The Teaching Reform of "Sensor Principle and Application" Course Based on OBE Education Concept

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Abstract

Outcome based Education (OBE) emphasizes "student-centered, output-oriented" continuous improvement to meet the needs of students to acquire knowledge and develop abilities. The result orientation of the existing "Sensor principle and application" course teaching reform emphasizes the understanding and application of sensor principle, mastering the principle of language rules, object-oriented programming method and thinking mode. The teaching reform of this course is based on the concept of OBE, focusing on the combination of sensor principles and students' majors, and guiding students to apply object-oriented development tools reasonably and efficiently in related professional engineering. Comprehensive projects should be introduced into practical teaching to appropriately increase the workload and difficulty of practical teaching and cultivate students' awareness and ability of teamwork. Solve the "pain points" and "blocking points" existing in the curriculum, so as to combine the curriculum with talent training. The results of practical application show that the students' engineering application ability is improved and they can complete the comprehensive practical project well.

Keywords: OBE; Sensor principle and application; practical teaching; talent training

1. Introduction

Outcome Based Education (OBE) is the basis of quality evaluation of engineering education certification and the development direction of new engineering education reform in the new era. It is a structural education model centered on the expected learning output to

organize, implement and evaluate [1,2]. This model is different from the traditional education model, emphasizing not the traditional sense of "how teachers teach and teach what", but "how students learn and learn what", and it is clear that the school wants students to achieve the learning outcomes, how teachers effectively help students to achieve the learning outcomes, how to know that students have achieved these learning outcomes. This requires different schools to combine their own characteristics and set up major and related courses according to social needs [3]. According to the different situations of students, students are equipped with academic mentors to guide students to achieve learning goals. The investigation and realization of social needs is both the logical starting point of OBE education concept and the only criterion for testing and evaluating educational outcomes." From teacher-centered to student-centered, the combination of core quality and personality development is the starting point of OBE and the implementation point of evaluating students' learning results. Sensor Principle and Application is an important professional technical course for electronic information and automatic control majors. Sensor is an important way and means to obtain information, and it is an important unit for the development and application of intelligent technology. "Sensor Principle and Application" is a multidisciplinary, engineering practice of a strong professional course, in the professional curriculum system in the position of the link between the preceding and the following. According to the characteristics of the curriculum system, this paper discusses how to guide the teaching reform of the curriculum with the educational concept of OBE [4-6].

2. The problems existing in the course teaching process

After reviewing the teaching process of "Sensor Principle and Application", we believe that there are mainly the following problems:

(1) The knowledge is complicated and the content is scattered, there is no organization and coherence, and it is difficult for students to master it.

(2) Students lack perceptual understanding of similar but different types of sensors, and feel boring in learning, without initiative and enthusiasm.

(3) There is a disconnect between experiment and theory. Experiments are taught separately, and most of them focus on performance tests, so students lack a sense of harvest.

(4) The homework is almost all concept and principle narrative questions and performance parameter calculation questions, lack of vivid extracurricular exercises that can

inspire students' creativity.

(5) There are large differences in the individual sources of students in ethnic colleges and universities, and the learning outcomes of different students with the same knowledge are more discrete.

In short, there are many problems in the teaching process of "Sensor Principle and Application" course, which have both commonalities and personalities. They affect students' learning enthusiasm from different aspects and in different ways, which is not conducive to improving students' ability to analyze and solve practical engineering problems and practical innovation. Therefore, it is urgent to introduce new teaching concepts and teaching models [7,8].

3. Results-oriented curriculum system reform

School of Electrical and Electronic Engineering of Zhengzhou University of Science and Technology adheres to the education and teaching concept of "students as the main body, teaching according to their aptitude, classification training, and emphasizing practice", aiming at cultivating innovation and entrepreneurial ability of engineering students, and cultivating senior applied engineering talents with good organization and management ability, unity and cooperation spirit, and innovative thinking consciousness for the economic development of Central Plains region [9,10]. According to the training plan and graduation requirements of relevant majors in our college, the course "Sensor Principle and Application" has been comprehensively reformed.

(1) Clarify the relationship between the course objectives and the achievement of relevant graduation requirements. According to the training plan and teaching syllabus, establish the correlation between graduation requirement indicators and the support of each course, and determine the weight value of the course content and main assessment links on the indicators according to the support strength of the teaching link to the graduation ability requirements. The purpose of the course "Sensor Principle and Application" is to enable students to master the basic principles, main characteristics and use methods of various sensors, to choose and use sensors reasonably, and to flexibly apply these sensors and technical methods to solve practical problems in the future graduation design and practical work. The course evaluation mainly focuses on the learning process, including the regular assessment, the final examination and the experiment assessment. Normal assessment weight

0.4, including class attendance 0.2, class discussion and homework 0.2; Final exam weight 0.4; Experimental operation and report weight 0.2.

