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Teaching Reform of Basic Electronics Technology Courses in the Context of the Guangdong-Hong Kong-Macao Greater Bay Area Construction

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Abstract

The construction of the Guangdong-Hong Kong-Macao Greater Bay Area requires a large number of electronic technology professionals, with a continuous increase in the demand for talent quality. However, the current electronic technology foundation courses exist in the form of disconnection between theory and practice, and insufficient cultivation of students' innovative abilities. To address these issues, this paper proposes a series of teaching reform measures: Firstly, the teaching content is optimized by introducing artificial intelligence technology for circuit optimization, which stimulates their interest and spirit of exploration in new technologies. Secondly, innovative teaching methods are adopted, with the BOPPPS teaching model at the core, and methods such as case analysis are used to continuously improve teaching effectiveness. Thirdly, the assessment methods are reformed by setting up multi-mode assessments at various stages to continuously track students' understanding and mastery of knowledge. Fourthly, educational resource construction is strengthened, such as improving teachers' teaching skills and perfecting the construction of practical and teaching resources. Through the teaching reform of the basic electronic technology course, we can effectively enhance students' technical skills and innovative thinking, thereby meeting the talent needs of the electronic information technology and industrial development in the Greater Bay Area to a certain extent.

Keywords

Basic Electronics Technology; Greater Bay Area; BOPPPS.

1. Introduction

Under the grand blueprint of the construction of the Guangdong-Hong Kong-Macao Greater Bay Area (Greater Bay Area), the rapid development of electronic information technology and industry has created an increasing thirst for high-quality and innovative talents. As an indispensable cornerstone of science and engineering education, especially electronic information majors, the electronic technology basic curriculum not only shoulders the important task of building a solid theoretical framework for students, but also carries the key mission of stimulating students' practical ability and innovative potential. However, in the face of the continuous improvement of talent quality standards in the Greater Bay Area, the existing teaching mode and content of basic electronic technology courses have gradually exposed their limitations, and it is difficult to fully meet the market demand for application-oriented and innovative talents. As the key driving force of the national economic development, the electronic information industry of the Greater Bay Area has become an important pillar supporting economic growth. In this context, the teaching reform of the basic curriculum of electronic technology is particularly urgent and important. On the one hand, we urgently need to update the teaching content to ensure that students can keep up with the latest trends of

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electronic technology and understand the industry dynamics to better adapt to the market demand, we also need to innovate the teaching methods and enhance the practical teaching skills and innovative thinking skills, so as to lay a solid foundation for their future career.

2. Problems Existing in The Traditional Teaching Mode

2.1. The course content is boring and difficult to understand

The basic course of electronic technology is an important basic technical course for engineering majors in universities, such as communication engineering, electronic information engineering, electrical engineering and automation. The course is mainly divided into three parts: circuit analysis foundation, analog electronic technology foundation and digital logic circuit foundation. The course covers a large amount of theoretical knowledge of circuit and electronic technology, including cumbersome formulae, complex theorems, and esoteric principles. These theoretical contents are often more abstract, lack of intuition and interest, making it difficult for students to quickly form an intuitive understanding and in-depth understanding. In order to master these theoretical knowledge, students need to invest a lot of time and energy in learning and memory, which undoubtedly increases the difficulty and boredom of learning.

2.2. Lack of practical case study and application background

The basic course of electronic technology is famous for its profound theoretical foundation and high abstraction. The course content often focuses on the teaching of theoretical knowledge, but it is easy to ignore the combination with actual cases and the introduction of application background. On the one hand, compared with other professional courses, this course is difficult, it is difficult for students to connect the knowledge with practical application, easy to fear, it is difficult for students to connect the knowledge with practical application, leading to an obvious gap between theory and practice [1].On the other hand, the lack of teaching methods combined with practice, simple theoretical teaching, this lack of practical and applied teaching method is easy to make students weariness. In addition, the lack of application background may make students feel that the knowledge they learn is disconnected from real life. Students may not be able to realize the practical application value of the knowledge learned, resulting in a lack of learning motivation.

