Cross-border integration: the cultivation path of innovative talents in electromechanical specialty under OBE theory

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Abstract: Based on the principle of OBE theory and the context of interdisciplinary and cross-professional integration, this paper explores the cultivation path of innovative talents of mechanical and electrical majors, and provides some thoughts and references for training talents of mechanical and electrical majors with more comprehensive literacy.

Key words: Cross-border integration; OBE theory; Mechanical and electrical major; Training of innovative talents

1. Introduction

In the era marked by rapid development of science and technology, the training of mechanical and electrical professionals is faced with the challenge of how to equipping them with the capacity to solve practical comprehensive problems innovatively to adapt to the ever-changing science and technology and industrial needs. To this end, we introduce the theory of Outcome-Based Education (OBE) and combine the educational concept of cross-border integration to re-examine the innovative talent training path of electromechanical major.

2. Literature review

2.1 Overview of OBE theory

The core principle of OBE theory is centered on students' practical ability and achieved learning results, and emphasizes students' practical application ability by setting clear learning goals and evaluation standards, so as to better adapt to the future work environment. Introducing OBE theory into mechanical and electrical majors transforms the traditional education mode from knowledge transfer to a results-oriented training path that emphasizes practical skills.

2.2 The application of cross-border integration in education

Cross-border integration is an educational concept that promotes the integration of different disciplines and professional fields. The introduction of this concept into the mechanical and electrical major is expected to break the boundaries of traditional disciplines, prompt students to understand and apply knowledge more comprehensively, stimulate their innovative thinking and cultivate their comprehensive problem-solving ability.

3. The cultivation path of innovative talents for electromechanical major based on OBE theory in the context of cross-border integration

3.1 Construction of A-CST results-oriented curriculum

3.1.1 Curriculum connotation

Based on A (Achievement), anchored C (Core competencies), connected S (Industry and Education Standards), and implemented T (Transboundary), a series of "A-CST" results-oriented courses have been developed.

The course design emphasizes the integration of OBE theory, industry standards, teaching benchmarks, and the skill requirements of relevant enterprises. It aims to clarify the core competencies of students majoring in mechanical and electrical engineering while fostering a practical application-oriented approach. Learning objectives are closely aligned with practical applications, emphasizing students' ability to solve real-world mechanical and electrical problems.

In the implementation process, interdisciplinary elements are introduced to expose mechanical and electrical engineering students to knowledge from other fields. For instance, in the Mechatronics control course, we incorporate computer-related knowledge to deepen students' understanding of intelligent control systems. Another example involves integrating the intelligent car project into core courses such as "Mechanical Design and Manufacturing" and "Electrical and Electronic Technology". This approach allows students to learn about designing the mechanical structure of a car in the mechanical design course and designing the car's electrical system in the electrical course.

3.1.2 Course structure

Guided by OBE theory, the A-CST results-oriented curriculum can be divided into three levels: core courses, interdisciplinary elective courses and practical projects to ensure that students acquire practical skills and have the ability to solve integrated problems.

Core curriculum: Set up core courses based on core competencies, such as "Mechanical Design", "Electrical and Electronic Technology", etc., to ensure that students acquire the necessary knowledge in critical domains.

Interdisciplinary elective courses: According to the needs of enterprise positions, interdisciplinary elective courses are introduced, such as "embedded system design", "Computer vision and image processing", "AI application", etc., so that students can understand the knowledge of computer programming and image processing related to the field of mechatronic engineering, and promote the cross-border integration ability of mechatronic engineering students.

Practical project development: introducing real industrial cases, developing a series of practical projects based on OBE theory. For example, in the mechanical design course, students are asked to design a part that meets a specific industry standard, so as to exercise

their design thinking and practical operation ability. In the mechanical and electrical system integration project, students are asked to design an intelligent agricultural mechanical and electrical system, including intelligent irrigation, soil monitoring and control, automatic harvesting and other functions. In the project, students should not only have an in-depth understanding of their own professional field, but also constantly think about how to solve practical problems in other fields through mechanical and electrical technology, and inspire their innovative thinking.

