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Research and Practice Online-offline Blended Teaching Mode on Computer Networks Curriculum

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Abstract. After combing the basic ideas and development processes of the online-offline blended teaching, under regular epidemic prevention and control and in the context of the "Computer Networks" curriculum reform, analyzes the pain point problems of the course, and constructs a problem-oriented online-offline blended teaching mode, explains the design ideas for blended teaching from teaching content and resources, teaching organizations and implementation, assessment methods, etc. Related SPOC is developed on the online learning platform China University MOOC. The implementation process includes before class, during class and after class. The teaching contents are network architecture and hierarchical model, basic communication principle, IP packet forwarding, reliable transmission principle, routing algorithm, mainstream network application, etc.. Verified by teaching practice, a good teaching effect has been obtained. The innovation of this research is to integrate the intelligent education environment, advanced teaching concepts and optimal teaching design to construct a scientific and efficient blended teaching model based on the intelligent teaching platform.

Keywords: Online-offline blended teaching; problem-orientated; teaching mode; regular epidemic prevention and control.

1. Introduction

The ravage of the new crown pneumonia epidemic causes many universities in the world to adopt online teaching. Chinese universities also actively carry out online teaching in various forms, and the teacher has achieved the integration and migration of "offline classroom" to "online classroom". The universities have achieved the established goal of "keeping teaching during class suspension, keeping learning during class suspension" in response to the crisis, also accumulated experience in implementing blended teaching. The practice exploration of online-offline blended teaching gradually become the development trend of higher education and become a normalization means of teaching reform in colleges and universities.

Blended teaching adopts a variety of information methods, gets the classroom teaching through online courses, and emphasizes the teaching overall planning of meaningful learning, and pays more attention to the integrated design of learning activity sequences and chains. However, most teachers are not familiar with blended teaching design, the online-offline blended teaching is still in the starting stage, and its theoretical research lags practical application. Therefore, under regular epidemic prevention and control, the new model of "Internet +" blended teaching is explored, and the research and practice of guiding blended teaching are of great significance.

"Computer Networks" is a core course for network engineering. It is a preamble course for multi-professional courses, which is an important cornerstone in the cultivation of professionals for network engineering. "Computer Networks" learn the basic concepts, basic principles, and main equipment of computer networks, cover theory and practice. The traditional teaching model of the course is offline teaching. In response to the post-pandemic era, the "Computer Networks" curriculum carried out the online-offline blended teaching and achieved the ideal teaching effect, and the reference can be provided for other engineering courses.

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2. Definition and Development of Blended Teaching

There are different definitions of blended learning. He Kekang resists the blended learning inherits the double advantages of traditional learning and online learning, both plays the leading and supervision role of teachers and plays the independent learning role of students [1]. Li Kedong et al. believes that blended learning is organically integrated with two learning patterns of face-to-face teaching and online learning, and it can reduce costs and improve the benefits [1]. Curtis believes that blended learning is a combination of facial teaching and computer-assisted online learning [2].

In teaching practice, the researchers put forward different blended teaching modes, such as the blended teaching model based on intelligent teaching platforms such as UMU interactive learning platform, Blackboard platform, Chaoxing Xuexi Tong, Rain Class, etc. get a wide range of applications in China. Huang Ronghuai et al divide blended learning into three phases based on teaching design: front-end analysis, activity and resource design, and teaching evaluation. The first phase is the front-end analysis, that is, the student analysis phase, including learner characteristics, learning content, and learning environment analysis; the second phase is learning activities and resource design, including determining learning objectives, choosing learning contents, designing learning activities, etc.; the third phase is teaching evaluation, including evaluating three aspects of the learning process, activity organization and curriculum assessment. Foreign research is also unable to enumerate, such as American scholar Cohen proposed "octagonal framework." In the octagonal frame, blended teaching can be divided into eight dimensions such as teaching, institution, technology, interface design, assessment, management, resources, and ethics. These eight dimensions are interdependent and improve the teaching effect by optimizing the online-offline teaching structure. Among them, teaching and assessment mainly refer to teaching objectives, contents, platforms, methods, and strategies; institutions and management is mainly maintenance of digital learning management and learning environment; technology and interface design mainly provide hardware and software technology and good user experience; and resources and ethics are mainly open teaching resources as well as equality, friendly learning atmosphere [3].

