Research and Practice of Promoting the Construction of Electronics Technology Course Design by Subject Competition in the Context of New Engineering—Take the "e-Topics" competition as an example

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Abstract. Introducing the latest projects of electronic design competitions into the practical teaching of electronic technology courses, so that the knowledge points of circuit analysis, digital electricity and analog electricity can be effectively connected and the "islands" of knowledge points of traditional practical courses can be broken; The research came out set of closed-loop teaching process of "competition training - grouping before class - practice during class - defense after class" and proposed a six-loop innovative teaching method of "interest - team - theory - practice - stage - review" To guide students to learn actively and develop their ability to synthesize their knowledge and solve practical and complex engineering problems.

Keywords:Course Design; Academic competition ;Practical teaching; Electronic technique.

1 Introduction

In 2017, China launched the construction of new engineering disciplines, encouraging universities to explore the cross-fertilization of disciplines, combining science and engineering, cross-industry, breeding cross-specialties, and cultivating engineering talents across faculties, disciplines and specialties [1]. It has become a "booster" and "multiplier" for the cultivation of innovative talents in new engineering. The traditional electronic technology curriculum design projects are slow to update and do not meet the requirements of interdisciplinary and interprofessional talents training under the background of new engineering, and are generally disconnected from the actual engineering cases, and cannot link the knowledge points in various courses "islands" efficiently [2].

By introducing the latest projects in electronic thematic design competitions into the practical teaching of electronic technology course design, the knowledge points in

S. Yacob et al. (eds.), *Proceedings of the 2023 7th International Seminar on Education, Management and Social Sciences (ISEMSS 2023)*, Advances in Social Science, Education and Humanities Research 779,
https://doi.org/10.2991/978-2-38476-126-5_175

circuit analysis, digital electricity and analog electricity are efficiently linked; at the same time, by encouraging students to exchange credits with the award certificates and other measures, students can be effectively guided to independent learning [3], so that they can avoid directly facing the boring theoretical knowledge and cultivate their interest in learning in the wonderful practical cases. Knowledge application ability, solution design ability, system development and circuit debugging ability [4].

2 Reform of teaching contents

In the background of the construction of new engineering, based on the shortage of traditional practical teaching courses, actively explore interdisciplinary and interdisciplinary teaching cases, introduce the exciting practical projects in electronic thematic design competitions into the electronic technology course design, link the knowledge points in circuit analysis, digital electricity and analog electricity efficiently, emphasize the connection between theory and practice, lay a solid foundation for students to master more complex and systematic circuits in the future It also aims to improve students' awareness and ability of independent analysis, judgment and problem solving, and to deliver applied talents who can solve complex engineering problems for socialist construction [5].

Take the cases in the electronic thematic design competition in the past four years as an example, the cases are from the hands of top experts in circuit design, as shown below, the cases perfectly integrate the rectifier, filter, voltage regulator, counter, register, latch, operational amplifier, waveform generator, combinational logic control and other circuits in the courses of circuit analysis, digital electricity and analog electricity, which opens up the traditional practical course knowledge points in the "silo", guide students to learn actively and develop their ability to synthesize the knowledge they have learned and solve practical and complex engineering problems.

During the teaching process, we use mind maps to link up the knowledge points, use case study, heuristic, group discussion and "old with new" teaching methods, and encourage students to use simulation software and PCB design.

3 Reform of teaching methods

Traditional electronics technology course design in the second semester of the second year of intensive training 1-2 weeks, students passively receive the tasks issued by the teacher, resulting in most students are not interested in the course, lack of initiative in learning, this topic and electronic thematic design competition docking [6].

(1) Before the course, freshmen are encouraged to actively participate in the discipline competition training, and the learning period is extended to 25 months. Students who have performed well or won prizes in the training process of electronic project design competition can exchange credits, and are exempted from taking the practical course. With the division of labor and cooperation of electronic associations, students can choose their own interested case study training, and they can also determine the course credits after completing the established tasks.

(2) In the course, the teacher released excellent project cases in the past five years, and elected outstanding students as team leaders. Students can choose interested cases and team leaders independently, discuss in groups, cooperate with each other, and help each other to complete the design, debugging and production of the cases.

(3) At the end of the course, students are assessed from five dimensions: simulation design, welding typesetting, function realization, learning attitude and course design report. At the same time, a number of students from each group are randomly selected to come to the stage to explain their analysis and understanding of the case, so as to prevent students from shoddy, let each student participate in the team and actively learn, and at the same time, teachers give comments and feedback to each student who comes to the stage, forming a teaching closed loop to ensure the teaching quality.

4 Reform of appraisal methods

The traditional assessment methods of curriculum design generally assess students from the dimensions of simulation design, welding typesetting, function realization, learning attitude, curriculum design report, etc., but they fail to allow students to participate in relevant subject competitions (winning prizes) or training (outstanding performance) for credit exchange, and students fail to choose interested cases and team leaders independently, ignoring the importance of students taking the stage to explain cases, and the assessment methods are single, which does not form a closed loop of teaching and cannot really grasp the depth of students' understanding of knowledge points [7-8].

