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RESEARCH ARTICLE

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Research on the Construction of a Gold Class of Wireless Sensor Networks Based on OBE

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Abstract: With the rapid development of information technology, the emergence of 5G technology has brought about profound changes in various industries, especially in the field of Internet of Things (IoT). 5G technology has become an important infrastructure for the development of IoT, and the rapid social development of IoT has put forward new requirements. However, this development also brings an urgent need for specialized talents, especially in wireless sensor networks. Therefore, cultivating talents with knowledge and skills related to 5G and IoT is an urgent problem in the current education field.

Aiming at the deficiencies of the Wireless Sensor Networks course in terms of teaching content, teaching methods and teaching materials, a series of innovative reforms have been made in the design of course goal-oriented practical teaching content, blended teaching mode, and practical teaching material system. Practice has proved that the above teaching reforms can enhance students' ability to solve complex engineering problems, improve students' learning efficiency and participation, and ultimately improve teaching quality, which provides effective support for the cultivation of high-quality IoT talents.

Keywords: OBE; gold class; professional talents

1. Research Background

With the rapid development of information technology, the emergence of 5G technology has brought about profound changes in various industries. 5G not only dramatically improves speed and bandwidth, but also demonstrates significant advantages in latency, connection density and network slicing. These characteristics make 5G an important infrastructure for the development of IoT. IoT refers to the connection of various physical devices through the Internet to realize the exchange of information and communication.The popularity of 5G technology provides strong support for the widespread application of IoT, enabling the rapid development of application scenarios such as smart homes, smart transportation, and smart cities.

With the large-scale construction of 5G base stations in China, the IoT industry will also usher in a new round of rapid growth, which puts forward new requirements for the cultivation of IoT talents in colleges and universities. The goal of Wireless Sensor Networks, as a core course for IoT majors, is to enable students to understand the development and trends of wireless sensor networks, familiarize them with their working principles, and cultivate their ability to collect, aggregate, process and remotely monitor information using wireless sensor network technology.

Some foreign universities have adopted the advanced OBE (Outcome-Based Education) concept for curriculum reform, focusing on the practicality and cutting-edge of teaching content. In comparison, there are still some deficiencies in China's teaching materials and teaching methods in this field (Xi & Cui, 2024; Chang & Zhang, 2021; Li & Wang, 2021; Gong & Xiao, 2020). Due to the fast update of technology, the current practical teaching materials for the course of Wireless Sensor Networks are extremely lacking, and the teaching methods are relatively backward, which are specifically manifested in the following aspects:

poor learning resources, insufficient breadth of knowledge, failure to introduce the latest technological achievements into the teaching materials, although China is in the international leading position in 5G technology and Internet of

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Things applications, few domestic technological achievements are included in the practical teaching of this course, which is extremely unfavorable to the development of domestic technology.

The experiments are mainly verification experiments, the depth of knowledge is insufficient, and students fail to obtain effective training in the ability and quality of solving complex engineering problems.

The teaching mode is based on "teachers talk and then students practice", students have limited time to invest in the course, and the initiative is insufficient.

Therefore, reforming the practical teaching of Wireless Sensor Networks has become an inevitable requirement for cultivating excellent talents in Internet of Things to meet the urgent needs of society for high-quality talents.

2 Course Objective-oriented Practical Teaching Content Design

2.1 Requirements of higher-order goals

In the construction of the "Golden Course", the higher-order objectives put forward higher requirements for the design of practical teaching content (Ministry of Education, 2019). This means that the teaching content should not only be equipped with basic knowledge, but also need to add more challenges to push students toward higher-order knowledge and skills (Zeng et al., 2024; Li, 2018; Cui & Yang, 2024; Zhu et al., 2020; Ma & Luo, 2019). Therefore, enhancing the difficulty and challenge of practice content becomes an important goal of instructional design. Specifically, the practice content should include the following aspects:

(1) Enhancing the difficulty and challenge of practical content: when designing experiments or projects, multifactorial variables can be added, for example, letting students not only consider the topology of the network, but also cope with multiple challenges such as network security and data privacy when constructing a wireless sensor network. By providing problems in real situations, students are prompted to develop problem-solving skills in the process of coping with difficulties.