Since the beginning of 2020, the online teaching conducted by colleges and universities is the full popularity of the whole staff of blended teaching. Aiming at this unprecedented online teaching, many scholars have launched research from different perspectives. The research team led by Wu Daguang has retrained the evolution path of higher education technology in China, explored the difficulties in promoting education technology in China [4]; Liu Zhentian summarized the highlights of emergency online teaching under the epidemic; Xue Chenglong and Li Wen are analyzed blended teaching practice of 3 foreign universities by international comparison; Hu Xiaoping and Xie Zuoxv analyzed the advantages and challenges of college online teaching in the epidemic based on the online teaching quality report including 57 universities and courses statistical report from two provinces of Fujian and Shandong; Jia Wenjun analyzed the comments on Weibo for online classes from the college students using the word frequency statistics and clustering analysis methods. The status quo of blended learning is summarized to provide reference and revelation for blended teaching in China [5]. In addition, there are also some researches to discuss the teaching model, teaching cases, and teaching results of the blended teaching.

In short, after more than 20 years of development, blended teaching shows new connotations under the current "Internet + education", and its development trend is information and intelligence. Under the guidance of advanced teaching concepts, blended teaching could achieve better teaching effects by integrating online and offline teaching, optimizing and combing various teaching elements, to achieve intelligently precision and personalization teaching. It should play the role of both of the teacher's design, guidance, and inspiration and mobilize the autonomy and enthusiasm of student learning. However, in sharp contrast to the concept of blended teaching is widely recognized, the implementation of the current blended teaching is based on the teacher's teaching experience. But the problems about how to effectively implement blended teaching, what may be "mixed", and so on have no very clear understanding, and theoretical guidance is insufficient, so the teaching model that can be copied needs to be studied and explored.

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3. Construction of Blended Teaching Mode Under Regular Epidemic Prevention And Control

Based on this, based on the theory of education and teaching, the paper attempts to propose a theoretical framework of blended teaching from the perspective of system architecture; explores the blended teaching model effectively enhance learners' achievement, helps teachers to adjust teaching contents and teaching strategies; establishes scientifically formative evaluation indicators and a mechanism for continuous improvement of blended teaching.

3.1 Problem-Oriented Online-offline Blended Teaching Mode

In long-term teaching practice, the pain points of the course found include: 1) Before learning, students believe that they have been familiar with online applications, so have high learning interest, and have full self-confidence to learn this course well. However, the actual teaching of Computer Networks is strong theoretical, the protocols are abstract, which is getting out of the computer networks from the actual application, so there is a large gap among expectations of students and actual learning; 2) There are many concepts and principles in the curriculum, the work process of the protocols are abstract, the knowledge point is scattered and lacks systemic, and the learning is difficult. The traditional teaching model of teacher centers ignores students' participation, and the learning methods of students have lack guidance, often leading to teaching and learning disagreement; network technology development and knowledge update are fast, and the past theoretical teaching and practical teaching have neglected the cultivation of thinking methods, which makes students' knowledge expansion and innovation ability insufficient; 3) due to limited funding, the school resources are lacking, software and hardware needed by computer network experiments are insufficient. As a result, some experiments cannot be completed on the actual equipment. At the same time, practical teaching content is still based on basic practical skills such as network basic configuration, lacks comprehensive practical ability training to solve practical problems.

