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Research and Exploration of Digital Signal Processing Course Design Teaching based on OBE Concept

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Abstract

The country is constantly promoting the accreditation of Engineering Education Specialty Based on the concept of OBE (Outcomes-based Education). Changing the teaching mode and method based on the OBE Education concept has become the development direction of many universities. Compared with the traditional teaching mode, the OBE concept calls for teaching reform based on results. Learning results is the leading direction, and the aim is cultivating comprehensive quality of students. Learning enthusiasm of students is improved. Combineing the characteristics of the course design of digital signal processing as a professional practical course and based on the OBE concept, the teaching methods is improved. Teaching means and evaluation standards are both improved. Constantly improving the teaching process, and training students to be comprehensive and high-quality with self-study, innovation and teamwork, the ultimate goal of teaching is achieved.

Keywords

Course Design of Digital Signal Processing; OBE (Outcomes-based Education); Engineering Education Professional Certification.

1. Introduction

OBE (Outcomes-based Education) is a new type of teaching philosophy, which is very different from the traditional teaching philosophy. At present, a complete teaching system under the guidance of OBE concept has not yet been formed in China, and is still in the stage of exploration and research [1-4]. It is an important platform for students to understand the frontier knowledge of related fields and to cultivate practical and innovative skills [5]. It is an important practical course for communication, electronics, and automation related majors, and lays the foundation for the subsequent courses on communication principles, image signal processing, voice signal processing, and postgraduate study. Foundation [6, 7]. In the teaching of professional practice courses such as digital signal processing course design, it is important to grasp the difference between professional practice courses and basic practice courses, as well as to pay attention to the connection with the follow-up courses. Digital signal processing theory is widely applied and rapidly developing, and the traditional teaching methods of basic practical courses are no longer applicable to the current teaching requirements [5]. Therefore, it is necessary to change the traditional teaching mode of practical courses and explore new teaching methods.

2. Current Teaching Situation of Digital Signal Processing Course Design

Traditional professional practice courses are characterized by the lack of innovative teaching contents, unilateral domination by teachers, and a single mode of assessment and evaluation [8, 9].

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2.1. Insufficient Innovation of Teaching Contents

The practical content of traditional practical courses is mostly fixed. Due to the abstract theory of digital signal processing, more emphasis is placed on the understanding of basic knowledge and the connection with subsequent courses is neglected in the practical teaching, while the restriction of experimental equipment leads to the unchanging and single experimental content for many years, and students' innovation and cooperation cannot be fully reflected. Digital signal processing is a fast-developing and widely-applied theory, and the single and obsolete course design cannot fully reflect these two characteristics.

2.2. Teacher's Unilateral Dominance

Traditionally, practical courses use a "you design, I perform, you talk, I do" classroom teaching model. The teacher designs the experimental content and indicates the procedure to be followed by the students to complete the experiment step by step. The instructor and students use the available lab equipment to complete the experiment in the lab, and students are not required to do anything other than transcribe the lab report after class. Since the teacher has already done the design of the experiment, the experiment must be well designed and have good results. Students are completely dependent on the teacher's lab manual, and often do not think about the design principles, problem solving, and reasonableness of the results of the experiments. Students' feedback, creativity and problem-solving ability are not fully displayed.

2.3. Single Mode of Assessment and Evaluation

The final evaluation method of traditional practical teaching is based on students' attendance, seriousness during the experiment, and the writing of the lab report. Due to the single practical content, this evaluation method leads to the problems of students copying lab reports and the lack of attention during the experimental process, which seriously affects their learning motivation.

3. Theoretical Basis of the OBE Concept

The OBE philosophy is called outcome-based education, or OBE. The OBE philosophy is reflected throughout the teaching process, from the development of the syllabus, the establishment of teaching methods, the evaluation of learning outcomes and the process of job application [1-4].

The development of the syllabus is actually the definition of the students' graduation goals, and with clear graduation goals, there are corresponding teaching goals to develop the syllabus according to the teaching goals. On the basis of the syllabus, the required teaching methods are established, and various teaching methods are developed according to the characteristics of different courses in order to fulfill the requirements of the syllabus and achieve students' mastery of the knowledge system. Determining student mastery requires the use of learning outcomes assessment, which can take various forms, such as examinations, assessments, and practical exercises. Ultimately, students are measured by their performance in the workplace, so the final step is the application of the learning outcomes to the job. The above four components fully embody the OBE concept [1].