2.3. The defects of the experimental teaching link

There are many problems in the experimental course of electronic technology. First of all, the content and method of the experiment are relatively single. The modular experiment box limits students 'independent design and innovation space. There are too many verification experiments and the content is outdated, and the lack of comprehensive and designed experiments is not conducive to the cultivation of students' innovative thinking and practical ability. Secondly, the experimental assessment mechanism has the problem of a single evaluation method and fuzzy evaluation criteria, which mainly relies on experimental reports, which is difficult to fully reflect students' practical ability and innovative thinking. In addition, experimental resources and support are insufficient, including the quantity and quality of experimental equipment, experimental instructions and teacher guidance are not in place. Finally, students themselves also lack of experimental interest and experimental skills, leading to the lack of interest and motivation in the experiment, or encounter difficulties in the experimental operation. These problems jointly affect the teaching effect of the experiment and the cultivation of students' ability.

2.4. The assessment mechanism is old

The old assessment mechanism has many deficiencies, it is often too heavy on the examination of theoretical knowledge, through the closed book examination and theoretical questions to

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test the degree of students, which is easy to make students take the test psychology, the front loose after tight, but ignoring the cultivation of practical ability and innovative thinking [2].At the same time, the evaluation method is single, only based on the final examination results and the experimental report to evaluate the results, can not fully reflect the students' practical ability and innovative thinking. In addition, the old assessment mechanism also lacks the evaluation of students' learning process, only focuses on the final learning results, and ignores the problems and deficiencies in the learning process of students.More importantly, this assessment mechanism may be out of touch with the practice link, which cannot effectively test the students 'practical ability and the application degree of knowledge, especially in the basic course of electronic technology, the practice link is crucial, and the disconnection will lead to the lack of students' practical ability.

3. Pedagogical Reform Measures

3.1. Optimize the teaching content

In view of the boring and difficult course content and the defects of experimental teaching links, a comprehensive and in-depth reform has been carried out. In superposition theorem, for example, after the theory teaching, we increase the actual case analysis, for example, the superposition theorem applied in experimental operation, the teacher beside give guidance and error correction, let the students on the basis of understanding the theory, can more intuitively see and master its application in the actual circuit, so as to deepen the mastery of knowledge. With the rapid development of science and technology, the industry cutting-edge technology and the latest research results continue to emerge, which puts forward higher requirements for the teaching content. Actively introduce new electronic components, advanced circuit design methods and other cutting-edge content, so that students can follow the technical trend, broaden their professional horizons. For example, in the course, it is necessary to introduce in detail how to use the latest microcontroller for circuit design, and how to use artificial intelligence technology for circuit optimization and other [3]. The introduction of these cutting-edge content not only improves students' professional quality, but also stimulates their interest in new technologies and the spirit of exploration.

3.2. Innovate teaching methods

In view of the teaching problems of boring and difficult course content and lack of practical cases and application background, the BOPPPS teaching mode is used in the basic teaching of electronic technology, which has brought innovation to the traditional teaching mode. BOPPPS Teaching mode is a new student-centered teaching design framework that emphasizes teaching interaction and feedback. It includes six core links: introduction, learning objectives, pre-test, participatory learning, post-test and summary. These links connect with each other, forming a complete teaching cycle, aiming to maximize the learning effect of students [4].In the introduction process, teachers can effectively attract students' attention by showing the practical application of the circuit, asking relevant questions or telling interesting stories. Teachers clearly set the learning objectives, covering the three dimensions of knowledge, ability and emotional values, to ensure that students clearly understand the learning direction of this lesson. For example, when learning the decoder, the knowledge goals include understanding the concept and working principle of decoding and decoder, the ability goal focuses on cultivating the ability of circuit analysis and application, and the emotional value goal is to enhance students' enthusiasm for learning through example teaching. The pre-test link helps the teachers to master the students' prior knowledge and understanding degree, and provides a basis for the follow-up teaching. Participatory learning, as the core of BOPPPS teaching mode, helps students to be guided to actively participate in and cooperate in learning in the basic teaching of electronic technology through group discussion, experimental

