teaching reform of sensor technology and application course in electronic information engineering specialty in colleges and universities from the aspects of curriculum objectives, teaching contents, methods and means, and evaluation and feedback mechanism. It can improve the teaching efficiency and cultivate students' ability to solve complex engineering problems.

Keywords: *Engineering education professional certification, Curriculum reform, Sensor technology and application.*

1. INTRODUCTION

Engineering education professional certification is an important link in the process of training engineering professionals [1]. It is an internationally accepted quality assurance system of engineering education and an important basis for realizing international mutual recognition of engineering education and engineer qualification. After 10 years of efforts and practice since 2006, China has become a formal member of the Washington Agreement in June 2016 [2]. Since then, some specialties in some universities have passed the professional certification of engineering education. This means that graduates' degrees will be internationally recognized. It marks a historic new leap from a big country of higher education to a powerful country of higher education, which also opens a new goal of engineering specialty in colleges and universities in China.

Sensor technology and application is a professional course of electronic information engineering in our university, and it is also one of the important core courses of this specialty. It plays a link role in the whole curriculum system. It is one of the key cores for learning subsequent electronic professional courses and solving complex engineering practice problems of the electronic systems.

This course is widely used and involving many knowledge fields such as physics, chemistry and biology. With the development of computer Internet technology and new materials and new fields, sensor technology is more diversified, requiring students to have higher knowledge reserves and basic skills. Combined with the current engineering education professional certification work, it is necessary to change the current traditional teaching methods, and focus on the ability of students to solve complex engineering problems. Scholars have conducted a series of studies to solve the problem [2-7]. Everyone has made various attempts in teaching mode, practice teaching and teaching methods. These research results provide valuable reference for the teaching practice of this course.

2. THREE CONCEPTS OF ENGINEERING EDUCATION PROFESSIONAL CERTIFICATION

Three concepts of engineering education professional certification: Student-centered, outcome-based education and Continuous quality improvement.

2.1. Student-centered education

Traditional education is teacher-centered, mainly because teachers are specific operators of education. Therefore, the current teaching process is dominated by teachers. There are also many school evaluation work is aimed at teachers ' teaching process, such as strict teaching supervision system, teaching progress management, student evaluation system, regular teacher teaching competition, etc. The assessment of students is basically evaluated according to the final examination results after the course. Engineering education professional certification puts forward the student-centered education concept. It mainly reflected in the goal of the education around the cultivation of students. The teaching process design focuses on the cultivation of the students' ability to solve problems and improves teachers and educational resources to meet the students' learning effect. The focus is to evaluate the learning effect of students. This has changed the traditional concept of teacher-centered education.

2.2. OBE (***outcome-based education***)

Traditional education is curriculum-oriented in teaching design (course-based education). According to the courses set by the talent cultivation plan, teachers can complete the courses of general education, basic specialized courses and specialized courses, and students can meet the graduation requirements if they pass the exams of each course. This design method is a bottom-up forward design. The OBE concept of engineering Education certification is a reverse design approach. Starting from the needs of the society, the social needs determine the school's goal of training talents, and then according to the school's training objectives to determine the requirements to be achieved when students graduate, and then decide the design of the school's curriculum system and the establishment of educational activities. This is a top-down design, bottom-up support process.

2.3. Continuous quality improvement

Traditional teaching requires improvement in the teaching process. In order to improve teaching, many methods such as evaluation and inspection are adopted. This is essentially teacher-centered teaching improvement, failing to form a sustainable and effective feedback mechanism.

The concept of continuous improvement in engineering education certification needs to establish a long-term evaluation and feedback system. The goal is to further enhance student learning rather than just improve the teaching process. The continuous improvement system needs to evaluate and feedback training objectives, graduation requirements, teaching links, etc. The effect of continuous improvement is reflected in students' performance. The sole purpose of evaluation is improvement.

The implementation process of engineering education certification is shown in Figure 1.