On the basis of the five dimensions of traditional assessment, we added credit exchange, students' independent choice of cases and group leaders, students' taking the stage to explain cases, teachers' comments and other methods, forming a closed-loop teaching, so that teachers can clearly understand each student's learning level, ensure fairness, and at the same time make each student nervous and active, actively integrate into the team, and exercise students' comprehensive abilities such as language expression and logical thinking[9-10].

The total score of the course = process evaluation score (simulation design 10%+ welding typesetting 10%+ learning attitude 10%+ function realization 40%) + summative evaluation (course design report 20%+ lecture on stage 10%), or the course is exempted from credit exchange.

5 Function and significance of improving teaching quality

(1) It is beneficial to cultivate students' knowledge application ability, scheme design ability, system development ability and circuit debugging ability. Compared with the traditional practice teaching mode, the electronic thematic design competition project is introduced into the course design of electronic technology, which effectively links the boring knowledge points in circuit analysis, digital electricity and analog electricity, and cultivates students' ability to apply theory to practice and solve practical problems in wonderful practice cases.

(2) It is beneficial to cultivate students' interest in learning and the ability of autonomous learning. Students who have performed well or won prizes in the training process of electronic thematic design competition can exchange credits and avoid taking this practical course. Students' association, division of labor and cooperation can be used to cultivate students' spirit of teamwork, mutual help and mutual assistance, and promote the all-round and common development of students' quality.

(3) Facilitate teachers' self-improvement as well as the improvement of subject competitions. Taking the competition projects as an opportunity to dynamically update the practical course projects, teachers need to deeply understand and expand the relevant knowledge involved, and guide, comment and answer questions to students, which also motivates teachers to continuously learn and strive to improve their professional quality, so as to better improve the quality of classroom teaching as well as competition guidance.

(4) It is conducive to the cross-fertilization of courses and the cultivation of applied talents required by society. The practical cases in the competition are used to open up the "islands" of knowledge in the courses of circuit analysis, mathematics, and analog electricity, and to better develop students' ability to apply their knowledge to solve complex engineering problems.

6 Key issues to be addressed

(1) In the context of new engineering construction, the ‘isolated island’ issue of knowledge points in traditional practical courses has been resolved, and cross-integration of courses has been achieved. This lays a solid foundation for interdisciplinary and interprofessional talent training.

(2) Traditional electronic technology courses have failed to implement a flexible dual-track assessment and evaluation system, neglecting the importance of students' independent choice, teamwork, and case presentations. The assessment method is singular and does not form a closed teaching loop, preventing teachers from truly grasping the depth of students’ understanding of knowledge points.

(3) Practical engineering cases and industry-applicable teaching content have not been integrated into the classroom. This topic takes competition projects as an opportunity to dynamically update practical course projects, while also encouraging teachers to improve themselves by answering students’ questions and providing feedback.

(4) The issue of low student interest in participating in subject competitions and difficulty in improving the quality of electronic technology course teaching has been resolved. This has motivated students’ enthusiasm for autonomous learning, understanding the coherence between knowledge points, and the importance of solving complex practical engineering problems.

7 Expected Benefits of the Project

(1) Through the reform of teaching content, teaching methods, and assessment modes, and the integration of cases from electronic subject design competitions, students'

interest in learning is stimulated, their theoretical level and application ability are improved, thereby enhancing their ability to solve complex practical engineering problems.

(2) By implementing a flexible dual-track assessment and evaluation system, methods such as credit exchange, students' independent choice of cases and team leaders, students presenting cases on stage, and teacher feedback have been added. This has formed a closed teaching loop and improved students' comprehensive abilities.

(3) Through this research project, teaching cases and a comprehensive assessment mode have been developed to bridge the 'isolated islands' of knowledge points in courses such as circuit analysis, digital electronics, and analog electronics. This approach is further being promoted to other engineering experimental courses.

(4) This approach can benefit students, schools, and society in three ways: 1) Student benefits: mastering the ability to solve complex engineering problems, enabling students to better and more quickly adapt to work in enterprises. 2) School benefits: simultaneously improving the quality of subject competitions and teaching, enhancing the influence of universities. 3) Social benefits: providing the market with high-quality applied talents, enabling society to receive higher-quality practical skills services, and improving social benefits.

8 Conclusions

Through the integration of disciplinary competition projects, the "silos" in the knowledge of traditional practical courses are opened up, the students' independent learning ability is strengthened, and the students' ability to apply their knowledge in an integrated manner to solve practical and complex engineering problems is cultivated. A closed-loop teaching process of "competition training - grouping before class - practicing during class - defending after class" has been formed and an innovative six-loop teaching method of "interest - team - theory - practice - on stage - review" has been proposed. The competition project is used as an opportunity to dynamically update the practical course projects, prompting teachers to improve themselves in the process of answering and commenting on students' questions. Establish a dual-track assessment and evaluation system where students who win electronic thematic design competitions or excel in training are eligible for credit redemption, regardless of the traditional format, The student-centred approach focuses on assessing students' ability to apply knowledge and solve practical engineering problems, while greatly increasing students' motivation to participate in subject competitions.

Acknowledgment

1. This research was supported by 2022 Teaching reform Research Project of Jiangxi province, Research and Practice of Promoting the Construction of Electronics Technology Course Design by Subject Competition in the Context of New Engineering—Take the "e-Topics" competition as an example (JXJG-22-20-17).

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