3.1.3 Curriculum implementation

During the course implementation, we should pay attention to the introduction of new technologies and tools. First, we should introduce virtual simulation tools to allow students to carry out actual operation and debugging in the virtual environment, reduce the experiment cost, and ensure that students have enough practical hands-on opportunities through the repetition of work scenes. The second is to introduce the latest engineering software, such as CAD drawing, PLC, Arduino and other programming tools, in order to maintain the cutting-edge of the course. By using these tools, students can better adapt to the needs of the industry.

The implementation of the curriculum should also be results-oriented and emphasize teamwork. For this purpose, innovative design competitions can be held regularly to allow students to work together in competition projects and encourage students to come up with innovative solutions to practical problems. This will not only test the results of practical teaching, but also stimulate students' creativity and teamwork spirit. For example, by involving students in the design of an electro-mechanical system with efficient energy use, and presenting their ideas and skills in a competition, the implementation design is designed to cultivate students' ability to collaborate in an interdisciplinary environment, and encourage them to learn and cooperate in an interdisciplinary collaboration.

3.1.4 Course evaluation and feedback

Clear assessment criteria: Set assessment criteria, including not only the mastery of theoretical knowledge, but also the ability to design and produce practical projects. For example, in the Smart Car design project, students are not only assessed on their design documents and reports, but also need to demonstrate the actual operation effects of their car.

Timely feedback: Through regular quizzes and practical application assessment, students are kept abreast of their learning progress, and teaching methods and course design are adjusted to ensure students' understanding and practical application of the course content. And timely carry out practical project display, so that students can timely understand their performance in the project, promote students to adjust the learning strategy in the process of the project, to ensure that students have a comprehensive mechanical and electrical technical literacy.

3.2 Creation of "one key, two cores, three dimensions five steps" results-oriented teaching paradigm.

With "One key" (results-oriented teaching) as the basic pursuit, "two cores" (professional standards and core literacy) as the goal, "three dimensions" (target navigation, cross-border integration, evaluation of the whole process) system promotion, "five steps" (introduction of real situations -- thinking about core issues -- design and implementation plans -- sharing and display results -- evaluation and feedback expansion) sequential learning process, To achieve high efficiency of teaching organization and high effect of students' learning.

One key "results-oriented teaching" : teaching always focuses on the cultivation of students' practical ability and the achieved learning results.

Dual cores "professional standards and core quality" : based on the needs of both production and teaching, focus on students' core competencies and core abilities. Teaching design, teaching implementation, and teaching evaluation all aim to achieve the dual-core as the fundamental teaching objective.

Three dimensions of "target navigation", "cross-border integration" and "evaluation process" : □Refine the curriculum standards into students' learning objectives, give clear and clear target requirements, and design teaching activities around the target requirements under the creation of professional context tasks. □ Analyze the knowledge and skills matching the learning goals and activity design, introduce interdisciplinary elements, break the barriers of traditional disciplines, and cultivate students' comprehensive problem-solving ability. □ According to the requirements of the objectives, evaluation and teaching in the same direction, with the whole evaluation to lead the teaching reform, to ensure the quality of teaching.

The five steps: "introducing real situation -- thinking about core issues -- designing implementation plans -- sharing and displaying results -- evaluation and feedback expansion" : creating a real professional situation of interaction between learning and teaching in the whole teaching process, emphasizing students as the subject of learning; By thinking about the core problems that really need to be solved in teaching, the knowledge points are presented in the form of creative lists; Design the implementation plan of the interdisciplinary integration project; Guide students to carry out model making, iterative optimization, and share and display results, so as to promote students' sense of achievement, enhance flow experience and form ability; Innovative evaluation, timely feedback, interest and demand, integration and expansion, to promote students' lifelong sustainable development.

3.3 Improve the training system of innovative talents for mechanical and electrical majors

3.3.1 Mechanism construction

Core competence assessment mechanism: Establish a professional core competence assessment mechanism to comprehensively assess students' mastery of core fields such as machinery, electricity and control through regular assessment activities, so as to provide basis for curriculum design and adjustment.

Feedback mechanism: Establish a two-way feedback mechanism between students and teachers, and encourage students to put forward suggestions on the curriculum and teaching methods. Through regular seminars and questionnaires, students' opinions are collected and timely adjustments are made to ensure that the curriculum design is consistent with the actual needs.

