

Teaching innovation and practice of communication principles in the context of the 5G era

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Abstract. As a cutting-edge technology in the field of communication, 5G technology poses new challenges and opportunities to the teaching of communication principles courses. "Communication Principles", as the core course of these majors, must be constantly updated to adapt to the development of new communication technologies. This article takes the "Principles of Communication" course as an example, combines the characteristics of 5G technology and education, discusses the characteristics of the course and the current teaching situation, and proposes a series of teaching reform measures. These measures include structural adjustments to theoretical course content, using Matlab virtual simulation technology to strengthen experimental teaching, combining postgraduate entrance examination professional knowledge explanations, introducing after-school 5G practical training and professional certificate assessment, etc. Practice has proven that these teaching reforms can effectively improve the integration of theory and practice, enhance students' ability to analyze and solve problems, and better meet the training needs of applied talents.

Keywords: Communication principles, 5G technology, Matlab virtual simulation technology.

1 Introduction

In 2012, the European Union officially launched the METIS (mobile and wireless communications enables for the 2020 information society) project^[1] to conduct research on 5G communication network technology. The demand for professional talents in related fields is growing day by day. Teaching reform for 5G technology requires the introduction of new teaching methods and means, such as teaching based on interactive virtual experimental platforms, project-based learning, practical case analysis, etc. These new teaching methods can cultivate students' understanding and application ability of new technologies and enhance their competitiveness in the job market. At the same time, the complexity and cutting-edge nature of 5G technology requires that the teaching of communication principles courses should pay more attention to the combination of theory

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and practice. In the teaching reform, practical cases, virtual simulation experiments and other means are introduced to help students combine theoretical knowledge with practical applications and improve their ability to solve practical problems.

This article further explores the teaching innovation and practice of the "Principles of Communication" course, and makes structural adjustments to the course content based on the latest development status of 5G technology. In the experimental part, considering the shortcomings of existing experimental boxes for experiments, we adopt Matlab The method combines virtual simulation; at the same time, activities such as knowledge expansion of postgraduate entrance examination content, 5G practical training and professional certificate training have been added. Finally, the practical teaching showed that the teaching innovation and practice of the "Communication Principles" course can combine theoretical knowledge with practice, help improve the teaching effect, and lay a solid foundation for subsequent students' further study or work.

2 Characteristics of education under the background of 5G technology

The development of 5G technology brings more possibilities and challenges to education, making education more personalized, flexible and practical, and promoting the progress and development of education. In the context of 5G technology, education presents the following characteristics.

2.1 Intelligent education

According to statistics, the low latency and high speed of the 5G network have increased the response speed of intelligent education applications by more than 10 times. The intelligent education platform can realize real-time learning content push and personalized learning path customization through the 5G network, improving students' learning efficiency. efficiency and satisfaction.

2.2 Teaching across time and space

Existing 4G networks have been widely used in the Internet of Things and promoted innovation in IoT application models. In the future, the development of IoT technology requires innovation in technical standards such as large-scale connections, security, network coverage, and low latency^[2]. The high bandwidth and low latency of the 5G network can make remote teaching smoother. It also supports high-definition video conferencing and remote experimental operations, providing students with broader learning resources and opportunities.

2.3 Diversified teaching content

Driven by 5G technology, a large number of courses and projects related to 5G technology have emerged in the education field. As of now, there are more than 1,000 online courses around the world covering knowledge in artificial intelligence, cloud computing, big data and other fields, providing students with more diversified learning options and opportunities.

2.4 Practical teaching enhancement

5G network can support virtual simulation teaching and help create a better learning environment. In addition, 5G technology can also support the construction of virtual teaching scenarios, providing more diverse, personalized and convenient teaching methods for education.

3 Characteristics and teaching status of the course "Principles of Communication"

3.1 Characteristics of the course "Communication Principles"

"Communication Principles" is a highly theoretical course with many knowledge points, involving signal transmission and processing, covering digital signal processing, filtering, sampling, etc. It requires professional courses such as signals and systems, high-frequency electronic circuits, etc. Take it as a prerequisite course. Some abstract concepts in the course need to be explained with corresponding technologies. In view of the rapid update of communication technology, the teaching content needs to be combined with the new needs and new technologies of society.