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operation, case analysis and other methods. For example, students can be organized to conduct a project, namely, group design and implement a multi-oscillator circuit based on a 555 timer, and explore its frequency output changes under different parameter Settings. Each group needs to deeply understand the working principle and multi-resonance mode of the 555 timer through theoretical calculation, circuit construction, waveform observation and other steps. In the post-test section, students' mastery of learning objectives is evaluated through quizzes and circuit design experiments. In the summary link, guide students to reflect on the learning content and learning process, and teachers also reflect on the effectiveness of teaching methods and improvement space, so as to jointly promote the improvement of teaching quality.

3.3. Reform of assessment methods

In view of the old problem of the assessment mechanism, the reform of diversified assessment methods has been implemented. This reform not only retains the traditional closed-book examination, but also adds the practical operation assessment links, such as circuit construction, equipment debugging and waveform observation, etc., to test the students' practical operation ability. Introduce project assessment, arrange project tasks related to the course content, require students to complete in groups and submit project reports or physical demonstration, so as to comprehensively investigate students' theoretical knowledge, practical ability and team cooperation ability [4].The setting of oral examination and defense also provides students with opportunities to show their expression ability and understand their knowledge. In order to strengthen the process evaluation, students' classroom participation, homework completion, and the quality of experiment reports are included in the scope of ordinary performance assessment, and phased tests are set up in different stages of the course. Modern technical means, such as online examination system and virtual simulation experiments, are introduced to improve the efficiency and security of examinations. Formulate detailed assessment plans, strengthen teacher training, improve teaching facilities, and establish a feedback mechanism between students, teachers and schools, so as to timely adjust and improve the assessment methods.

3.4. Construction of educational resources

Teacher resource construction. Teacher resource construction of electronic technology basic course is a systematic project, aiming to improve the teaching quality and teachers' professional quality. To build a high-quality teacher team, to gather high-quality teacher resources. Introduce teachers with rich teaching experience and profound academic foundation, as well as encourage and support existing teachers to continuously improve themselves. The college should regularly organize teacher training and build a teacher resource sharing platform, promote the communication and cooperation among teachers, invite education experts to share advanced teaching ideas and methods, and improve teachers' teaching ability and professional quality. Through training and in the teacher resource sharing platform and other forms, let teachers understand the latest teaching techniques and methods, and apply them to practical teaching.

Experimental and practical resources construction. The Guangdong-Hong Kong-Macao Greater Bay Area is actively promoting scientific and technological innovation and industrial upgrading. Circuit and electronic technology, as the basic disciplines supporting the development of modern electronic industry, the improvement of its experimental and practical resources construction resources can better meet the needs of industrial development. The school can build a modern laboratory equipped with cutting-edge equipment and equipment to ensure that students can have access to the most cutting-edge technical tools, and provides detailed experimental instructions and standard report templates to guide students to complete the experimental tasks efficiently and accurately. The laboratory opens to students in spare time, providing an experiment platform for students, and provides relevant teachers to give guidance

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in the experiment to ensure the safety of students in the experiment process. It provides a good platform for cultivating students' independent experimental operation ability and interest in scientific research [5] .

Construction of teaching resources. The basic course content of electronic technology has much theoretical knowledge and it is difficult to understand. When students study this course, it is not enough to study the course only during class time. The teacher team can use modern information technology to make micro-lesson videos for the difficulties and priorities of the course and collect high-quality video resources related to the course, including expert lectures and technical demonstrations, so as to broaden students' knowledge horizon. Using the online teaching platform, it realizes the convenient release of courses, flexible assignment of homework and immediate feedback of online tests, providing students with a rich and variety of learning resources. The school has established diversified communication channels such as course forums and wechat groups to facilitate real-time communication and interaction between students and teachers. Through the regular organization of online or offline learning and communication activities, to further promote the ideological collision and academic discussion between students, and create a strong learning atmosphere [6].

