

# Teaching Reform of "Sensor and Detection Technology" Based on Online Open Course

Chunyue Pan

Wenzhou Polytechnic, Zhejiang 325035, China

## Abstract

Based on the study of the characteristics and training requirements of the sensor and detection technology course, the current situation of the course and the problems in teaching are analyzed, and the online and offline Hybrid Teaching Reform Based on the online open course is proposed. The teaching content is optimized, the teaching mode and assessment method are updated, the students' initiative in learning is fully stimulated, the ideological and political elements of the course are sorted out, the ideological and political education is integrated into the professional teaching process, and the training technology is excellent, Engineering application talents with good quality.

## Keywords

Online open courses; Online and offline mixing; Sensors; Curriculum; Ideological and Political Education.

## 1. Course Nature and Orientation

With the rapid development of information technology, sensor technology has become a research hotspot in the field of science, technology and engineering application. The course of sensor and detection technology is an important compulsory course for electrical engineering, automation, electromechanical engineering, electronic information and other engineering majors. The content of the course is relatively scattered, and the main content includes sensor technology foundation, force sensor, temperature sensor, displacement / level sensor, photoelectric sensor, new sensor and so on. In addition, the detection system also involves automatic control principle and computer related knowledge. Through the study of this course, students need to master the working principles, measuring circuits, error analysis and typical applications of various sensors, so as to grow into application-oriented talents with interdisciplinary knowledge structure and comprehensive application ability. From the current teaching situation, students have a good grasp of basic theoretical knowledge, but their ability to solve practical engineering problems is insufficient. Therefore, relying on online open courses to carry out curriculum teaching reform, implement online and offline mixed teaching mode, and cultivate applied engineering and technical talents is a major task we are facing.

## 2. Overall Teaching Design

### 2.1. Design idea

During the teaching process of this course, under the guidance of teachers, through analysis and reasoning, students can induce and summarize independently, so as to enhance students' understanding of the working principle and application direction of various commonly used sensors; Through classroom explanation and discussion, project driven, case analysis, learning doing integration and other methods, students can promote their understanding and application of what they have learned, so as to cultivate their ability to select and apply sensors and analyze and debug automatic detection systems. Make full use of modern teaching means,

constantly improve teaching methods, organize students to learn fresh materials through multimedia, network, audio-visual and other means, highlight the analysis of typical cases, use interactive teaching to make students receive simulation training, and improve their ability to find problems, analyze problems and solve problems.

## **2.2. Course objectives**

### **2.2.1. Capability objectives**

- (1) Be able to master the basic physical effects, working principles and typical structures of various commonly used sensors;
- (2) Be able to reasonably select and correctly install various types of sensors according to the detection requirements;
- (3) It can design a reasonable detection circuit with different types of sensors according to the characteristics of the measured signal;
- (4) Able to analyze and debug the automatic detection system according to the system design requirements and technical indicators.

### **2.2.2. Knowledge objectives**

- (1) Basic concept of sensor; (definition, composition, classification and characteristics);
- (2) Basic theory of sensor; (mathematical model and basic characteristics);
- (3) Structure and principle of common sensors;
- (4) Selection and application of sensors;
- (5) Simple fabrication of measurement system.

### **2.2.3. Quality objectives**

- (1) Be able to find problems in work in time, analyze problems and propose solutions;
- (2) In the process of project teaching based on the actual operation process, students' team cooperation ability and expression ability of professional and technical communication are trained;
- (3) Learning ability to acquire new knowledge and skills; Ability to solve practical problems.
- (4) Have a strong sense of work responsibility and a good sense of social responsibility.

## **2.3. Course content design**

Using teaching projects as the carrier, the basic knowledge of sensors is integrated into teaching cases, reducing the learning pressure and improving the teaching effect. The teaching contents and related teaching items are shown in Table 1.

## **2.4. Teaching method design**

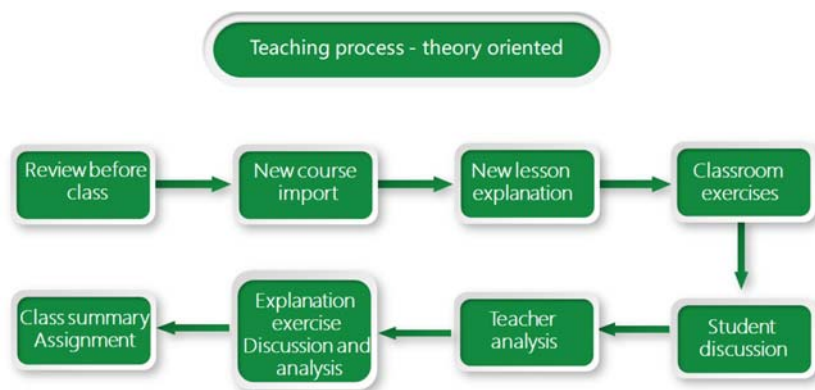
### **2.4.1. Using online open course platform to realize online and offline mixed teaching**

A series of teaching videos, tests, assignments, examinations, etc. are provided on the course platform, and posts can be posted to discuss and exchange learning experience, mainly for preview before class and review of homework after class. Offline teaching is dominated by classroom teaching. Each class uses the preview quiz on the platform to realize the flipped classroom teaching mode. The teacher teaches the main knowledge points, the students raise difficult problems and discuss them, and the teacher finally analyzes and concludes.

