

Exploration and practice of wireless network technology course teaching reform based on CDIO+online and offline mixed teaching

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Abstract: With the rapid development of information technology, wireless network technology plays a more and more important role in modern society. In order to meet the needs of the industry and improve the quality of teaching, this study proposes a teaching reform scheme of wireless network technology course based on CDIO (Conceive, Design, Implement, Operate) education mode and online and offline hybrid teaching method. Firstly, this paper analyzes the current teaching status and existing challenges of wireless network technology course, and then discusses the theoretical basis and advantages of CDIO education mode and hybrid teaching method. On this basis, a set of teaching reform framework integrating CDIO concept and blended teaching strategy was designed, and the effectiveness of the framework was verified through empirical research. The results show that the teaching reform program can significantly improve students' practical ability, innovative thinking and learning satisfaction, which has important enlightenment and application value in the field of engineering education.

1. Introduction

In the information age of the 21st century, wireless network technology has become a key force to promote social progress and economic development, and the demand for related professionals is increasing. However, the traditional teaching mode is often difficult to meet the rapidly changing technical needs and students' personalized learning needs. Therefore, the teaching reform of wireless network technology course has become particularly urgent. As an internationally recognized engineering education framework, CDIO (Conceive, Design, Implement, Operate) education model emphasizes the project-centered learning experience and the cultivation of engineering practice skills by simulating the real engineering practice environment. To promote students' innovative thinking and ability to solve complex engineering problems. At the same time, the blended teaching model provides flexible learning methods and personalized learning paths for students by combining online autonomous learning and offline interactive discussion. This study aims to explore the teaching reform of wireless network technology course based on CDIO

education mode and online and offline hybrid teaching method, in order to improve students' theoretical knowledge, practical skills application and innovation ability cultivation. Through the analysis of the whole process of curriculum design, teaching implementation and effect evaluation, this paper puts forward an innovative teaching reform scheme, shows the practice process and effectiveness of the teaching reform, and provides new ideas and methods for the teaching reform of wireless network technology courses and broader engineering education courses. The research results are not only of great significance to improve the teaching quality of wireless network technology courses, but also provide reference teaching reform experience and mode for other engineering education courses. It is expected to provide theoretical support and practical guidance for higher education institutions in the field of engineering education teaching reform^[1-3].

2. Theoretical basis and literature review

2.1. Theoretical basis of CDIO education model

CDIO education model is an internationally recognized engineering education model, which takes the Conceive, Design, Implement and Operate of products and systems as the education environment, aiming to cultivate students' engineering practice ability and innovative thinking. The theoretical basis of this model emphasizes the integration of technical knowledge and individual and team capabilities through project practice, so as to realize the systematic development of engineering education. The implementation of CDIO model helps to improve the comprehensive quality of students, including basic engineering knowledge, personal vocational skills, teamwork and communication skills, and understanding of the enterprise and social environment. CDIO embodies the unity of systematicity, scientificity and advancement, and represents the development trend of contemporary engineering education^[4-5].

2.2. Research progress of blended teaching model

As a research hotspot in the field of education, the research progress of blended teaching model shows that this model can effectively improve students' learning effect and participation. Blended teaching combines the advantages of traditional face-to-face teaching and online learning, and meets the learning needs of different students through flexible learning paths and personalized learning experiences. Research shows that blended teaching can improve students' autonomous learning ability and critical thinking, and promote the development of digital, intelligent and information education^[6].

2.3. The teaching status of wireless network technology course

In order to adapt to the rapid development of technological changes, the course of wireless network technology is faced with updated needs in teaching content and methods. The analysis of the current teaching situation points out that many course content updates lag behind and fail to reflect the latest technology and industry standards in time. In addition, students generally lack the opportunity to apply theoretical knowledge to practical problems, which requires the reform of teaching content and methods to improve the practicality of the course and the practical skills of students^[7].

