

Exploration of the Blended Teaching Mode for Experimental Class of Pathogenic Biology and Immunology

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Abstract: With the rapid development of information technology, modern educational technology is also constantly innovating. In education, this development has led to changes in teaching modes, and the blended teaching mode emerged at a historic moment and has gradually become a hot spot. Pathogenic Biology and Immunology is an important course for clinical medical majors, and it has significant implications for the cultivation of professional ethics and aseptic techniques for clinical professional students. To respond to the comprehensive promotion of educational reform, and cultivate more practical and clinically capable medical students, an exploration of the blended teaching model for the experimental course of "Pathogenic Biology and Immunology" was carried out, in which we tried integrating online and offline teaching resources, optimizing the teaching process, and strive to enhance the students' interest in learning and practical skills.

Keywords: Pathogen Biology and Immunology; Laboratory Classes; Blended Teaching Mode; Teaching Reform

1. Introduction

Medical experimental courses, play an important role in medical education and carry the key mission of cultivating students' practical abilities, research literacy, and comprehensive qualities. The status of experimental courses is increasingly prominent in the modern medical education system. They serve not only as a bridge between theory and practice but also as an important way to cultivate innovative medical talents. Experimental courses provide students with a platform to transform theoretical knowledge into practical skills [1]. Through hands-on experiments, students can intuitively

understand abstract theoretical knowledge, deepen their memory, and improve learning efficiency. Experimental courses also cultivate students' research literacy and develop their team spirit, innovative thinking, and problem-solving ability [2]. However, the traditional teaching methods for medical experiments often have many drawbacks for the students, such as limited teaching resources, low student participation, and cultivation of insufficient practical abilities.

Therefore, exploring a new and effective experimental teaching model is particularly urgent and important. The blended teaching mode combines the advantages of traditional classroom teaching and online teaching by integrating online and offline resources, which breaks the restrictions of time and space and provides students with more flexible and diverse learning methods [3-5].

In medical experimental courses, the blended teaching mode can enrich the teaching methods and enhance the students' practical operation abilities and self-learning capabilities [6]. The reform of the experimental teaching mode for Pathogenic Biology and Immunology, as a basic medical subject, is of great significance for cultivating high-quality medical talents.

2. The Characteristics and Current Situation of the Experimental Course of Pathogenic Biology and Immunology

Pathogenic Biology and Immunology is a compulsory course for medical majors and a professional basic course for clinical medicine students. It is the cornerstone of studying various disciplines in clinical medicine, helping medical students understand the essence of diseases, diagnostic methods, and treatment principles [7]. This subject mainly includes theoretical and experimental teaching. Through experiments, the students can visually observe the pathogen and immunology,

structure, and interactions between pathogens and hosts, thus further understanding theoretical knowledge. By strictly adhering to biosafety standards during experiments, the students can enhance their safety awareness and sense of responsibility [8]. Unfortunately, there are some issues in the experimental course of Pathogenic Biology and Immunology, such as the experimental teaching resources being relatively scarce, and the old equipment updating too slowly to meet the increasing demand for experiments.

Furthermore, the experimental teaching system is not yet complete, which focuses too much on the theoretical knowledge application, while neglecting the cultivation of students' practical abilities and innovative thinking. Additionally, the teaching methods are overly single and mechanical, lacking flexibility and interest, which makes it difficult to inspire students' interest and enthusiasm for learning. Furthermore, there is a shortage of qualified teachers for experimental teaching, and lacking professional competence and practical skills to meet the requirements of high-quality experimental teaching. The traditional modes of experimental teaching mainly comprised demonstrative and group experiments, and demonstration experiments account for a large proportion. Significant emphasis on verification experiments leads the students to complete experiments without totally understanding the basic principles and to the result that experimental investigation easily becomes a formality, and emphasized theory over practice, overly rigid operation, etc.

Therefore, it is imperative to change the teaching philosophy and modify the traditional teaching mode of experimental courses. Targeting the characteristics and current situation of the experimental course of Pathogenic Biology and Immunology, an exploratory reform for this course is conducted by adopting a hybrid teaching mode that combines Chaoxing Learning Platform and offline teaching. This mode integrates the advantages of traditional offline teaching with modern online teaching, providing students with more flexible and diverse learning methods to enhance the teaching effectiveness of the experimental course [9, 10].