(2) Focus on students' knowledge background and interests: When setting higher-order objectives, teachers should give due consideration to students' basic knowledge level and personal interests. Understand students' background through questionnaires or interviews, and set up programs that are associated with students' interests. For example, if most students are interested in smart homes, experiments can be designed around this theme to ensure that students can find fun in the challenge.

2.2 "From life" project design

The effectiveness of practical teaching often depends on the relevance of the learning content to students' lives, and the OBE concept emphasizes that education should be closely related to real life, so it is crucial to introduce "from life" project design.

(1) Introduction of real-life cases: For example, by analyzing real-life cases such as smart meters or shared bicycles, students can understand the important applications of wireless sensor networks in modern life. Students can design an experiment related to data collection and analysis of smart meters through a group project to observe the process of transmission, storage and analysis of meter data in the field to enhance their understanding of IoT applications.

(2) Enhance students' learning interest and real experience: through projects closely related to life, students can feel the practicality of learning. This experience not only enhances their learning interest, but also helps students combine what they have learned with practical situations to form a deeper understanding. For example, in the experiment, students are allowed to use real sensors for environmental monitoring, obtain data, and practically analyze the impact of the data on environmental monitoring, so as to enhance their understanding of IoT technology.

2.3 Experimental content design of "multi-level progression, multi-capability".

In order to realize the effective implementation of high-level objectives, the experimental content needs to be designed in the form of "multi-level progression, multi-capability". This design concept not only enriches the teaching form, but also can effectively improve the comprehensive quality of students.

(1) Diversification of experimental objectives and forms: Design multiple levels of experiments, such as basic experiments, intermediate comprehensive experiments and advanced creative experiments. In the basic experiment, students can

learn the basic use of sensors and data acquisition; the intermediate experiment requires students to solve specific problems, such as temperature monitoring using a sensor network; and the advanced experiment requires students to comprehensively apply what they have learned to design a complete intelligent monitoring system. This design not only allows students to build confidence in gradual improvement, but also to exercise their abilities in diverse tasks.

(2) Coordinate the enhancement of knowledge, ability and quality: When designing each experiment, ensure the coordinated development of knowledge, ability and quality. For example, through teamwork projects, students' communication and teamwork abilities are cultivated, while their practical hands-on abilities and innovative thinking are enhanced in technical learning. In this way, students enhance their practical application ability and comprehensive quality while mastering theoretical knowledge.

3 Research on Teaching Mode based on Online Platforms

In the context of today's education reform, the concept of OBE (Outcome-Based Education) is gradually gaining attention, emphasizing the learning outcome-oriented teaching mode. The concept requires diverse teaching methods to enhance learning efficiency, especially in higher education. In the face of the complexity and difficulty of the course content, the traditional classroom indoctrination teaching mode can no longer meet the high-level goals required by the “Golden Course”. Therefore, the teaching mode based on online platform has emerged as an important means to promote students' independent learning and teacher-student interaction.

3.1 Limitations of traditional teaching mode

The traditional classroom teaching mode is usually teacher-centered, emphasizing the transmission of knowledge, and students' learning is often passively accepted. This model has obvious limitations when facing complex courses and difficult knowledge:

(1) Time constraints: with limited class time, it is difficult to explore the course content in depth with class time alone, especially in the realization of higher-order objectives, and students are unable to obtain sufficient opportunities for practice and application.

(2) Insufficient interaction: In the traditional teaching mode, there is less interaction between teachers and students, and students' understanding and application of knowledge often rely on in-class lectures and lack independent learning and thinking outside the classroom.

(3) Insufficient learning motivation: students' learning motivation and interest are easily weakened in the process of passively accepting knowledge, and it is difficult to stimulate their active learning spirit.