2.4. Case analysis of the combination of CDIO and blended teaching

The case analysis shows that the combination of CDIO education model and blended teaching

can effectively improve the quality and effect of engineering education. This combination can not only provide rich learning resources and flexible learning methods, but also enhance students' practical skills and teamwork ability through project-oriented learning activities. The successful practice in the case provides valuable experience and enlightenment for other engineering education courses.

3. Theoretical framework of teaching reform

3.1. CDIO mode and implementation strategy

CDIO education model is an internationally recognized engineering education model, which emphasizes the cultivation of students' engineering practice ability and innovative thinking through the four stages of Conceive, Design, Implement and Operate. The goal of this model is to provide an educational environment with engineering projects as the core, so that students can learn and master engineering skills in real engineering practice. The implementation strategy of CDIO model includes integrating course content, ensuring that teaching activities are closely integrated with actual engineering projects, and promoting students' active learning and teamwork through project-oriented and problem-oriented teaching methods. The implementation of the CDIO model also requires teachers to have the corresponding guidance ability, as well as the school to provide the necessary laboratory and practice facilities^[8].

3.2. Advantages of blended teaching

Blended teaching mode combines the advantages of traditional face-to-face teaching and modern online learning, providing flexible and diverse learning methods. The characteristics of this model include flexibility, diversity, and personalized learning. Students can choose to participate in online or offline learning according to their own time and place, which improves the autonomy and flexibility of learning. Blended teaching makes use of online resources such as e-books, learning videos, and online discussions to enrich teaching resources while maintaining opportunities for face-to-face communication. In addition, blended teaching can provide personalized teaching arrangements according to the learning progress and ability of students, and thus improve the learning effect by providing an adaptive learning mode.

3.3. Wireless network technology teaching needs

The teaching demand analysis of wireless network technology course involves the understanding of the industry development trend, and the demand for students to master the knowledge and skills of wireless network technology. With the rapid development of mobile communications, Internet of things and smart cities, there is a growing demand for professionals in wireless network technology. Students need to have a comprehensive ability from basic theoretical knowledge to practical skills, including network design, deployment, maintenance and optimization. The teaching content should keep pace with the latest industry technologies and standards, while providing enough practical opportunities, such as laboratory practice, off-campus internships, and industry cooperation projects, to enhance students' practical skills^[9-10].

3.4. Integration of CDIO and blended teaching

The combination of CDIO education model and blended teaching can construct a comprehensive teaching reform framework. This integrated model not only emphasizes the whole life cycle

management of engineering projects, but also includes the blended teaching strategy of online autonomous learning and offline interactive discussion. Through this integration, students can learn theoretical knowledge online, and perform practical operation and teamwork offline, so as to realize the effective combination of theory and practice. This model requires teachers to design blended teaching plans in line with the CDIO concept, including project topic selection, teaching syllabus, network platform demand positioning and classroom teaching preparation. In addition, the role of teachers has changed from traditional knowledge imaders to learning guides and promoters, paying more attention to the cultivation of students' active learning and innovation ability.

4. Design of teaching reform program

4.1. A. Setting of course objectives and learning outcomes

The setting of course objectives should be based on the actual needs in the field of wireless network technology and the future development of students. Learning outcomes include not only the mastery of theoretical knowledge, but should also cover practical skills, innovation ability, and teamwork spirit. Course objectives should clearly indicate the level of knowledge and skill requirements that students should achieve after learning through the course, and how these knowledge and skills can be applied to solve practical problems.

4.2. Integration of teaching content and resources

The integration of teaching content requires the incorporation of the latest industry technologies and standards into the curriculum system, while ensuring the combination of theory and practice. The integration of resources includes traditional textbooks, online courses, laboratory equipment, industry case studies, and expert lectures. Teachers should select and design instructional resources that can support course objectives and learning outcomes and ensure that students can acquire knowledge and skills from multiple sources.