3. Integration of Online and Offline Blended Experimental Teaching Resources and

Evaluation Methods for Experimental Courses

3.1 Integration of Experimental Teaching Resources

Integrating online and offline hybrid experimental teaching resources breaks through the time and space constraints of traditional teaching, providing students with a diverse range of learning materials and methods to meet the personalized learning needs of different students, and enhance the effectiveness and quality of experimental teaching. Firstly, the online resources for experimental classes are diverse, covering various aspects such as experimental principles, operating procedures, and analysis of experimental results. A variety of online resources are created, including experimental teaching outlines, courseware, and experimental video tutorials, presented in various forms such as videos, animations, and graphics, allowing students to intuitively understand the experimental process and improve learning effectiveness by enriching online experimental teaching resources. Secondly, we have upgraded and renovated the laboratory, updated experimental equipment, and improved the quality of experimental teaching. We have increased the training of experimental teachers, enhancing their professional competence and teaching abilities. At the same time, the teaching and research office teachers have conducted teaching research to explore new teaching methods and approaches to improve the quality of experimental teaching classes. Through optimizing and integrating experimental teaching resources, we can provide higher quality and more efficient teaching resources for experimental teaching and cultivate more excellent medical talents.

3.2 Grading Method for Experimental Classes

The traditional assessment method of this course mainly focuses on the completion of experiment reports, neglecting the process assessment. In the blended teaching mode of online and offline, various experimental teaching activities have been conducted, requiring multiple assessment methods to evaluate students' learning effectiveness. Therefore, we have established a combined

assessment method of process and final assessment. Assessment of the experimental results of Pathogenic Biology and Immunology, 10% is from experiments (experiment reports, experimental operations, experimental principles, and result analysis, etc.), 5% from regular scores (attendance rate and participation in experimental classes, etc.), and 10% from process assessment (completion of Learning Path tasks, studying learning materials for each experimental class, studying experimental videos, participating in discussions, quizzes for each experiment, etc.). Combining processes and final assessment can better reflect the fairness of examination and encourage students to focus on learning in experimental classes.

4. Implementation of the Hybrid Teaching Mode Combining Online and Offline

According to the teaching objectives of the clinical course "Pathogenic Microorganisms and Immunology" and the training program for clinical professionals, combined with the functions of the Chaoxing Study Platform, we effectively carry out the online and offline teaching modes of "Pathogenic Microorganisms and Immunology" experimental courses. We organically combine online and offline activities in three stages: pre-class, in-class, and post-class. The specific

mode design is shown in Figure 1.

Before class, the teacher publishes learning announcements, requirements, and grading methods on the Learning Platform. At the same time, they upload experiment videos, experiment pictures, and experiment courseware. Students watch experiment videos review experiment pictures on the Learning Platform, and participate in group discussions. The teacher also sets up thematic discussions in the discussion area of the Learning Platform. The teacher answers students' questions online, organizes the problems encountered by students while watching the videos, and improves the classroom teaching design. Students can provide feedback on the problem observed during the video process through the Learning Platform, and make suggestions and requests. Taking the lesson on "Disinfection and Sterilization" as an example, we uploaded a video on disinfection and sterilization on the Learning Platform, as well as some pictures of common disinfection and sterilization equipment. Each group is assigned to explain the operation and precautions of a type of sterilizer. After grouping, students receive their respective tasks and engage in group discussions to help them understand the use of commonly used sterilizers, the significance of disinfection and sterilization, and achieve in aseptic operation.

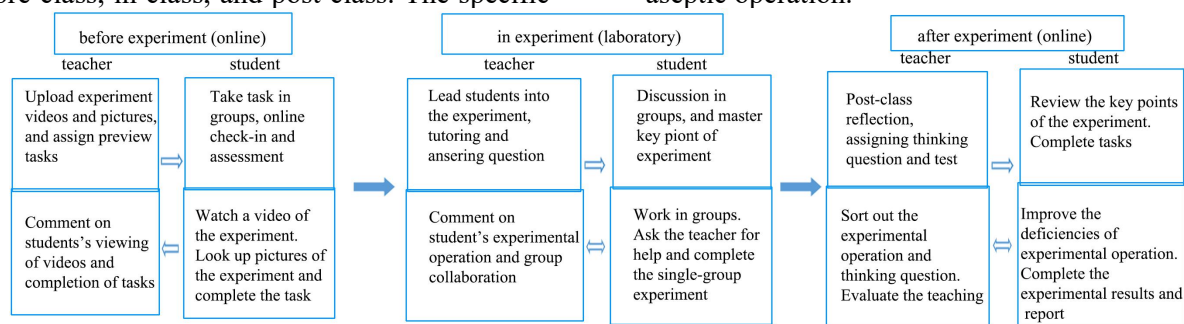


Figure 1. Design of Blended Teaching Mode for Experimental Course of Pathogen Biology and Immunology