(2) Classroom theory teaching reform. A sensor is a device or device that can sense the specified measured signal and convert it into a usable output signal according to a certain law. Therefore, the traditional course theory teaching mode is mainly to introduce the principle of the sensor, then introduce the structural characteristics, then introduce various conversion circuits, and finally introduce the practical application of the sensor. The teaching method is simple, lack of vividness, boring theory, abstract technology is difficult to mobilize the enthusiasm of students to learn, and students will lose their interest in learning over time. Combined with the OBE concept and according to the actual curriculum reform requirements, this course has carried out reform attempts from the following aspects. First, in terms of teaching content, we focus on starting from the electronic devices familiar to students, inspiring and guiding students' impression of sensor applications, and enhancing their learning interest [11-13]. In addition, in the classroom teaching, attention should be paid to the connection between sensors and other related courses, so that students can understand the interdependence between various courses, and strengthen the ability to comprehensively apply all aspects of knowledge to analyze and solve problems. For example, when talking about the basic characteristics of sensors, pay attention to the connection with the "Signal and system" course; When talking about the principle of sensors, it emphasizes the connection with University Physics; When teaching conversion circuit, pay attention to "Circuit analysis", "analog Electronic technology", "digital electronic Technology" and "electronic measurement technology" and other courses; When talking about the application of sensors, it focuses on the connection with single-chip computer and college students' extracurricular innovation. This can not only mobilize the students' learning initiative, but also exercise the students' ability to comprehensively use all aspects of knowledge. Secondly, in terms of teaching methods, we should strengthen the use of multimedia. Abstract principles and invisible internal structures are presented to students through animation and simulation, and then combined with animations, pictures and videos of practical application, which can not only make the classroom content more vivid, but also let students see the real application situation outside the book and text knowledge, effectively solving the hollow sense of theoretical learning. In addition, the use of network resources to assign some extracurricular homework to students, so that students can combine their own hobbies, consult information about sensors, and write reading reports. Third, in the course of teaching, it is clear that students are

the main body of learning. How to let this subject exert its subjective initiative is the key to learn a course well. Teachers should arrange classroom discussions with different contents at different times and stages according to the teaching content. In this way, students' independent learning ability can be enhanced through thinking, and students' ability to organize and explain sensor knowledge can be trained, so that knowledge and ability can accompany students' growth just like sensors in mobile phones. The essence of OBE is everything for the students, everything for the students, everything for the students. Therefore, in teaching, we should always pay attention to helping students with learning difficulties, especially those students from remote ethnic areas. Let them build up their confidence in learning, and create a learning atmosphere for them to unite and help each other and make progress together.

(3) Experimental teaching reform. First, in terms of basic experiments, there are many kinds of sensors and different conversion circuits, but they also have rules to follow in experiments, most of which convert non-electricity in reality into voltage output. Therefore, the basic experiments are not many, but fine. According to the characteristics of different majors, about three representative experimental projects can be selected, and students with good basic ability and a relatively poor student can be formed into a pair to complete the experiment together, or students can choose to do different experiments according to the experimental equipment. Based on the principle of "consolidating the foundation, focusing on ability, emphasizing quality, and cooperating to help", we try not to let a student transfer the team. The experimental assessment is also based on group assessment. The better students are required to help guide the worse students to write experimental reports and make data analysis, and the experimental results of this group are taken as the experimental results. Second, in the comprehensive experiment, students can re-form a group of three, but still follow the principle of strong with weak, emphasizing common progress. Lab projects can be either given by the teacher or designed by the students themselves [14,15]. Students are required to negotiate and discuss the design scheme of the experiment. After the teacher's guidance and approval, students design the circuit, select the sensor and circuit components by themselves, and finally complete the production, and give the experimental results and report. This aspect emphasizes the design and application of experiments and the ability of students to comprehensively use relevant knowledge to analyze and solve problems, which not only enhances students' teamwork spirit, but also trains students' flexible use of sensors, and more importantly, strengthens the application ability of classroom theory to solve specific

practical problems. Third, in order to enable students to fully understand the application of sensors in actual production and life, students are organized to participate in contests or extracurricular activities related to sensor courses. At the same time, students are allowed to engage in intelligent car competition, robot competition, drone competition and electronic design competition and other sensor-related competition projects as the current sensor experiment, and the results of the competition can also be used as experimental results. It is very important to establish a reasonable test method to evaluate the effect of experiment teaching and the comprehensive ability of students, and to stimulate the enthusiasm of students. In the aspect of comprehensive innovation, we should pay attention to the assessment of process and problem-solving ability [16-18].

4. Use network resources to establish online mobile information platform to improve students' autonomous learning ability

Make full use of network resources to establish a mobile information platform after class, which can find the weak links and common problems of students in the first time, so as to facilitate teaching reflection and improvement, and constantly optimize the teaching process; In addition, students with outstanding ability and strong thirst for knowledge will be timely guided and gradually guided to extend their online learning and self-development.

1) Online preview review: the knowledge points will be decomposed, sorted out and made relevant teaching resources, and pushed to the mobile information platform for students to preview before class and review after class.

2) Online homework: Push daily knowledge assignments on the information platform to help students further deepen their understanding and mastery of knowledge points in a way that students are willing to accept, and strengthen the application of knowledge points.

3) Project extension training: Students are required to update and optimize the function of the project after understanding and digesting the classroom engineering cases, and upload it to the information platform to improve students' engineering practice ability and innovation ability.

5. Conclusion

Guided by the OBE concept, it is proposed that the teaching of "Sensor Principle and application" for non-computer engineering majors should be closely related to the

professional courses and reflect the application value of development tools in the major. The concept of building minimum software system is introduced in teaching to cultivate students' practical engineering application ability. The concept of project is introduced into practical teaching, and the form of teamwork required by enterprises is simulated to improve students' hardware design ability, coordination and cooperation ability and professional report writing ability. And by breaking through the barriers between "online-offline" and "in-class - out-of-class", the students' object-oriented programming ability and object-oriented application ability have been improved as a whole.

Conflict of Interest

No potential conflict of interest was reported by the authors.

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