4.3. Innovation of teaching methods and means

The innovation of teaching methods aims to improve students 'interest and participation in learning, including flipped classroom, project-based learning, case analysis, simulation experiment and team cooperation. The innovation of teaching means involves the use of information technology tools, such as online education platforms, virtual reality (VR), augmented reality (AR), etc., to enhance the interactivity and practicality of learning.

4.4. Design of teaching activities

4.4.1. Online teaching activities

Online teaching activities should make full use of network resources and platforms to provide flexible learning time and space. Activities can include online lectures, interactive discussions, simulation experiments, self-regulated learning tasks, and remote collaborative projects, among others.

4.4.2. Offline teaching activities

Offline teaching activities focus on face-to-face interaction and practical operation, including laboratory practice, workshops, seminars, group discussions and field visits. These activities help

students to deepen their understanding and skills in practical operations.

4.4.3. Blended teaching activities

Blended teaching activities combine the advantages of online and offline to design flexible and diverse learning paths. For example, students can preview the course content through the online platform, then have in-depth discussions and practical operations in the offline class, and finally review and self-assessment through the online platform.

4.4.4. Construction of teaching evaluation system

The construction of teaching evaluation system should fully reflect the learning outcomes of students, including formative and summative evaluation. Formative assessment focuses on student learning processes such as assignments, project progress, and classroom engagement. Summative assessments, such as final exams, project reports and portfolios, are given at the end of the course. The evaluation system should also include self-evaluation and peer evaluation to promote self-reflection and critical thinking among students. In addition, the evaluation criteria should be clear, impartial, and closely corresponding to the course objectives and learning outcomes.

5. Implementation strategy of teaching reform

5.1. Selection of teaching platforms and tools

The selection of teaching platform and tools is the key to the implementation of blended teaching. Those platforms that can provide rich interaction, easy access and operation, and support the uploading and sharing of a variety of teaching resources should be selected. For example, platforms that support live video, online quizzes, discussion forums, and collaboration tools can be selected. In addition, the stability, security and whether the platform can meet the needs of students with different learning styles should also be considered. Teachers should be trained to be proficient in the use of these tools and to be able to guide students in the effective use of these resources.

5.2. Development and utilization of teaching resources

The development of teaching resources should focus on diversity and practicality, including electronic textbooks, multimedia content, case studies, simulation software, etc. Resources should be developed in close connection with course objectives and learning outcomes to ensure consistency with industry trends and technological advances. Teachers can cooperate with industry experts to introduce real engineering projects and cases to improve the practical and forward-looking teaching content. At the same time, teachers should also teach students how to evaluate and select online resources to develop their information literacy.

5.3. The transformation of teachers' roles and professional development

In the teaching reform, the role of teachers has changed from knowledge imparts to learning guides and promoters. Teachers need to update their teaching ideas, master new teaching methods and technologies, and how to effectively conduct online and blended teaching. Teachers' professional development includes participating in educational technology training, academic exchanges and teaching seminars to continuously improve teaching ability and professional quality. At the same time, teachers should also participate in teaching research to explore innovative teaching models and strategies to adapt to the changing educational environment.

5.4. The cultivation of students' autonomous learning ability

The cultivation of students' autonomous learning ability is an important part of teaching reform. Teachers should encourage students to set learning goals, develop learning plans, and monitor their learning progress. By providing online resources and tools, instructors can help students develop competencies in information retrieval, assessment, and application. In addition, teachers should design challenging projects and tasks to stimulate students' curiosity and desire to explore, and encourage them to actively seek knowledge and solve problems. Through peer assessment, self-assessment and reflective activities, students can better understand their own learning process and learn to self-regulate and self-motivate.

6. Teaching reform practice Case analysis

6.1. Description of Implementation process

The implementation process description in the case analysis expounds the various stages of the teaching reform in detail, from the preliminary plan to the final implementation. This includes the start of the reform, the preparation of teachers and students, the integration of teaching resources, the construction of teaching platforms, and the smooth development of teaching activities. The description highlights key decision points during implementation, challenges encountered and their responses, as well as milestone events during implementation.