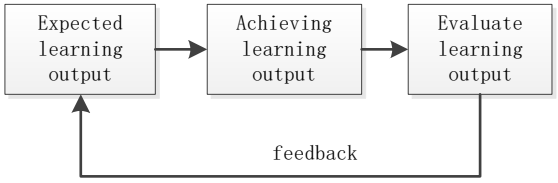

Figure 1. The implementation process of engineering education certification

3. CURRICULUM REFORM OF SENSOR TECHNOLOGY AND APPLICATION UNDER THE BACKGROUND OF ENGINEERING EDUCATION CERTIFICATION

Based on the three concepts of engineering education certification, the course Sensor Technology and Application changes the traditional teaching mode and adopts reverse thinking, that is, according to social needs, combined with the school positioning, starting from the course objectives, to develop indicators that can support the graduation requirements and meet the course objectives set by the course. Design each teaching process and evaluation system to achieve the curriculum objectives, ensure the implementation of the learning process, and finally achieve the expected learning objectives. Therefore, curriculum reform should be carried out from the aspects of curriculum objectives, teaching content, teaching methods and evaluation and feedback system.

The logical relationship of curriculum reform is shown in Figure 2.

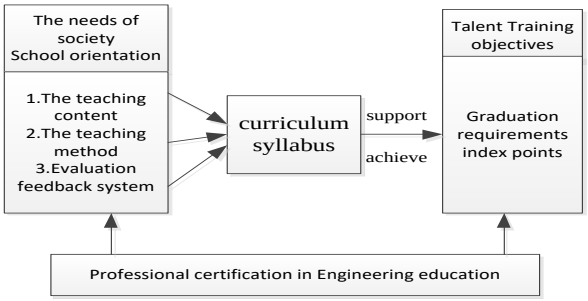

Figure 2 The logical relationship of curriculum reform

In the figure, specific reform contents such as course objectives, teaching content, teaching methods and evaluation and feedback system are reflected in the curriculum syllabus to support the achievement of graduation requirements.

3.1. Course objectives setting

In the field of electronic information engineering, sensors are at the head of the information chain. It's the cornerstone of information processing. With the emergence of new technologies and new industries, sensors have become the internal power to promote the establishment of intelligent digitalization of human-machine network integration. Therefore, according to the new social needs and school orientation, the curriculum objectives of sensor technology and application should be adjusted accordingly. Course objectives must correspond to supporting graduation requirement indicators. Shown as Table 1.

Table 1. Course objectives

Course objectives	Graduation requirements index points	Graduation requirements
Master the basic composition, working principle, performance indexes and application methods of various sensors. Identify and judge the key links and core problems in the sensor circuit. Ability to evaluate the rationality of measurement plan.	1.4: Able to apply professional knowledge to solve complex engineering problems and related sub-problems in the field of electronic information.	1. Engineering knowledge
Have the ability to analyze and design circuits of each sensor unit for specific applications, complete component selection and parameter calculation, to develop students' ability of engineering calculation and circuit experiment in solving specific measurement problems.	3.1: Able to design unit circuits to meet specific requirements, complete component selection and parameter design, circuit modeling and simulation, etc.	2.Design/develop solutions

3.2. Integration of teaching content

According to the social demand for application-oriented talents and the orientation of the school, the course of Sensor Technology and Application should scientifically arrange the theoretical teaching content and practical teaching content according to the characteristics of students. Attention should be paid to the timeliness and practicality of knowledge, while considering the legal, safety, professional standards and other social requirements in the professional field.

3.2.1 Modular content integration

Adjust the course content of sensor technology and application reasonably according to modularization. Sensors are classified by use, rather than by traditional working principle. Integration of Sensor Contents Based on Engineering Requirements. For example, when explaining temperature sensors, according to the requirements of the measured temperature, respectively explain thermocouple, thermistor, thermal resistance sensor, and infrared sensor. By comparing and explaining several sensors, students can feel more intuitively, which is conducive to cultivating students ' ability to select sensors according to their needs.