There is a big difference between the traditional teaching philosophy and the OBE philosophy, as the traditional teaching is teacher-oriented. In order to incorporate the OBE concept into our teaching, we have reformed our digital signal processing course design.

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4. Practical Solutions for Digital Signal Processing Course Design under the Guidance of the OBE Concept

Under the guidance of the OBE concept of engineering education professional certification requirements, a new teaching approach was designed based on the course features of the digital signal processing course design [10-16]. It breaks the model of a single practical content. The experimental content is a combination of designated experiments and self-selected topics, taking into account the strong abstraction of the course theory and the need to motivate students.

4.1. Practice Content Scheme

In order to deepen students' understanding of the application of digital signal processing theory, and also for the smooth progress of students' later topics of their own choice, four designated experiments are designed, namely: time domain sampling and signal reconstruction, frequency domain sampling and recovery, FIR digital filter design using the window function method, and signal frequency components and power analysis using FFT. These four designated experimental contents are more comprehensive than the basic experiments in the digital signal processing course, and are more widely used in the theory of digital signal processing, which will also be used in the later topics of students' choice. The students will then work in groups to select their own topics, which are grouped together, and a series of work on their own topics will be the final assessment of the course.

4.2. Free Topic Selection

In the free topic selection, a group of 2-3 people are required to spend a week looking for a topic related to digital signal processing for the group's course design. After one week of basic topic selection, the report (including course design title, basic design content, and group members' division of labor) will be submitted, and the instructor will coordinate the planning according to the topic. Due to the wide application of digital signal processing, it is possible to ensure that there is no repetition among the topics selected by all groups, thus fully mobilizing the initiative of each student. The final report should not only contain the team's research ideas, but also a detailed description of the individual's work. Such a report not only shows teamwork, but also emphasizes the workload of each team member.

4.3. Final Assessment Scheme

The assessment is divided into two parts: the basic score and the practical score. The basic score is determined by the difficulty and workload of the chosen topic, and the approximate basic score is determined from the beginning of the group's topic selection. Since each group of students chose the topics according to their own interests and abilities, the difficulty of the topics differed greatly, so the difference in the basic score was naturally formed. At a later stage, the workload could be expanded to increase the basic score based on completion, and the basic score was the same for each group. After the basic score was set, a final score was given to each student based on the workload and practice results of each group member.

5. Embodiment of the OBE Philosophy

5.1. Graduation Requirements for Digital Signal Processing Course Design

In the Engineering Education Professional Certification System, the requirements for graduation in Digital Signal Processing course design are: a. Be able to operate experimental setups according to experimental protocols, conduct experiments, analyze and interpret experimental results, and synthesize information to reach valid conclusions. b. Understand the social constraints and evaluative elements of engineering practices and solutions in the field of

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electronic science and technology. c. Be able to take initiative with members of other disciplines Working Collaboratively.

5.2. A New Teaching Model that Fully Reflects the Requirements of the OBE Philosophy

a) In the process of determining the sub-selected topic, students first need to read a lot of literature to understand the application environment and development status of digital signal processing theory, so that they can understand the application of digital signal processing theory in the field of engineering practice and the constraints and evaluation elements of society through their own learning, and at the same time improve their ability to search and read the literature, laying a foundation for future study. This is a skill that is in high demand among today's college students. This is a skill in short supply for today's college students.

b) In the process of grouping and dividing the work among students, the teamwork spirit is fully reflected. In today's rapid development of modern science, the closed door has long failed to meet the needs of society. Each large-scale project needs the cooperation of countless people to be realized, and good teamwork spirit is very important in the workplace. The team leader should not only complete his or her own design work, but also make overall planning and give full play to the ability of each team member in order to complete the course design successfully.

c) The self-selection section fully reflects the students' initiative. After learning about the laboratory and related experimental equipment, students can choose their own topics based on their own interests and abilities. This process not only reflects the students' understanding of digital signal processing theory, but also the students' expectations and expectations of their own positioning. After the self-selected topic is determined, the experimental scheme is designed on the basis of proficient use of experimental equipment. The experimental scheme cannot be formed in one go, and during the experimental process, the experimental scheme has to be constantly adjusted according to the experimental results in order to achieve the ultimate success. Such an experimental process not only requires students to be able to analyze and interpret the experimental results with reasonable accuracy, but also to correct the problem areas and improve their ability to analyze and solve practical engineering problems.

d) The new assessment model starts with group topic selection, so that the whole practical process of students is reflected in the final grade. The richness of the topics eliminates the possibility of students slacking off and stimulates students' initiative to do the topics they like. The final report contains the research ideas of the whole group as well as the self-workload of each team member, forming a scientific evaluation system.