6.2. The specific implementation of teaching activities

In the specific implementation part of teaching activities, the case analysis shows how to transform the teaching plan into actual teaching practice. This covers the utilization of online teaching resources, the organization of offline interactive activities, and the implementation of blended teaching strategies. The description of the specific implementation focuses on the innovation of teaching activities, the participation of students, the guiding role of teachers, and the effect of technology tools in supporting teaching.

6.3. Student feedback and interaction

The student feedback and interaction part reflects the students' direct feelings and suggestions for the teaching reform. Student feedback collected through various channels, such as questionnaires, discussion board posts, and face-to-face communication, provides valuable first-hand information for teaching reform. This part analyzes the participation of students, their views on teaching content and methods, and their satisfaction with teaching environment and resources, thus revealing the impact of teaching reform on students' learning experience.

6.4. Evaluation and analysis of teaching effect

The evaluation and analysis part of the teaching effect is a comprehensive review of the teaching reform effect. The effectiveness of the teaching reform was evaluated by comparing students' learning outcomes, skill mastery, and attitude changes before and after the reform. The analysis uses a variety of assessment tools and methods, including test scores, work quality, student self-evaluation, and peer evaluation. This section also explores how the teaching reform has promoted students' critical thinking, innovation and problem solving skills, and how these outcomes match the teaching objectives. Through the in-depth analysis of the teaching effect, the case analysis provides

a basis for continuous teaching improvement.

7. Teaching Reform effect and reflection

7.1. The effect of teaching reform

The effect of teaching reform is reflected in many aspects. Firstly, there was a significant increase in student engagement and interactivity, as typically measured by active participation in class discussions, online interactions, and group projects. Second, students also improved their academic performance and practical skills, as assessed by exam scores, quality of assignments, project completion, and skill tests. In addition, student satisfaction with the course increased, reflecting improvements in teaching methods and content. The teaching methods and strategies of teachers have also been updated, improving the efficiency and quality of teaching. Finally, the teaching reform may also have a positive impact on students' critical thinking, innovation and self-directed learning ability.

7.2. Existing problems and challenges

Although the teaching reform has achieved some results, it also meets some problems and challenges in the implementation process. For example, some students may have difficulty adapting to the new teaching model, especially those who are used to traditional teaching methods. Technical issues, such as instability of online platforms and incompatibility of teaching resources, may also affect teaching effectiveness. Teachers may face challenges of inadequate technical training, increased teaching burdens, and changes in assessment systems. In addition, the uneven distribution of teaching resources and the diversity of students' backgrounds may also lead to the uneven teaching effect.

7.3. Deep thinking of teaching reform

The in-depth thinking of teaching reform involves a comprehensive reflection on the reform objectives, methods and results. This includes a reassessment of the idea of teaching reform and a critical analysis of strategies and methods in the implementation process. In-depth thinking should also consider how to better meet the learning needs of students, how to make more effective use of teaching resources and technology, and how to build more inclusive and supportive learning environments. In addition, consideration needs to be given to how to continuously evaluate and monitor the long-term effects of instructional reforms, and how to adjust and optimize based on feedback.

8. Conclusions

In this paper, the teaching reform of wireless network technology course is comprehensively reviewed and evaluated, and the effectiveness of the combination of CDIO mode and hybrid teaching method is verified. By updating the course content and adopting interactive and project-oriented teaching strategies, the reform significantly improved students' academic and practical skills, while enhancing their critical thinking and self-learning ability. The professional development of teachers has been promoted, and they are more proficient in using teaching techniques and methods in order to adapt to the new teaching model. Moreover, the successful implementation of the reform provides valuable lessons for educational policy makers and school administrators, demonstrating the importance of continuous assessment and reflection in ensuring

the quality of teaching and learning. These experiences are equally instructive for other courses and fields, encouraging educators to explore innovative teaching methods to adapt to the changing educational environment and technological advances, and to lay a solid foundation for the overall development and future success of students.

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