3.2.2. Introduction of social requirements such as laws, safety and occupational standards in professional fields

The traditional teaching material of 'Sensor Technology and Applications' course usually introduces only professional knowledge, not too much about morality, law and other related content outside professional knowledge. The concept of engineering education accreditation focuses on the educational achievements of each student. Graduates need humanistic quality besides professional knowledge. Therefore, the cultivation of students' humanistic quality can be strengthened by adding relevant laws, safety and occupational standards while explaining the practical application of sensor engineering.

3.3. Reform of teaching methods and means

Teaching methods and means are essential in the course of teaching. Effective teaching methods and means have played a multiplier role in achieving curriculum objectives. Engineering education professional certification concept focuses on students 'ability to solve complex engineering problems. It is necessary to change the current teaching method that emphasizes "teaching" rather than "learning" to prevent students from being limited to mastering the content of the textbook and ignoring the generation of ability. A

variety of teaching methods and teaching means can be combined with modern tools to complement each other.

3.3.1. Introducing Modern Advanced Internet Technology and Network Management Mode

The concept of engineering education accreditation focuses on the ability development of each student rather than individual excellent students or poor students. Traditional teaching methods make it easier for teachers to focus on individual students with excellent or poor grades rather than on each student. The introduction of rain classroom and other means of modern classroom management and precision guidance. While completing the teaching task can also accurately grasp each student's learning state. The introduction of advanced Internet management technology can greatly improve teachers' teaching efficiency and grasp students' dynamics in real time. This is more conducive to the precise training of each student.

3.3.2. Flipped classroom

After students master the basic working principle of sensors, encourage students to collect and organize advanced sensors or front sensors. Let students show their research results in the way of flipped classroom. It can cultivate students' ability of teamwork, communication and communication, self-expression and lifelong learning.

3.4. Evaluation and feedback system

Continuous improvement is one of the concepts of engineering education accreditation. Through a continuous and effective evaluation system can test each student to complete the curriculum objectives. Effective feedback system can correct unreasonable factors in teaching and promote the continuous improvement of curriculum.

The course' Sensor Technology and Applications' adopts a multi-index evaluation system to test the achievement of the course objectives and adopts a system of supervision and feedback based on the course evaluation report.

3.4.1. Multi-index assessment system

In order to test the achievement of curriculum objectives, it adopts multi-index assessment methods, including final examination, routine examination and experimental examination. The examination results are composed of final examination scores, ordinary scores and experimental scores. The composition and proportion of the total score are shown in Table 2.

Table 2. Composition and proportion of total score

serial number	The total score composition			proportion
1	grades on the final exam		Goal 1(55%) Goal 2(45%)	60%
2	experiment grade		Goal 1(50%) Goal 2(50%)	20%
3	ordinary grade	Ordinary performance, 50% of ordinary grade	Goal 1(25%) Goal 2(25%)	20%
		Homework, 50 % of ordinary grade	Goal 1(25%) Goal 2(25%)	

3.4.2. Feedback system

Multi - index assessment system can assess students' achievement of curriculum goals. The evaluation results are used to test the rationality of curriculum objectives and the effectiveness of teaching process, so as to improve the quality of teaching. At the end of the course and the assessment, the teacher will complete the course evaluation report. The course evaluation team reviewed the original materials of the course, including teaching plans, teaching materials, homework arrangement and correction, teaching process records, examination papers, experimental instructions, experimental reports, process assessment records, etc. Weaknesses in the teaching process can be identified and improved.

4. CONCLUSIONS

Engineering education certification is one of the most important components of higher education certification. Now it is the trend and hot spot of higher education accreditation evaluation. The implementation of certification plays a leading role in promoting the internationalization of electronic information engineering and improving the quality of education [8-9].

It is imperative to carry out the teaching reform of sensor technology and application courses guided by the three concepts of engineering education certification. The curriculum reform includes reasonable setting of curriculum objectives to support graduation requirements, integrating teaching contents, updating

teaching methods and means, and formulating effective and feasible evaluation and feedback systems. In this way, we can cultivate high-quality talents with both solid professional knowledge and humanistic quality.

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