3.2 Current teaching status of communication principles courses

3.2.1 The course content is extensive, and prerequisite course knowledge is easily forgotten

"Principles of Communication" covers a wide range of content, requiring students to master circuit principles, probability theory, especially prerequisite courses such as signals and systems. However, many students lack sufficient understanding of the importance of these prerequisite courses and their mastery is not deep enough, which will greatly increase the difficulty of teaching this course.

3.2.2 The course has many knowledge points and obscure content

"Principles of Communication" focuses on digital baseband transmission systems and digital bandpass transmission systems. It has many knowledge points and is closely connected. It contains the derivation of a large number of mathematical formulas, which is difficult for students to understand.

3.2.3 Rapid updates of communication technology

Currently, the update of the content of the "Principles of Communication" textbook lags behind the development of emerging communication technologies, and course teaching needs to be in line with the mainstream and trends of technological development.

3.2.4 The configuration of the experimental environment is outdated

The contents of the communication principle experimental boxes used by many schools are basically fixed, the experimental parameters cannot be adjusted, and they lack flexibility. In

addition, the aging of experimental box components can easily affect the accuracy of experimental data.

3.2.5 The content lacks pertinence

"Principles of Communication" is usually used by many schools as a professional course for postgraduate entrance examinations. The basic content teaching is relatively broad but not deep enough. The content of the postgraduate entrance examination is more in-depth and professional, covering a wider range, and has higher requirements for theory and algorithm.

4 Teaching innovation and practice of "Communication Principles"

We will combine the characteristics of communication courses with the actual teaching status to carry out teaching innovation and practice in the course. In the classroom teaching, relevant content on 5G technology is added, and Matlab virtual simulation tools are assisted for experimental teaching, and combined with the content of postgraduate entrance examination professional courses, not only focusing on the understanding of basic theories and comprehensive analysis of problems, but also paying attention to the postgraduate entrance examination requirements. Outside the classroom, we carry out expanded research and corresponding skill verification activities related to 5G communication technology to broaden students' knowledge breadth and improve their competitiveness for future jobs. The structure diagram of teaching innovation and practice is shown in Figure 1 below.

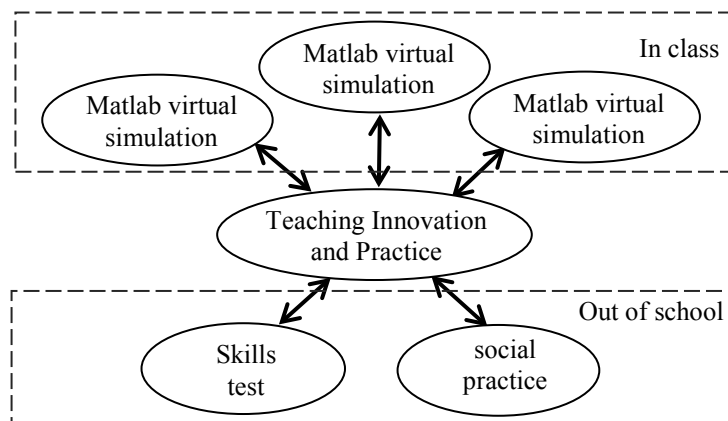


Fig. 1. Structure chart of teaching innovation and practice.

4.1 Structural adjustment of key and difficult points in course content

Most of the current teaching content of "Communication Principles" lags behind the mainstream development trends of current communication technology, and the content of today's mainstream 5G technology is relatively small and not in-depth enough. Taking "Principles of Communication" (7th Edition) written by Fan Changxin and Cao Lina as an example, this article introduces the teaching adjustments to the content of communication courses in actual teaching.

4.1.1 Review of knowledge from previous courses

Review the relevant knowledge points in the preface course of "Principles of Communication", such as probability density in "Probability Theory" and the characteristics of random processes in "Signals and Systems", to increase students' connections with relevant knowledge points and prepare for subsequent knowledge learning, and lay the foundation for the derivation of formulas.