In class, the teacher first guides students to carry out experiments and provides timely guidance and answers. Students discuss in groups, summarize the key points of the experiment, and work together to complete individual and group experiments. If any problems arise during the experiment, students can seek help from the teacher or observe experiment videos. Key parts of the experiment can be recorded, photographed, or filmed. The teacher gives on-the-spot

comments and summaries of each group of students' operations. For example, in the "Disinfection Sterilization" experiment class, students first, as a group, have representatives explain the structure, operation, and clinical applicability of the sterilizer, with each group member adding additional information. At the same time, there is peer evaluation among groups. Finally, the teaching teacher gives comments and summaries on the experiment class.

After class, the teacher summarizes the entire experimental teaching process and reflects on the existing problems. Post-lab reflection questions and test questions are issued. Students review the key points of the experiment, organize their thoughts, and summarize their learning methods and learning outcomes, to timely correct and improve their experimental operation skills. Students complete the experimental reflection questions and test questions. Teachers and students interact and communicate on the online learning platform, with the teacher providing answers and guidance, and guiding students to sort out and summarize the content of the experimental class. After completing the experiment report, students submit it on the learning platform for the teacher to correct and provide feedback. In addition, teachers can supply post-class extension learning resources on the learning platform, such as cutting-edge research findings related to experiments, experimental improvement plans, etc., to stimulate students' interest in further study and exploration.

5. The Effectiveness and Reflection of the Blended Online and Offline Teaching Mode

Through the practical exploration of the blended teaching model, both online and offline, we have found that the blended teaching model has achieved good results in the experimental course of Pathogenic Biology and Immunology. The blended teaching model has increased students' interest in learning, enriched teaching methods, stimulated students' learning interests, and encouraged them to participate more actively in the experimental course; the blended teaching model has enhanced students' self-learning ability. Through pre-class preview and post-class extension, students' self-learning ability has been significantly improved, enabling them to grasp experimental knowledge and skills better; the blended teaching model has strengthened students' practical operation ability. Group discussions and practical operation sections in the experimental course help cultivate students' teamwork and hands-on practical ability; optimizing teaching resources, the blended teaching model fully utilizes online resources, which breaks through the time and space limitations and improves the efficiency of teaching resource utilization.

Despite obtaining certain achievements in the hybrid teaching model for the experimental course of Pathogenic Biology and Immunology, there are still some problems and challenges. The quality of online experimental teaching resources is uneven, and some online resources vary in quality greatly, which requires the teachers' strict selection and integration of high-quality resources; student engagement is uneven, which reflects that some students possibly overly rely on online learning and neglect the interaction and practical aspects of the experimental course require further guidance and motivation from teachers; inadequate technical support, with some students not proficient in the use of online learning platforms, requiring enhanced technical support and training. We will continue to improve the hybrid teaching model of the experimental course of Pathogenic Biology and Immunology, fully utilize information technology to enhance the teaching quality, and cultivate more outstanding medical talents.

6. Conclusion and Outlook

The blended experimental course of Pathogenic Biology and Immunology integrated the advantages of online and offline teaching modes. Through this teaching model, students can watch experiment videos online in advance, which enables them to proficiently perform experiment operations after entering the laboratory, thus improving the success rate of experiments and enhancing learning effectiveness. The hybrid teaching mode of online and offline also helps enhance students' self-learning abilities, as they can independently choose their learning content and time, cultivating their skills in independent learning planning. Additionally, this mode can strengthen students' comprehensive abilities through tasks that require group discussions and online and offline collaborations, which can enhance students' teamwork and communication skills. In the laboratory sessions, students can develop their abilities in independent thinking, problem analysis, and problem-solving, thereby improving their experimental skills. However, the hybrid teaching modes of online and offline still require continuous reflection and improvement to meet students' learning needs.

With the continuous development of

technology, it is hoped that online teaching platforms can be further optimized, for example, improving the authenticity and interactivity of virtual experiments, allowing students to feel more immersive, just like operating in a real laboratory. At the same time, artificial intelligence technology provides personalized learning guidance to students, recommending learning resources and solutions intelligently based on students' learning situations and issues. Building a more comprehensive evaluation system, current evaluations may focus more on offline experiment operations and the completion of online learning tasks. In the future, evaluations can be added in aspects such as students' innovation ability and depth of thinking during independent learning processes, for example, setting up innovative experiment projects and providing additional evaluation scores for the students who demonstrate innovative thinking and abilities in the projects.

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