



Research on the Application of Professional Smart Classroom in Radar Equipment Teaching

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Abstract. In view of the problems existing in the traditional radar equipment course teaching, such as insufficient students' initiative, single teaching display means, separation of theoretical and practical teaching links, lack of practical training means and insufficient teaching feedback means, this paper studies the teaching reform of radar equipment course under the background of smart classroom. Using modern information technology and educational equipment, a radar professional smart classroom for radar equipment course teaching is proposed in this paper, and its structure and characteristics are introduced. On the basis of deepening the teaching philosophy of the course, a novel teaching mode of radar equipment course based on professional smart classroom is constructed, which has the characteristics of online and offline hybrid teaching, integration of theoretical and practical teaching, complementarity of simulation and equipment training, and combination of accurate teaching and effective improvement. Teaching practice has showed that this teaching mode can effectively solve the problems existing in radar equipment course teaching, stimulate students' learning interest and achieve better teaching effect.

Keywords: professional smart classroom · radar equipment · equipment teaching · teaching mode

1 Introduction

Radar equipment course is not only a compulsory course for students in our college, but also a professional core course with close combination of theory and practice. Because the learning object is the real radar equipment, which is set up on the outdoor position, the two-stage teaching mode of theoretical teaching in the classroom first and then practical teaching on the radar equipment is adopted in the actual teaching [1, 5]. In theoretical teaching, teachers usually explain the working principles of radar equipment with the help of PPT, blackboard writing and circuit diagrams. Teachers mainly talk and students listen in the teaching process. In practical teaching, students are usually divided into several groups. Each group takes turns on the equipment to learn the same subject. Students in the group take turns to practice. The teaching process is mainly teacher demonstration and student practice. With the rapid development of information technology and modern education concept, the equipment course teaching mode supported by

traditional classroom cannot meet the training needs of high-quality professional new talents [6].

Smart classroom is a new teaching place that organically integrates the traditional physics teaching space and modern information space by using modern information technologies such as Internet of things, cloud computing, big data and artificial intelligence, so as to provide intelligent conditions for the teaching and learning of teachers and students [2]. The emergence of smart classroom is the inevitable product of the integration of modern information technology and the development of higher education [4]. The existing research and practice results show that compared with the traditional classroom, the smart classroom can realize intelligent teaching information collection and processing, real-time learning feedback and teaching evaluation, convenient and flexible interaction and communication between teachers and students, students and students, personalized teaching guidance and resource push, thus changing the monotonous teaching environment of the traditional classroom and significantly improving the teaching efficiency [3, 7].

In order to innovate the teaching mode of radar equipment course and improve the teaching effect, we explore the teaching reform and practice of radar equipment course based on radar professional smart classroom in this paper. The paper is organized as follows: Sect. 2 introduces the problems existing in the traditional teaching of radar equipment course, the structure and characteristics of radar professional smart classroom are introduced in Sect. 3, Sect. 4 discusses the teaching mode construction of radar equipment course based on radar professional smart classroom. Finally, the conclusions are introduced in Sect. 5.

2 Problems Existing in Traditional Teaching of Radar Equipment Course

Students' initiative is not enough. In the traditional equipment teaching mode, teachers dominate and students learn what teachers teach. This passive teaching method of 'You teach, I learn' and 'You demonstrate, I practice' is not conducive to stimulate students' learning enthusiasm and initiative, and affects the learning effect.

Teaching display means are single. In theoretical teaching, the display mean of textbook, PPT and circuit diagrams is difficult to attract students' interest. In practical teaching, due to large number of students, small space, poor light and loud noise, it is often difficult for students to see and hear the teacher's operation and explanation clearly. In addition, the practice in groups one by one reduces the teaching efficiency.

Separation of theoretical and practical teaching links. The two-stage teaching mode of theory before practice leads to the lack of on-site reference and verification of real equipment when students study theory in the classroom, and the theoretical knowledge learned in the early stage is forgotten when students train skills on equipment, which finally affects students' understanding and mastery of knowledge and skills.

Lack of practical training means. Due to the limitation of real radar equipment structure, some important parts of equipment cannot be seen or touched, so it is difficult to carry out specific training in these parts. In addition, due to the lack of construction means of electromagnetic environment such as terrain, interferences and targets, it is

difficult to carry out targeted training under specific electromagnetic background, which is not conducive to the cultivation of students' equipment application ability.

Insufficient means of teaching feedback. In traditional teaching, in addition to oral questions, chapter tests, course tests and other rough methods, there is a lack of more effective means to accurately and timely grasp the characteristics of learning and teaching effect, which is not conducive to teaching improvement. Furthermore, the depth of the teaching content cannot take into account the students at both ends, which is not convenient for the personalized development of students.

