Exploration on teaching reform of Mechatronics System Design

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Abstract. "Mechatronics System Design" is a mechanical professional course involving many disciplines with high comprehensive degree and strong practicality. The traditional teaching method mainly uses the lecture-based, the examination method is old, the practical teaching is not strong, the effect is unsatisfactory. In order to improve the teaching quality and cultivate students' ability of innovative design and comprehensive application of knowledge to solve practical problems, the teaching reform mainly focuses on teaching methods, process control and assessment methods, and fully integrates discipline competition with course teaching, and has received good teaching effects

Keywords: Mechatronics, teaching reform, discipline competition

1 Introduction

The course "Mechatronics System Design" is a compulsory course for the major of mechatronics engineering, mechanical design and manufacturing and automation of the school where the author works. The teaching goal of the course is to enable students to master mechanical design, sensor, SCM principle and application, hydraulic pressure technology, PLC and embedded system, stepper and servo motor, frequency conversion control and other technologies, and to train students to have the ability of mechatronics system design and physical production and debugging. Effectively improve students' hands-on ability, effective communication and teamwork ability and vocational skills and professional quality for the post; To be competent for the vocational needs of mechatronics technical post group, to confirm, analyze and solve engineering problems in the field of mechanical engineering, and to have excellent professional quality and outstanding post innovation ability to lay a good foundation.

This course is comprehensive and practical, involving mechanical, electronic, computer, control knowledge[1-2] of many disciplines, for the teaching has brought a certain difficulty. Since the two majors offering this course are IEET Engineering education certification [3]majors, this course is defined as the "cap[4-5]point course" with the opportunity of professional construction. "Capstone course", also known as CAPstone course, is an important compulsory course required by the international

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engineering education professional certification standards, and has been widely valued by the international engineering education circle. Capstone course is aimed at senior college students, the implementation process needs the participation of teachers on campus or teachers in enterprises, students apply the professional curriculum knowledge to solve complex and integrated engineering design and manufacturing problems, is the last course of undergraduate course teaching. Through Capstone course teaching, students can be better guided to study and finish, and the teaching effect can be promoted. Guided by the three concepts [6-8]of "student-centered, results-oriented and continuous improvement" of international engineering education certification, and combined with the characteristics of mechanical majors, this paper carries out a series of course teaching reforms such [9-10]as assessment mode reform, teaching content reconstruction and teaching method change to cultivate students' engineering practice ability and knowledge application ability. The teaching reform of this course adopts the teaching method of "learning as the center and teaching as the leading". Teachers should do a good job in the construction of teaching resources, the construction of teaching platform and the control of teaching process; Students work as a team in project learning, which is mainly open learning. Finally produce a series of teaching results. This process can be continuously improved to continuously improve the quality of teaching.

2 The main problems in traditional teaching

The original total class time of this course is 56 hours, opened in the first semester of the senior year, mainly taught by teachers, the use of examination papers for assessment, this teaching mode is outdated, not only make students can not raise interest in learning, but also can not achieve the due learning effect. In order to truly grasp the students' learning situation, the author conducted a questionnaire survey on the students, teachers and teaching supervisors who took the course in the past three years, and collected 300 questionnaires in total. According to the results of the questionnaire, the participants of the course believe that there are the following problems in this course:

"Mechatronics System Design" has been opened four times in my school. The original total class time of this course is 56 hours, which is opened in the first semester of the senior year, mainly lectured by teachers. The composition of traditional mechatronics system design course is shown in Fig 1.

This course adopts examination paper for assessment. This teaching mode is outdated, which not only discourages students' interest in learning, but also fails to achieve the due learning effect. In order to truly grasp the students' learning situation, the author conducted a questionnaire survey on the students, teachers and teaching supervisors who took the course in the past three years, and collected 300 questionnaires in total. According to the results of the questionnaire, the participants of the course believe that there are the following problems in this course:

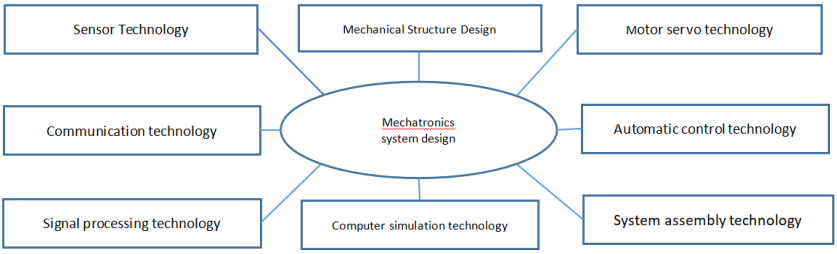

Fig. 1. Traditional mechatronics system design course composition

(1) The course knowledge is too comprehensive and closely related to the previous courses, so many students cannot connect the knowledge points in learning, which affects the learning effect and fails to stimulate students' learning interest.

(2) The course is highly practical, and the traditional course teaching cannot meet the learning objectives of improving the integration of mechanical and electrical courses, and the practice platform of the school is also difficult to meet the needs of personalized teaching.

(3) Outdated assessment methods, single examination methods, ignoring process evaluation, so that the evaluation results can not objectively reflect the learning situation of students.

(4) The content of the textbook is broad, and the content of each chapter is relatively independent. Some contents have been learned by students in related courses, such as single-chip microcomputer, sensor, etc., and repeated learning causes students to hate learning.

(5) The teaching mode is single and lecture-oriented. The teaching process of this course mainly focuses on classroom theory teaching, and the knowledge points are very scattered, which is difficult for students to master and apply what they have learned.