4.1.2 Reduce learning requirements for analog modulation systems

In view that analog communication technology has been gradually phased out, subsequent course studies will reduce the learning requirements for the analog communication part and will instead allow students to study by themselves after class, in order to save teaching hours and improve students' learning enthusiasm.

4.1.3 Add explanation of postgraduate entrance examination knowledge content

Covers important contents such as modulation and demodulation technology, digital communication basics, wireless communication basics, communication system performance analysis, etc. Help students need to understand these knowledge points in depth and lay the foundation for students who plan to continue their studies in order to achieve excellent results in exams.

4.1.4 New 5G technology content

Considering the importance and widespread application of 5G technology, we will add more content related to 5G communication technology. As an important subject of national technological innovation and the bearer of overseas interests, Chinese companies have begun to compete more and more head-on with large American companies. Huawei has now become the leader in 5G, but no company in the United States can compete with it in the 5G field. rival^[3]. Through video playback and reports, students will be introduced to the current status of my country's 5G development to enhance students' national confidence and pride. At the same time, adding learning content related to 5G communication technology can better stimulate students' interest in learning.

4.2 Courses combined with virtual simulation experiments

4.2.1 Combined with virtual simulation experiments

In today's new era of Internet of Everything, the commercialization of 5G technology will bring more job opportunities to the communications industry. The positioning of talent training in colleges and universities is mainly reflected in the combination of four dimensions: goal, type, level, and specification requirements^[4]. As an application-oriented undergraduate college that aims to cultivate applied talents and focuses on the cultivation of practical abilities and vocational skills, it has always adhered to the It is oriented towards the cultivation of applied talents and is committed to cultivating high-tech talents that meet national and local needs. In order to better meet the needs of the industry, our school has launched school-enterprise cooperation with Zhongxing Group, relying on the school's provincial characteristic laboratories, industrial college off-campus practice bases, entrepreneurial incubation bases, etc., to provide students in related majors with an

excellent professional practice environment . Students can practice while learning in the practice base, and deepen their understanding of theoretical knowledge through hands-on operations. At the same time, this also improves students' systematic analysis and problem-solving abilities, as well as their professional qualities, laying a solid foundation for students' future career development.

4.2.2 Construction of 5G training base

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4.3 Expansion of communication technology knowledge after class

In addition to completing the teaching content of "Communication Principles", we hope to further enhance students' understanding of theoretical knowledge of communication principles and stimulate their enthusiasm and interest in independent learning through various activities to expand communication technology knowledge after class. Since January 2019, the State Council has launched the National Vocational Education Reform Implementation Plan. This plan implements the "academic certificate+several vocational skill level certificates" system in vocational colleges. For students majoring in electronics and communications, in addition to academic certificates, it is crucial to obtain corresponding vocational skill level certificates, which will help them to be fully prepared for employment and entrepreneurship. Combining the talent training direction and basic conditions, the teaching innovation and practice of the "Communication Principles" course laid a solid foundation for the implementation of the reform plan.

5 Conclusion

"Principles of Communication" is a course with strong theory and wide application. Based on the analysis of the characteristics of 5G technology and the characteristics and teaching status of "Principles of Communication" course, this article proposes a series of reform explorations, including the structure of the course teaching content. Activities such as making adjustments and expanding professional knowledge for postgraduate examinations, using experimental boxes to assist Matlab virtual simulation technology in experimental sessions, conducting 5G communication training and training to obtain professional

certificates. The purpose of these teaching innovations is to enhance the connection between current course teaching and knowledge application.

Facts have proven that these innovations and practices not only help guide students to better analyze and solve problems, but also enhance their interest in learning this course. At the same time, it also improves students' ability to connect theoretical knowledge with practical technology applications, making it more suitable for cultivating application-oriented talents needed by society and the country.

Thanks to the school, colleagues and cooperative enterprises for their strong support in the teaching reform of "Communication Principles" course. Your collaboration and support are not only an important guarantee for promoting teaching innovation and improving teaching quality, but also demonstrate the team's cohesion and common educational mission. This spirit of cross-border cooperation and support has laid a solid foundation for future teaching reforms and will continue to inspire us to pursue excellence and provide students with a better educational experience.

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