Therefore, reforming the traditional teaching mode, especially introducing an online platform to support blended teaching, has become an inevitable choice to improve teaching quality and learning effect.

3.2 Blended teaching mode based on online platforms

In order to solve the above problems, this course proposes to adopt the “three segments and one reflection” blended teaching mode, which combines the advantages of the online platform to design the practical teaching content and teaching reflection before, during and after class. The basic idea of this model is:

3.2.1 Pre-lesson preparation

In the pre-course stage, the teacher releases the guided learning tasks through the online platform, and adopts video self-study, interactive Q&A, etc., to guide students to actively learn. The main activities in this stage include:

(1) Video self-study: Teachers record course-related video materials in advance, which students can watch according to their own learning pace. The video content should cover the core concepts and basic knowledge of the course to help students establish a preliminary knowledge framework.

(2) Interactive Q&A: The online platform provides an interactive function where students can ask questions after watching the video and the teacher will answer them in time. This approach not only enhances students' motivation to learn, but also helps teachers understand students' knowledge mastery, so as to adjust the subsequent teaching content in a targeted manner.

(3) Expanding knowledge: Teachers can recommend relevant reading materials and online resources on the platform to encourage students to

carry out independent learning and knowledge expansion.

Through this stage of preparation, students can establish a preliminary understanding of the course content before class, laying a foundation for subsequent classroom learning.

3.2.2 In-class Teaching

The in-class teaching mainly arranges three aspects, namely, the crosstalk of knowledge points, the analysis of key points and difficulties and the discussion of topics. This segment is designed to consolidate students' knowledge understanding and promote interaction between teachers and students.

(1) Knowledge point lecture: Teachers in the classroom on the content of the pre-class self-study lecture, to help students clarify the knowledge pulse, to ensure that all students on the same basis for in-depth discussion.

(2) Analysis of key points: For the pre-course study of students' common problems, the teacher will focus on analysis. This link not only helps students to solve specific problems, but also promotes their in-depth understanding of knowledge.

(3) Thematic discussion: Thematic discussion is arranged in the classroom to encourage students to have in-depth exchanges around specific topics. Teachers can flexibly adjust the content of the discussion according to students' interests and classroom feedback, so as to enhance the interactivity and sense of participation in the classroom.

Through in-class teaching, students can not only consolidate what they have learned, but also improve their critical thinking and cooperation ability in the discussion.

3.2.3 Extension from after class

The post-course stage mainly includes homework release and knowledge extension, aiming at consolidating students' learning and encouraging them to conduct in-depth research.

(1) Assignment release: Teachers release assignments through online platforms after class. The content of the assignments should be closely related to classroom learning and require students to apply what they have learned to solve practical problems. The forms of assignments can be diversified, such as group projects, case studies, research reports, etc., in order to improve students' participation and practical ability.

(2) Knowledge extension: Teachers can recommend relevant online courses, literature and research reports, and encourage students to conduct independent study after class to further extend their knowledge.

Through post-course extension, students can consolidate what they have learned and improve their problem-solving ability in practical application.

3.2.4 Teaching Reflection

Reflection is an important part of the teaching mode. Based on the big data analysis provided by the online platform and the offline classroom, teachers can reflect on the teaching effect in time and put forward effective improvement measures.

(1) Data analysis: the online platform can collect students' learning data, including video viewing, homework completion, discussion participation, etc. Teachers can analyze students' learning data based on these data. Teachers can analyze students' learning effects based on these data to understand which knowledge points are mastered better and which aspects still need to be strengthened.

(2) Classroom feedback: Teachers can collect students' feedback on classroom teaching through questionnaires or discussions after each class. This kind of feedback can not only help teachers understand the students' learning experience, but also provide a basis for the adjustment of subsequent courses.

(3) Continuous improvement: Based on the data analysis and classroom feedback, teachers should regularly reflect on and adjust the teaching content and methods to ensure the continuous improvement and optimization of blended teaching.