In response to the pain points problems in the teaching, the problem-oriented online-offline blended teaching mode is proposed. In teaching, teachers use visual ways to help students build the entire network architecture and make abstract understanding knowledge easy to understand; build problem set with actual associated, emphasize the scientific and relevance of problem design; make full use of the advantages of online-offline blended teaching, highlight the process assessment, fully reflect the two main mechanisms of teacher-dominant and student-subject, to create a study community, inspire students to take the initiative think, have comprehensively cultivate thinking ability and practical ability. Figure 1 shows the process of online-offline blended teaching.

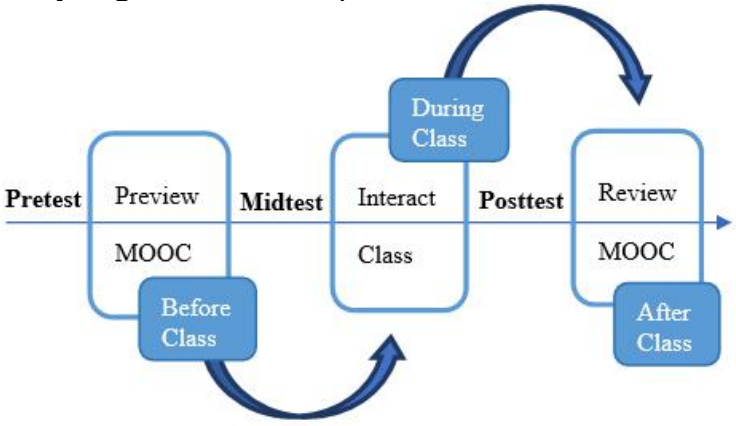

Fig. 1 Process of online-offline blended teaching

The main ideas of teaching design include: condensing the overall problem tree of the curriculum and the problem chain of specific knowledge points, and constructing a structured and systematic curriculum system based on the problems; discussing basic problems from the essence of the problems, not just talking about what it is, to cultivate students' learning ability and thinking

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methods; facing practical problems, set the context to associate the knowledge points in teaching with students' daily network experience; in theoretical classes, use network commands, WireShark packet analysis software, and eNSP virtual network environment to build and other practical verification theories; in experiments, carry out real network equipment practical operations and comprehensive experimental projects; use physical objects, animations, software, and network commands to carry out visualized teaching; adopting diversified teaching methods and evaluation methods, to integrate and use diversified information teaching tools in teaching, and organically integrate the ideological and political content of the course with each teaching link of the course.

3.2 Teaching Contents and Resources

The course uses domestic authoritative textbook "Computer Networks (7th Edition)" edited by Xie Xiren. The online course is selected for the provincial first-class online open course "Computer Networks", and SPOCs are developed on online learning platforms such as China University MOOC and XuetangX. Many years of teaching process have accumulated a large number of teaching resources including curriculum video, animation, tool software.

In the selection of teaching content, focus on selecting the network core concepts and important protocols. The core principle of the network surrounds network architecture and hierarchical model, basic communication principle, IP packet forwarding, reliable transmission principle, routing algorithm, mainstream network application, etc., have representative protocols include HTTP, TCP, IP, ICMP, OSPF, ARP, PPP, etc. The teaching content is generally based on IP technology, with the Internet as an example, allowing students to learn and improve their interests. Remove network technologies that have now rarely been used as ATM, X.25, ISDN, DDR, token ring network. From the perspective of ability training, increase practical teaching content such as protocol analysis, configuration, IP address planning, router, switch configuration, etc.

Since the knowledge points need to be implemented in different teaching methods, they should be implemented in different teaching methods. Therefore, they must be classified and divided into 5 types, including difficulties, key content, ordinary content, supplemental content, and practical content. Arrange different content in pre-class preview, lessons, and practice after class.

4. Summary

Under regular epidemic prevention and control, the research and practice of online-offline blended teaching are carried out. Leading by network technology education, the teaching quality of computer education is promoted, and the quality of teaching under the epidemic prevention and control is improved.

The research results should be continued to applied and improved based on feedback, and constantly condense the reproducible and extendable blended teaching model.

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