6. Summary

As a double first-class university, cultivating comprehensive and high-quality talents has always been the goal of teaching. Under the guidance of the OBE concept, the course is designed in a new way, using a student-led teaching method and a combination of solidarity, free topic selection and teacher guidance to give full play to students' initiative, promote students' understanding of theoretical knowledge and hands-on ability, their self-evaluation and orientation, and the cultivation of the spirit of solidarity and cooperation and other comprehensive qualities. The ultimate pedagogical goal.

References

[1] Yunpeng Xin: Research on the curriculum design model of marketing majors based on OBE education concept, China Marketing, Vol. 1008 (2019) No.17, p134+139. (In Chinese).

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[2] Hongyan Zhang: Reform on Practice Teaching of Information Engineering Major Guided by Engineering Education Professional Accreditation, Experimental Technology and Management, Vol. 36 (2019) No.5, p167-169+175. (In Chinese).

[3] Jianan Liu, Shuhui Min: The Exploration and Practive of the Reform in Education of Mechanical Design Course under the Background of Engineering Education Professional Accreditation, Chemical Higher Education , Vol. 160 (2018) No.2, p21-24. (In Chinese).

[4] Lin Dong, Yuanzheng Xu, Lianbin Wang : Optimization of practical teaching sessions in distributed control course design oriented to engineering teaching certification, Education Modernization, Vol. 15 (2018) No.4, p201-202+209. (In Chinese).

[5] Xiuhong Li, Wenhui Li, Jiajun Ren, et al.: Teaching Reform of "Mechanical Course Exercise"in the New Engineering Background, Experiment Science and Technology, Vol. 16 (2018) No.3 , p132-134. (In Chinese).

[6] Ling Cheng, Dongdong Xu: Application of Matlab Simulation in Communication Principle Teaching, Research and Exploration in Laboratory, Vol. 29 (2010) No.2, p117-119. (In Chinese).

[7] Jiangtao Xia, Dongjiao Sun: Application of Matlab in course of Modern Communication Theory, Experimental Technology and Management, Vol. 31 (2014) No.1, p110-113+119. (In Chinese).

[8] Fengyuan Wang, Xudong Zou, Jiang Liu, et al.: Practiceand Evaluation Analysis of Teaching Reform in Automobile Design Course, Education Teaching Research , Vol. 6 (2018) No.2, p91-93. (In Chinese).

[9] Wei Zhang: Exploration of Teaching Reform on Advanced SCM and Technology under Researched Teaching Mode, Journal of Southwest China Normal University (Natural Science Edition), Vol. 43 (2018) No.6, p190-194. (In Chinese).

[10] Wei Hu, Shi Yin, Chunhua Deng, et al.: Design and Realization of Sandwich Teaching Method and Evaluation Scale in Motor and Electrial Control Experimental Course, Experimental Technology and Management, Vol. 36 (2019) No.6, p37-41. (In Chinese).

[11] Zhaosheng Teng, Bambu Wang, Bo Ouyang, et al.: Reform and Practice of Management Mode of Discipline Competition for Electrical Information Majors, Experimental Technology and Management, Vol. 36 (2019) No.6, p21-24. (In Chinese).

[12] Yonghui Wang, Zhiqun Cheng, Xuejian Ma, et al.: Construction and Practice of Experimental Teaching Projects with Virtual-actual Combination for Electronic and Information Majors, Experimental Technology and Management , Vol. 36 (2019) No.6, p184-188. (In Chinese).

[13] Ru Xu: Research on "Four-three" Teaching System of WEB Courses under Background of New Engineering, Experimental Technology and Management , Vol. 36 (2019) No.6, p249-253. (In Chinese).

[14] Li Liang: Reform and Practice on Practical Teaching of Digital Electronic Technology Course, Modern Education Equipment in China , Vol. 299 (2018) No.10, p19-21. (In Chinese).

[15] Jinfen Liu: Exploring the Teaching Reform of Java Web Programming Course, Teaching and Research, (2019) No.14, p52. (In Chinese).

[16] Yun Wang: Research on Teaching Content Reform of Information System Analysis and Design Course, Think Tank Times, (2019) No.6, p219-220. (In Chinese).