Based on the online platform, the “three stages and one reflection” blended teaching mode provides a new way of thinking for the teaching of difficult courses. Through independent learning before class, interactive discussion during class and knowledge expansion after class, students can not only learn efficiently within the limited classroom time, but also improve their problem-solving ability in practical application. The introduction of reflection ensures the continuous improvement of teaching quality. Through the implementation of this teaching mode, the higher-order goals required by the “Golden Class” can be better realized, and high-quality talents adapted to future development can be cultivated.

4. Goal and Efficiency-oriented Construction of Quality Practice Teaching Materials

High-quality practical teaching materials are the basis for the success of blended practical teaching. In order to enable students to make effective use of after-school time to improve the quality of learning, this course constructs a practical teaching materials system that is "integrated at both ends and complementary in multiple ways". This structure not only helps students acquire knowledge in different environments, but also emphasizes the complementary nature of different types of teaching materials to support students' all-round learning.

4.1 Integration at both ends

The so-called "two ends" refers to the combination of the cell phone end and the classroom end to form a complete online and offline learning environment. In this model, the mobile terminal mainly provides students with learning resources and activity support through online teaching tools, so that students can study and review anytime and anywhere after class. The flexibility and convenience of the mobile terminal enables students to utilize their spare time for learning more efficiently in their busy lives.

The classroom side, on the other hand, refers to traditional offline learning venues that focus on face-to-face teacher-student interactions and hands-on activities. In offline classes, teachers are able to provide a more intuitive transfer of knowledge through explanations and demonstrations, while also promoting cooperation and communication among students. The combination of the two learning ports realizes the seamless connection of learning resources, allowing students to freely switch between the different ports as needed, enhancing the autonomy and flexibility of learning.

4.2 Multiple Complementarities

On the basis of "two-end integration", this course has built four types of practical teaching materials to ensure the comprehensiveness and depth of the learning content. These four types of teaching materials include Extended Knowledge Bank, Project Bank, Assignment Bank and Activity Theme Bank.

(1)Expanded Knowledge Base: This base provides information in the form of PPT, PDF and micro-lessons, which are mainly used for pre-course preparation and in-class reference. Through the diverse formats, students can choose the most suitable learning materials according to their own learning styles, thus enhancing the optimization and effectiveness of learning.

(2)Project library: The project library is divided into case library and DIY question library. The case library provides practical learning materials through microclasses and specific code examples to help students understand the application of theories in real-world problems, while the DIY question library is designed in problem-oriented, task-oriented and engineering-oriented formats to stimulate students' innovative thinking and ability to solve real-world problems. This diversity is designed to meet the needs of students at different levels while promoting their ability to apply their knowledge in practice.

(3)Assignment bank: The design of the assignment bank aims to consolidate what students have learned and increase the opportunities for practice. Assignments should cover tasks of different levels of difficulty, which not only help students consolidate their knowledge, but also provide a platform for them to demonstrate their understanding and abilities.

5. Summary

Through an in-depth study of the Wireless Sensor Networks course, this thesis proposes a series of targeted teaching reform programs to meet the current challenges faced in higher education. Against the background of the increasing popularity of 5G technology, the education of IoT majors needs to be constantly innovated in terms of both content and form. By introducing the concept of OBE (Outcome-Based Education), we have realized a multi-dimensional reform in the design of practical teaching content, the innovation of teaching mode, and the construction of teaching materials, with a special emphasis on the importance of a high-quality practical teaching material system oriented to goals and efficiency.

By establishing a blended teaching mode based on an online platform, we ensure students' comprehensive learning experience before, during and after class, and enhance their independent learning ability and problem solving ability. The construction of the new version of the textbook library covers diversified learning resources and meets the needs of students at different levels, thus effectively enhancing the depth and breadth of learning.

The above teaching reform not only meets the urgent demand for professionals in modern society, but also lays a solid foundation for the future development of the Internet of Things field. With the deepening of teaching reform, it is expected to further promote the improvement of education quality and cultivate more high-end talents who can adapt to the development of the times.

Conflict of Interest

The authors declare that They have no conflicts of interest to this work.

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