Teaching Reform and Practice of Microcontroller Application Technology Course Based on OBE-CDIO concept

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Abstract

In order to enhance students' practical ability and expansion ability in the study of microcontroller application technology course, this paper proposes a course teaching reform based on OBE-CDIO concept, with students as the centre, designing teaching outcome objectives according to OBE concept, relying on CDIO engineering concept, taking real project R&D cases of enterprises as the carrier, integrating into course thinking and government, optimising teaching core tasks, through in project implementation, task Students' knowledge and skills are enhanced through project implementation, task practice and multiple assessments. Through the curriculum reform and practice, students' knowledge application and engineering practice ability have been greatly enhanced.

Keywords

OBE-CDIO educational concept, Microcontroller technology, Project practice, Multiple assessment.

1. Introduction

With the deepening of the concept of Made in China 2025, the digitalization and intelligence of manufacturing equipment has become a trend, and microcontroller technology is a necessary way and an important grip to achieve this goal[1,2]. Therefore, it is very important to carry out the teaching reform research of "Microcontroller Application Technology" and cultivate skilled talents of microcontroller technology with the ability of R&D and innovation in the new era.

However, students in higher education institutions in general have low interest in learning knowledge and theory and insufficient independent exploration ability, which leads to the not very good learning effect of microcontroller application technology course. Therefore, this paper organically integrates OBE concept and CDIO concept, and proposes the teaching reform method of microcontroller application technology course based on OBE-CDIO concept, which can enhance students' learning interest and improve students' software programming and debugging ability, practical operation ability and comprehensive quality ability by optimizing teaching design, introducing enterprise practical project cases and improving course evaluation system.

2. OBE-CDIO Teaching and Learning Concept

Outcome Based Education (OBE) is a philosophy of education that is oriented towards the outcomes of student learning[3,4]. The focus of OBE is not on the number of credits students receive for their work, but on the competencies they have at the end of their learning journey, measured by what they are able to do after completing their learning, reflecting their cognitive ability to apply their knowledge to solve real-world problems. "CDIO (Conceive Design Implement Operate), is a centralised and abstract expression of 'learning by doing' and 'project-

based education and learning'. This course combines the OBE-CDIO teaching concept, taking students as the centre of teaching, turning the original "microcontroller theory teaching" into "students' project practice learning" as the main body, through the reform of the evaluation system, so that the traditional one-way transfer of knowledge from the teacher to the students, into the traditional one-way transfer of knowledge[5]. Through the reform of the evaluation system, the traditional one-way transfer of knowledge from the teacher to the students will be changed to the students actively and actively "discovering and creating" knowledge by themselves, changing the traditional teaching mode[6].

3. Approach to Teaching Reform

The curriculum reform follows the new concept of new engineering education, combines new structures, new models and new systems in the context of new engineering, integrates new technologies, new techniques, new concepts and other means, integrates elements of curriculum thinking and politics according to the job requirements of society and enterprises, designs teaching objectives and evaluation systems, and carries out corresponding reform and innovation of the course "Microcontroller Application Technology" on this basis.

3.1. Reform of the Teaching Body

Combined with OBE theory, the role of the teaching subject is changed to enhance students' independent learning ability. Traditional teaching methods are based on a single "one-way transmission" and "one-to-many teaching" model, in which teachers attach too much importance to students' receptiveness and even advocate rote learning and mechanical training, which greatly hinders students' self-motivation for learning. This approach greatly hinders students' self-motivation in learning[7]. This course combines OBE theory with a student-centred approach, advocating that students take the lead in the 'teaching and learning' process, actively exploring and taking the initiative in practical programming and project debugging. Through project guidance, task orientation, student practice and self-breakthrough, teachers allow students to independently participate in research and development practice and learn knowledge and skills in the process.

3.2. Reform of The Teaching Mission

Combining CDIO theory and relying on real production and life cases, the teaching tasks are designed to enhance students' interest in practice. The traditional teaching tasks are all theoretical and practical, with no real-life projects to expand on, and students are generally not very interested in learning. The course relies on real-life cases, improving teaching projects with the times, from easy to difficult, from simple to deep, designing practical case tasks that meet students' knowledge and ability levels, enhancing students' interest and improving technical skills in practice[8]. The course also relies on online courses and designs post-course extension tasks to allow students who are capable to continue to improve their technical skills after the course.

3.3. Reform of the Teaching Evaluation System

Relying on the OBE concept and the assessment methods provided by CDIO, we implement diversified assessment and evaluation in conjunction with the expected objectives of the course. The whole course evaluation system is designed to run through the "before, during and after class", so that students can always take the evaluation as the target, regulate the code of conduct and improve their spiritual quality; introduce the "teacher tutor, student tutor and enterprise tutor" triadic evaluation subjects, and design the evaluation indexes in detail The system is also designed to broaden the dimensions of the evaluation of thinking and government and to achieve diversified, comprehensive and objective assessment and evaluation.