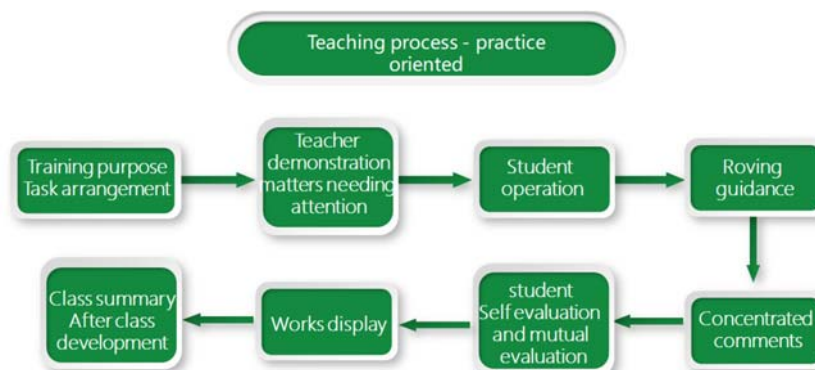
If it is a theory-based classroom, the teaching process is shown in Figure 1; if it is a practice-based classroom, the teaching process is shown in Figure 2.

**Table 1.** Teaching content of sensor and detection technology

Numble	Content of courses	Teaching project design	Reference class hours
1	Sensor Basics Resistance sensor	Selection of measurement method and error calculation and processing	4
2	Resistance sensor	Design and manufacture of electronic scale	14
3	Capacitive sensor	Design and analysis of fingerprint identification sensor	4
4	Inductive sensor	Analysis of roughness tester	6
5	Piezoelectric sensor	Design of glass breaking alarm	6
6	Thermocouple sensor	Realization of automatic flameout device for gas stove	4
7	Photoelectric sensor	Design of acousto-optic control lamp in corridor	12
8	Hall sensor	Application and selection of hall proximity switch	4
9	Digital sensors and new sensors	Recognition and selection of new sensors	10
10	total		64



**Figure 1.** Schematic diagram of teaching process based on Theory



**Figure 2.** Schematic diagram of teaching process based on practice

After class expansion is an important supplement to classroom teaching, with the focus on reflecting differentiated teaching. Excellent students are required to upload notes for other students to learn. In addition, after-school tests should be arranged differently; In the part of project production, excellent students should further optimize the functional design and parameter test of the project.

### 2.4.2. Integrate ideological and political elements

In the regular teaching process, we have always integrated ideological and political education. For example, when assigning homework, students should be guided to be honest and trustworthy, when training, students should be guided to work together. When learning various sensor products, students should cultivate their national feelings and love for Chinese goods. As an engineering major, students must be trained to have the spirit of craftsmanship and carry forward the ambition of building a strong country through science and technology.

## 2.5. Assessment scheme design

Students can participate in the final theoretical examination only after they participate in the teacher's classroom teaching and learning, including theoretical teaching and project production, and complete all relevant pre class preparation, after class homework and online tests on the online open course platform. The specific assessment scheme is: adopt diversified assessment methods and pay attention to process assessment. The designed assessment scheme is: Online 30% + offline 30% at ordinary times + final examination 40%. Online grades include video viewing Quizzes, homework, mid-term exams (to supervise students), discussions and interactions, etc; Ordinary achievements include attendance, experimental training, classroom questioning, and after-school development (especially the production of physical objects, and after-school supplement is very important); When conditions permit, the final examination can be divided into theoretical written examination and skill assessment.

## 3. Effect of Teaching Reform

The teaching reform of the course "sensor and detection technology" based on the online open course adopts the online and offline mixed teaching mode in the teaching process and assessment methods, which makes students more motivated to learn, more active in learning, and significantly improves the teaching quality. The survey of teaching satisfaction is shown in Table 2.

**Table2.** Teaching satisfaction survey (Sensor and detection technology, survey object: electronic 1901 and 1902 students, 80 in total)

Numble	Survey items	Satisfied	Basic satisfaction	Dissatisfied
1	Are you satisfied with the way of preview before class?	78	2	0
2	Are you satisfied with the classroom teaching method?	79	1	0
3	Are you satisfied with your homework?	76	4	0
4	Are you satisfied with the course module setting ?	79	1	0
5	Are you satisfied with the project	80	0	0
6	Are you satisfied with the assessment method?	79	1	0

#### 4. Concluding Remarks

The teaching reform of "sensor and detection technology" based on online open courses has achieved certain results. Students' evaluation of teaching, supervision and evaluation of courses are relatively high, but there are still some problems. In the future, we will make further progress, pay attention to student feedback, strengthen improvement, and further improve the teaching effect.

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