3 Content of teaching reform

Based on the survey results of teachers and students related to the curriculum, and adhering to the concept of engineering education certification, this paper proposes to "improve students' professional skills and enhance students' employment competitiveness" as the goal, and "promote the integration of competition and education, school-enterprise cooperation, strengthen the cultivation of practical skills, and improve traditional teaching methods" as the means to cultivate strong practical ability, innovative consciousness and practical ability. Have excellent professional skills, can solve the practical problems in industrial production of engineering talents, suitable for colleges and universities "Mechatronics system design" course teaching reform of new measures, including the following content.

The reform of teaching methods. The teaching of this course is no longer limited to traditional classroom teaching. First, the teaching location is flexible.

(1)According to the teaching needs, the classroom can be set up in the laboratory, the production line of enterprises, etc. Second, the teaching time is decentralized, the 56 lessons of this course are completed in two semesters, most of the teaching content of this course does not take centralized teaching, teaching in groups, teachers according to the completion of tasks. To carry out teaching activities flexibly; Third, set up a curriculum team. This course is taught by a teacher who has the knowledge background of mechanical design, mechanical manufacturing and control system design. The teaching is completed by modules. At present, there are 16 teachers in the course team. During the course, students communicate with teachers regularly until they complete the teaching tasks.

(2) Reform of teaching content. This course breaks the traditional teaching method with textbooks as the core content. First, a series of discipline competitions such as mechanical innovation competition and robot artificial intelligence competition were introduced into the course teaching, which greatly stimulated students' interest in learning. Through the discipline competition "promoting learning by competition", students' enthusiasm and participation are fully mobilized, and passive learning is transformed into active learning; Through the discipline competition "promoting teaching by competition", teachers can collect previous competition cases or award-winning cases in the teaching process of professional courses, build a teaching case database, and carry out targeted case teaching on this platform. Students' participation results can reflect the rationality of the teaching plan and teaching content. Teachers can analyze students' problems in the competition, find out the problems in teaching and learning in time, and then adopt more targeted reform strategies. The second is to integrate enterprise production cases into teaching to improve students' social adaptability. The course team and Guangzhou Yuefin Communication Technology Co., LTD jointly built the course teaching resources. After three years of construction, this course has formed a question bank from the competition topic selection and enterprise production practice cases.

(3) Reform of assessment mode. Students can be a group of 3-5 people, from the mechatronics system design course topic list to choose a topic, complete the design requirements of the topic. Test the students' mechatronics system design ability and problem-solving ability using the knowledge learned, including mechanical design and software design, including research and analysis, group division of labor, schematic design, implementation, debugging, document writing, report defense and other links. In the implementation process of the project, it is necessary to submit the proposal report, research report, mechanical design drawings, circuit schematics, program source code, system object or object model, defense PPT and other materials.

The student's final score is composed of the usual score and the final score. Course assessment focuses on process evaluation. Normal grades include attendance, class performance and homework; The final scores are mainly the scores of mechanical and electrical product design and production process: including the quality of physical works, written reports and defense course assessment. This course aims at the talent training plan and cultivates students with 7 core abilities such as professional skills and teamwork spirit. The specific assessment is shown in Table 1.

Table 1. Course assessment score table

Grade Categories	Project	Percentage
Usual grades (40%)	Attendance	30%
	Classroom performance	30%
	Homework	30%
Final grade (60%)	Proposal report	10%
	Closing report	30%
	Thesis proposal	10%
	Closing answer	10%
	Physical work	40%

4 Teaching reform results

After three years of teaching reform and practice, the research group has continuously explored the objective laws of curriculum teaching and scientific teaching methods, and fully mobilized students' enthusiasm and participation in learning. This course has achieved the following results: First, it has met the requirements of IEET certification cap-course. This course is the "top course" for Mechanical and Electronic Engineering, Mechanical Design and Manufacturing and Automation majors. The development of "top course" is an important index of IEET certification. This major has passed IEET engineering certification; Second, it promotes the development of discipline competition. Relying on the learning of this course and the guidance of the production of objects, a stepped discipline competition training system for mechanical majors has been built. That is, "old bring new" mode. Senior students who are members of the winning team or have competition experience will be the first echelon, sophomores with solid professional basic knowledge will be the second echelon, and freshmen with strong learning ability will be the third echelon. Give full play to the role of senior students and the advantages of gradient combination to achieve the "sustainable development" of the competition team, and form a discipline competition training system that starts from the first year, accumulates in the second year, and breaks through in the third year; The third is to improve the quality of graduation design. This course is a comprehensive course, students' course learning mode and achievement form are similar to graduation design. Through this course, students can master the relevant requirements of graduation design in advance; Fourthly, it improves the employment quality of students. Through the comprehensive design of mechanical and electrical products, the practical skills of students have been greatly improved and the quality of employment has been improved. At present, the employment rate of this major has reached 98%, and the employment salary has increased by 10% over the previous year.

5 Conclusions

In this paper, the traditional curriculum is reformed to the traditional teaching method. The first is to change the teaching mode, adopt group teaching, give full play to the advantages of team teaching; The second is to change the assessment method, the

results-oriented process assessment mode improves students' practical ability and innovation ability, and increases students' interest in professional knowledge; The third is to reconstruct the teaching content to realize the trinity training mode of "enterprise - university - student". By solving practical problems, it changes the current situation that college students' knowledge is "complete but not specialized", which leads to difficult employment, improves their professional skills and engineering ability, and increases their employment opportunities.

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