4. Specific Implementation Methods

4.1. Implement a Role-transformed Teaching Model That Allows Students to Take Ownership of Their Course

Based on the OBE theory, the teaching objectives are designed to be oriented towards the practical results of microcontrollers, so that students can speak more, practice more and evaluate more, and let them lead the learning of the course. According to the characteristics of higher vocational students who love to practice and are good at operation, the teaching mode of "learning by doing, researching by learning and creating by researching" is carried out based on the project practice. Students are asked to report their project proposals before the class, and after the teacher has explained them, students complete their work in groups and carry out mutual evaluation of their work within the group. The teaching time is dynamically allocated around the students' practical effects, allowing them to lead the course progress and complete the teaching.

Table 1. Project Examples of Ideological Penetration

Teaching Scenes	Knowledge points	Thinking into the Method	The Thinking Element
I/O operations	I/O mode configuration	The I/O mode configuration has to select the mode according to the actual situation, otherwise the system will not operate properly.	Results orientation Systematic analysis
	I/O input detection	The case of hardware damage caused by voltage supply out of range leads to the conclusion that there is a limit to everything and that one must not overstep it.	Benchmarking and benchmarking Strict compliance
Interruption systems	Interrupt priority	You need to prioritise things in life and learning to ensure that tasks are completed successfully.	Planning your life Embracing the good
	Interrupt nesting	If students are writing a program and are frequently interrupted by external things (phone calls, WeChat) that interrupt the programming, it will lead to disorganised thinking, so they need to reduce interrupt nesting.	single-minded single-minded
Timer	Timing principle	Introducing the idea that different people in philosophy feel time differently, leads to the idea that time is objectively the same, but subjectively varies enormously.	Cherish time race against time
	Timer division factor	The analogy is that an overclocked computer will affect its lifespan and needs to be properly downconverted. We should not overclock our work in our studies, and occasionally overclock to combine work and play.	Combine work and rest Healthy Living
Serial communication	Serial communication principle	Introduce the communication principles of the video transmission process of China's "Tianwen-1" moon landing to arouse students' interest in learning communication principles.	Science and technology for a strong nation National Confidence
	Parity check for serial communication	Introduce the story of the encrypted transmission of telegrams during the war against Japan to draw out the importance of proofreading.	Never Forget History The Chinese "Dream"

4.2. Implementing a Thought-provoking and Permeable Teaching Model to Motivate Students to Practice

Based on the CDIO theory, the project is designed as a "red and professional" practical case, incorporating the Civic and Political elements of the course, so that students are more motivated to learn, see Table 1. Before the class, students are asked to compile real-life production cases related to the course knowledge, and use the Civic Science cases to introduce the project teaching content and enhance students' interest in learning. For example, when explaining the knowledge point of digital tube display of microcontroller, use the data display of energy meter as a practical carrier, and at the same time introduce the Wenzhou Chint Group, which is the leading low-voltage electrical enterprise in China, and its market share of energy meter is the first in the country. If you learn microcontroller technology well, you will have the opportunity to work in a famous enterprise and contribute to the construction of your hometown.

4.3. Implement a Multiple Assessment Teaching Model to Promote the Achievement of Learning Objectives

The OBE-CDIO theory is integrated to design the teaching mode of "multi-evaluation orientation and multi-mentor collaboration" to enhance the teaching evaluation dimension and expand the learning width of the course[9,10]. The practical projects are designed to integrate various assessment indicators, such as the practicality of the project case, the collaboration within the project practice group, the stability of the project test, and the comprehensive nature of the project report, to enhance the students' comprehensive ability to "think, communicate, cooperate, practice and report". In addition, the introduction of part-time teachers from enterprises allows them to "create, solve and evaluate problems", incorporating enterprise culture and corporate norms to further enhance students' ability to apply their knowledge.

5. Conclusion

In this paper, the significance of OBE-CDIO theory in the reform of the course "Microcontroller Application Technology" is discussed, taking the course as an example. This paper discusses the significance of the OBE-CDIO theory in the reform of the course. The course is based on the OBE theory to complete the reform of the main teaching body; the CDIO theory to integrate the course thinking and designing teaching projects; and the OBE-CDIO concept to carry out multi-evaluation-oriented and multi-mentor collaborative teaching mode. After two semesters of course practice, the reform of the OBE-CDIO concept-based microcontroller technology course not only helps students to master the knowledge and skills related to microcontroller technology, but also enhances students' ability to analyse, think about and solve problems, and strengthens students' professional abilities such as project practice specification and team communication and cooperation.

Acknowledgments

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