3 Radar Professional Smart Classroom

Based on the general smart classroom (with the cloud integrated teaching platform as the core), aiming at the content and characteristics of radar equipment course teaching, the radar professional smart classroom integrates many subsystems such as real equipment remote control subsystem, complex electromagnetic environment construction subsystem, instruments remote control subsystem, multi-site audio and video interaction subsystem, simulation training platforms, actual combat database and so on. It is a specific teaching place for the theoretical teaching, practical training, special discussion, exercise and other teaching activities of radar equipment course.

3.1 Structure of Radar Professional Smart Classroom

The structure of radar professional smart classroom is shown in Fig. 1. In the radar professional smart classroom, the cloud integrated teaching platform has the functions of multi-mode teaching, teaching information collection and intelligent processing. The real equipment remote control subsystem is used to remotely control and operate the radar equipment erected on distant positions in the classroom, and view the monitoring terminal and admission terminal in real time. The complex electromagnetic environment construction subsystem is used to create targeted radar working environments for virtual training. The instruments remote control subsystem is used to remotely control the instruments equipped on the radar equipment and display the measurements in the classroom. The multi-site audio and video interaction subsystem is used for real-time voice and video interaction between radar position and classroom. The simulation training platforms and actual combat database are used to carry out simulation trainings and actual combat drills.

3.2 Characteristics of Radar Professional Smart Classroom

Radar professional smart classroom realizes the intelligent integration of teaching resources, intelligent service of teaching activities, intelligent interconnection of teaching means, intelligent recording of teaching process and intelligent evaluation of teaching effect. It has the following characteristics:

The StarC teaching cloud platform in the radar professional smart classroom can realize rich media display forms such as graphics, text, audio, video, mind map, multi-screen display and electronic blackboard writing, so as to optimize the presentation of teaching content and enhance the interest in the teaching process.

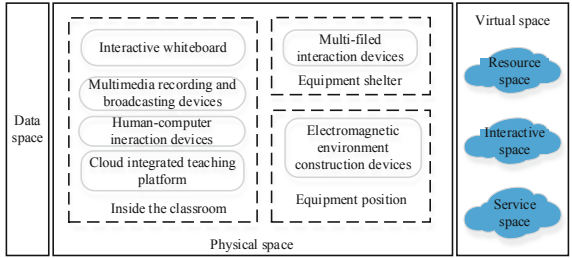


Fig. 1. The structure of the radar professional smart classroom

The rich teaching resources and convenient network interconnection function on the StarC teaching cloud platform provide complete conditions for the online and offline hybrid teaching of ‘students’ online self-study before class - teachers’ offline explanation in class - students’ online extended learning after class”.

The teaching cloud platform has the functions of screen capture questions, in class tests, random answers, group discussions and so on. It can realize various forms of communication and interaction between teachers and students and between students, so as to effectively stimulate students’ learning interest and initiative, and build a high-level teaching model characterized by autonomy, cooperation and exploration.

The established radar equipment fault case base, application case base and air intelligence record database improve the pertinence and practicality of teaching. The course settings, teaching plans, teaching contents and teaching tools related to course are shared online. Students can quickly access the cloud platform through learning terminals in multiple places for independent learning.

The multi-site real-time interactive teaching devices realize the interconnection between the classroom and the radar equipment position, which is convenient for the integrated teaching of theory and practice. Through 1 + N, main and auxiliary classes and other ways, the interaction of multiple places and multiple classes can be realized. All kinds of simulation training platforms effectively make up for the shortcomings of real equipment training.

According to students’ homework, test, preview, review, communication, reading and other data, we can accurately grasp each student’s learning habits, basic skills, weak links, learning interests and other information. Based on these information, teachers can timely adjust teaching strategies, accurately push relevant learning resources, and realize accurate teaching and students’ personalized development.

4 Construction of Radar Equipment Teaching Mode Based on Professional Smart Classroom

4.1 Course Teaching Philosophy

From the feedback of employers, they prefer compound talents who not only meet the needs of the first post, but also have long-term development potential. It can be seen that the traditional teaching concept of equipment course based on professional knowledge

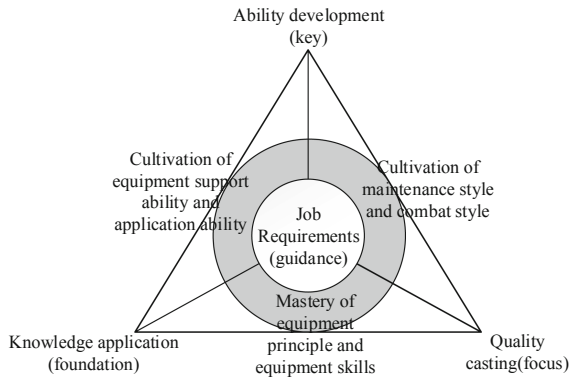


Fig. 2. Teaching concept of radar equipment course

has fallen behind. Therefore, the equipment course teaching should be conducive to the cultivation of students' professional ability and the development of students' long-term career, guide by the cultivation of comprehensive ability, highlight the dominant position of students, pay attention to the inspiration and guidance of the teaching process, and promote the self-construction and internalization of students' knowledge and skills.