4. Achievement Promotion

Through the above reform measures, students' mastery of the curriculum will be greatly improved, and the professional quality of teachers will also be significantly improved, so as to ensure the overall improvement of teaching quality. The rich experimental and practical resources will provide students with more practical opportunities, and significantly improve their practical operation ability and innovation ability. The introduction of digital teaching resources and diversified communication channels will create a more convenient and efficient learning environment for students, and promote the real-time communication and interaction between teachers and students. The improvement of the teaching feedback and continuous improvement mechanism will ensure that the teaching reform can be carried out smoothly, and that the teaching content, teaching methods and assessment methods can be continuously optimized according to the actual situation. With the implementation of these reform measures, the university will cultivate more circuit and electronic technical talents with solid theoretical foundation, strong practical ability and good innovation ability, and provide strong talent support for scientific and technological innovation and industrial upgrading in the Guangdong-Hong Kong-Macao Greater Bay Area.

5. Summary

With the vigorous development of the electronic information industry in the Guangdong-Hong Kong-Macao Greater Bay Area, the teaching reform of the basic courses of electronic technology has become the key to cultivating high-quality and innovative talents. Through the optimization of teaching, innovative teaching methods, assessment methods and the construction of educational resources, especially the construction of experimental and practical resources, students' hands-on ability and innovative thinking ability have been effectively improved, providing strong support for them to adapt to the market demand and become application-oriented and innovative talents. By implementing the above reform measures, the school can ensure that students can keep up with the frontier of electronic technology, have a deep understanding of the industry dynamics, and lay a solid theoretical foundation for their future career development [7]. This teaching reform is not only a breakthrough to the traditional teaching mode, but also a positive response to the needs of economic development in the Greater Bay Area. Our school firmly believes that through the continuous deepening of teaching reform, the basic curriculum of electronic technology will better serve the development of the

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electronic information industry in the Greater Bay Area and inject new vitality into the sustained growth of regional economy. In the future, our school will continue to explore more efficient and practical teaching modes, contribute to the cultivation of more high-quality talents with innovative spirit and practical ability, and jointly promote the prosperity and development of the electronic information industry in the Greater Bay Area.

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References

[1] Long Ma, Manjun Yan. Teaching Reform of "Circuit and Analog Electronic Technology Foundation" Course in Computer-Related Majors of Colleges and Universities. Science and Technology Wind, 2022, (25): p. 133-135.

[2] Yajun Wang, Yonghong Ma, Lina Meng. Discussion on the Teaching Reform of Electronic Technology Foundation Course Based on the Cultivation of Applied Talents. China Modern Educational Equipment, 2017, (21): p. 45-47.

[3] Xingli Zhang, Mingliang Gao, Jin Jin, et al. Exploring the Application of Artificial Intelligence Technology in the Reform of Higher Education. Science and Technology Information, 2024, 22(14): p. 203-206.

[4] Ying Huang, Pengying Deng. Application and Practice of BOPPPS Teaching Method in "Circuit" Course—Taking Superposition Theorem as an Example. Electronic World, 2022, (02): p. 60-61.

[5] Dongbin Tian, Deyan Yu. Research on the Teaching Reform of "Electronic Technology" Course. Science and Technology Wind, 2024, (18): p. 7-9.

[6] Xuesong Zhang, Xinxiang Liu. Discussion on the Teaching Reform of Graduate Courses Based on OBE — Taking "Modern Detection and Control Technology" Course as an Example. Science and Technology Wind, 2024, (23): p. 19-21+65.

[7] Haitao Zhou, Siyu Lin. The Logic and Path of University Teaching Reform from the Perspective of a Strong Higher Education Country. Inner Mongolia Social Sciences, 2024, 45(05): p. 40-46+221.