3.3.2 Platform building

Practice project platform: Set up a practice project platform for mechanical and electrical control integration, and provide students with actual operation sites and equipment. This platform can simulate real industrial scenes, so that students can learn more knowledge and skills in practical projects.

Cross-border cooperation platform: Build an interdisciplinary and cross-professional cooperation platform to encourage students majoring in mechanical and electrical engineering to participate in projects together with students from other related majors such as computer science and engineering technology. By sharing laboratories and resources, students are able to better understand knowledge in different fields and develop the ability to integrate across fields.

3.3.3 Faculty building

Cross-field teacher training: According to the needs of interdisciplinary cooperation, teacher training will be conducted to enable teachers majoring in mechanical and electrical engineering to better understand the knowledge related to computer, AI intelligence, engineering technology and other fields. This will help the teachers to better guide students in cross-field cooperation.

Introduction of industry experience: Teachers with industry experience are recruited to make classroom teaching closer to actual work needs and help students better understand the application of mechanical and electrical majors in the industry.

In summary, under the background of cross-border integration, the implementation framework of innovative talent training path for Mechatronic major based on OBE theory is shown in Figure 1 below:

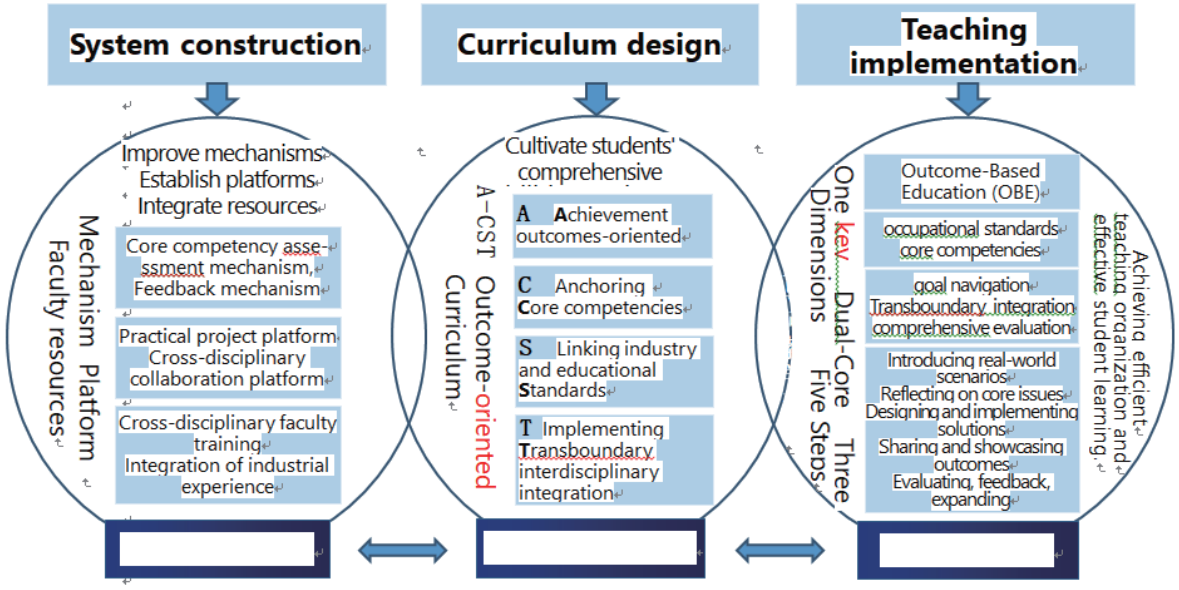

Figure 1: Implementation framework of the training path for innovative talents of electromechanical major based on OBE theory under the background of cross-border integration

4. Summary

Based on the OBE theory, combined with the cross-border integration education concept, this paper re-constructs the path of training innovative talents for mechanical and electrical majors from the aspects of course design, teaching implementation and system construction. On the basis of the introduction of OBE theory, it emphasizes the cultivation of students' practical application ability to ensure that students obtain comprehensive technical literacy in the core knowledge field. At the same time, the education concept of cross-border integration breaks the barriers of traditional disciplines, and encourages students majoring in mechanical and electrical engineering to understand and apply knowledge more comprehensively, better adapt to the future working environment, and have the ability to solve practical problems innovatively.

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