The teaching mode reform of radar equipment course based on professional smart classroom adheres to the educational idea of 'post demand and ability oriented'. According to the commonness and personality characteristics of students, aiming at improving the post ability and professional quality of students, the teaching philosophy of 'using two kinds of knowledge, cultivating two abilities and casting two spirits' is established according to the three levels of knowledge, ability and quality, as shown in Fig. 2.

4.2 Course Teaching Mode

Based on the powerful functions of radar professional smart classroom, we have explored a novel teaching form of radar equipment course to improve the teaching quality and efficiency, which is mainly characterized by students as subject, integration of online and offline teaching, integration of theoretical and practical teaching, complementarity of virtual and practical training, and combination of accurate teaching and effective improvement.

- Use the cloud integrated teaching platform to carry out online and offline hybrid teaching, so as to highlight the dominant position of students.

For example, in the teaching of radar transmit subsystem theory, with the help of rich online resources, teachers form the knowledge system of radar transmitter through the relevant contents of courses such as electronic circuit, radar principle and modern radar technology, relevant micro courses and MOOC through the way of mind mapping, so that students can preview and self-study online before class. In offline classroom teaching, teachers mainly give face-to-face explanations on the difficult problems existing in students' self-study, such as the working principle of modulator and the charging

and discharging process of energy storage line, which plays a role of answering questions and solving doubts. After class, teachers use the teaching cloud platform to push the test questions for students to review and consolidation. Teachers can also send the latest research materials of radar transmission theory for students to read, so as to expand their learning. In this way, it integrates the open advantages of online teaching and the on-the-spot experience advantages of offline teaching, changes ‘transmission-acceptance’ into ‘self-study, puzzle solving and extended learning’ under the guidance of teachers, and promotes students’ in-depth and autonomous learning.

- Use the multi-site real-time interactive subsystem to carry out the integrated teaching of theory and practice, so as to realize the organic integration of theoretical teaching and practical teaching.

For example, when teaching the theory of radar receiving subsystem, teachers can put the internal image of the receiving cabinet in the radar shelter on the large screen of the classroom in real time, so that students can easily view the actual situation inside the receiving cabinet when learning the composition and structure of the receiving subsystem, correspond the names of the circuit modules with the physical objects of the circuit modules one by one to form an intuitive impression, and deepen understanding and memory. In the process of learning the working principle of the receiving subsystem, the teacher can explain the processing process of the echo signal flowing through each module one by one in combination with the actual situation inside the cabinet, and help students clarify the signal change processing process.

- Use the simulation training platforms to carry out virtual training, so as to realize the organic complementarity of simulation initial training and real equipment intensive training.

The radar equipment simulation training platforms developed based on virtual reality technology is used to carry out the simulation training of radar equipment corrective maintenance, parameter testing, position optimization, combat application and other subjects. In the process of teaching implementation, the initial training of these subjects can be carried out on the simulation training platforms. According to the number of students, the number of training terminals can be conveniently expanded and repeated training can be carried out for many times, which not only improves the training efficiency, but also effectively alleviates the contradiction between more people and less equipment.

In the follow-up training of these subjects, the real radar equipment is used for intensive training to further consolidate the operation and deepen the understanding. The training mode of simulated initial training and real equipment intensive training effectively makes up for the deficiency of real equipment training, and achieves the good teaching effect.

- Use the rich data of StarC teaching cloud platform to carry out teaching evaluation and teaching improvement, so as to realize the unity of accurate teaching and effective improvement.

The StarC cloud platform has the functions of collecting, sorting and presenting data in the whole learning process, which provides conditions for intuitively understanding students’ learning characteristics and learning effects. According to the big data of students’ homework, test, preview, review, interaction and rush answer, etc., we can accurately grasp each student’s learning habits, basic skills, weak links, learning

interests and other information. Based on these information, teachers can timely adjust teaching strategies to improve teaching effect. Teachers can accurately push relevant learning resources according to students' personal characteristics, so as to achieve different teaching objectives such as making up the gap, consolidating the foundation, deepening and expanding, and finally realize students' personalized development.

5 Conclusions

Radar professional smart classroom promotes the deep integration of modern information technology and radar equipment course teaching, and gives birth to a novel equipment course teaching mode. The teaching reform practice of radar equipment course in recent two years shows that making full use of radar professional smart classroom can effectively stimulate students' learning enthusiasm and promote the effective improvement of teaching quality. At the same time, teaching based on professional smart classroom also brings some challenges to students and teachers.

For students, the most important thing is to change their inherent learning habits and methods from passive acceptance to independent learning and thinking. The second is to have the ability to analyse and summarize the large number of learning materials.

For teachers, the most important thing is to construct learning activities according to the teaching contents and characteristics, and build an independent, cooperative and exploratory learning activity platform for students. The second is how to conduct differentiated counselling for students through the teaching implementation based on smart classroom, and provide data support for subsequent teaching improvement. These issues will be studied in the future.

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